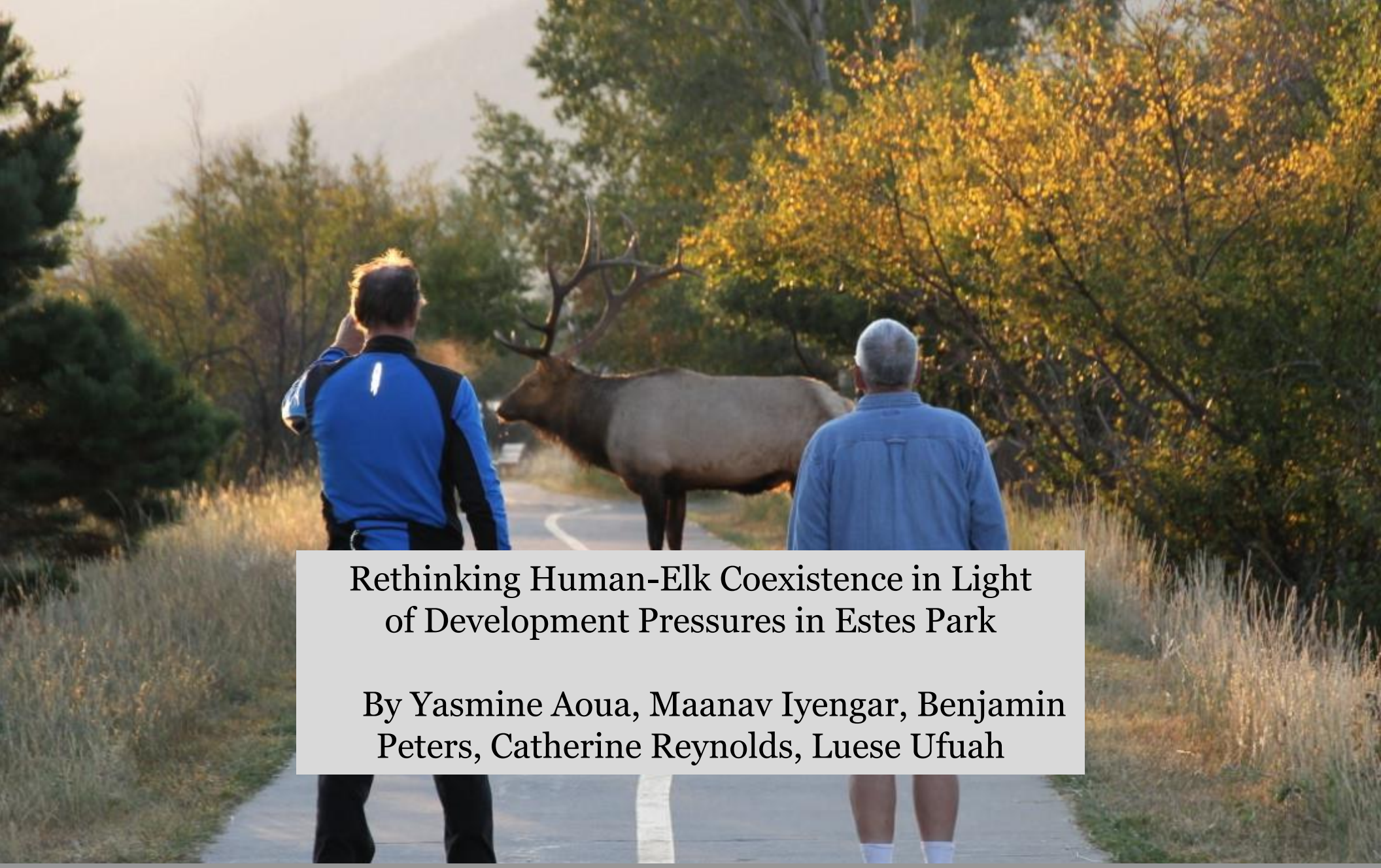

Rethinking Human-Elk Coexistence in Light of Development Pressures in Estes Park

By Yasmine Aoua, Maanav Iyengar, Benjamin Peters, Catherine Reynolds, Luese Ufuah

ESTES VALLEY WATERSHED COALITION

WPI

Rethinking Human-Elk Coexistence in Light of Development Pressures in Estes Park

An Interactive Qualifying Project

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Submitted to:

Wilynn Formeller, Estes Valley Watershed Coalition

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Abstract

Due to large elk populations, Estes Park faces coexistence-related issues, including unsafe tourist-elk interactions and a need for more inexpensive housing. We collaborated with the Estes Valley Watershed Coalition to examine human-elk conflict to support Estes Park's futures planning. We achieved this by understanding pressure points for elk and humans and rethinking strategies for coexistence. We designed educational materials, made suggestions on wildlife-friendly policies, and recommended futures planning workshops to envision a more equitable relationship between wildlife and humans.

Project Sponsor

ESTES VALLEY WATERSHED COALITION

The vision of the Estes Valley Watershed Coalition is to protect and improve the waters, forests, and wildlife of the Estes Valley Watershed - the headwaters of the Northern Colorado Front Range. We had the pleasure of having Wilynn Formeller, the Development & Program Coordinator of the Estes Valley Watershed Coalition, as our project sponsor.

Acknowledgements

We would like to show appreciation to all of the individuals who supported us in this project. First, we would like to thank the nine interviewees and 30 survey respondents who provided us with their knowledge and perspectives on human-elk coexistence in Estes Park. We are especially grateful to Kris Hazelton, Rachel and Andy Ames, Karen Bailey, Stephanie Shwiff, Chase Rylands, Alex Bergeron, and Aaron Jackson.

We would also like to give recognition to our sponsor, Wilynn Formeller for providing us with essential resources, contact lists, photographs, personal perceptions, and thoughtful feedback, which collectively enhanced our project. Additionally, we would like to thank our WPI advisors, Professors Ingrid Shockey and Leslie Dodson, who generously guided us with their utmost support throughout the course of the project. Furthermore, we would like to thank the YMCA of the Rockies for their cooperation and services, including advantageous amenities. We would also like to thank the Estes Park Shuttle service driver, Rich Basile, for transporting us to and from our project site locations. Lastly, we would like to thank Worcester Polytechnic Institute for providing us with this Global Experience, in which we were able to grow academically and socially.

Authorship

This report consists of numerous sections and subsections, which made it difficult, in some cases, to determine authorship. All team members provided substantial, intellectual contributions to the report. Each section of the report was drafted, revised, and finalized by all members. Edits were made with the agreement of each member before finalizations.

Authorship Table

Chapter - Section	Author (s)	Editor (s)
Abstract	M. Iyengar	All
Executive Summary	M. Iyengar, L. Ufuah	C. Reynolds
The Need for Coexistence	All	All
Pressures on Humans and Elk	-	-
The ecosystem of Estes Valley	L. Ufuah	C. Reynolds, M. Iyengar
Balancing the interests of residents, visitors, and elk in Estes Park	L. Ufuah	Y. Aoua, M. Iyengar
The Estes Valley Habitat Assessment	M. Iyengar	B. Peters, C. Reynolds
Impacts of climate change on RMNP elk population dynamics	C. Reynolds	Y. Aoua
The housing deficit and development pressures in Estes Park	M. Iyengar	Y. Aoua, B. Peters
Land and wildlife protection policies	C. Reynolds	L. Ufuah
Understanding habitat fragmentation	B. Peters	C. Reynolds
Summary	All	All
Our Approach to Understanding Human-Elk Conflict in Estes Park	-	-
Understand environmental pressure points for elk	C. Reynolds	L. Ufuah
Understand development and educational pressure points	Y. Aoua	C. Reynolds, M. Iyengar
Identify strategies for coexistence in Estes Park	B. Peters	L. Ufuah
Discoveries and Implications	-	-
Understand environmental pressure points for elk	C. Reynolds	L. Ufuah
Understand development and educational pressure points in Estes Park	Y. Aoua	L. Ufuah, C. Reynolds
Rethink strategies for coexistence	B. Peters	M. Iyengar
Discussion	All	All
Suggested Action Plans and Final Thoughts	-	-
Suggested Plans for Action	-	-
Relatable Educational Materials	B. Peters	L. Ufuah, C. Reynolds
Wildlife Friendly Development Code Changes	Y. Aoua	B. Peters
Futures Planning Involving Development and Elk	Y. Aoua	B. Peters, C. Renolds
Other Observations	L. Ufuah, M. Iyengar	Y. Aoua
Final Thoughts	All	All

MEET THE TEAM

Hi, my name is Yasmine Aoua. I am from Belmont, Massachusetts. I am currently a junior at WPI studying Robotics Engineering and Computer Science. I loved being surrounded by the mountains here in Estes Park. I've really enjoyed hearing residents' stories and learning from experts. I appreciated the experiences I've had throughout this project and hope our project was able to leave a positive impact on Estes Park.

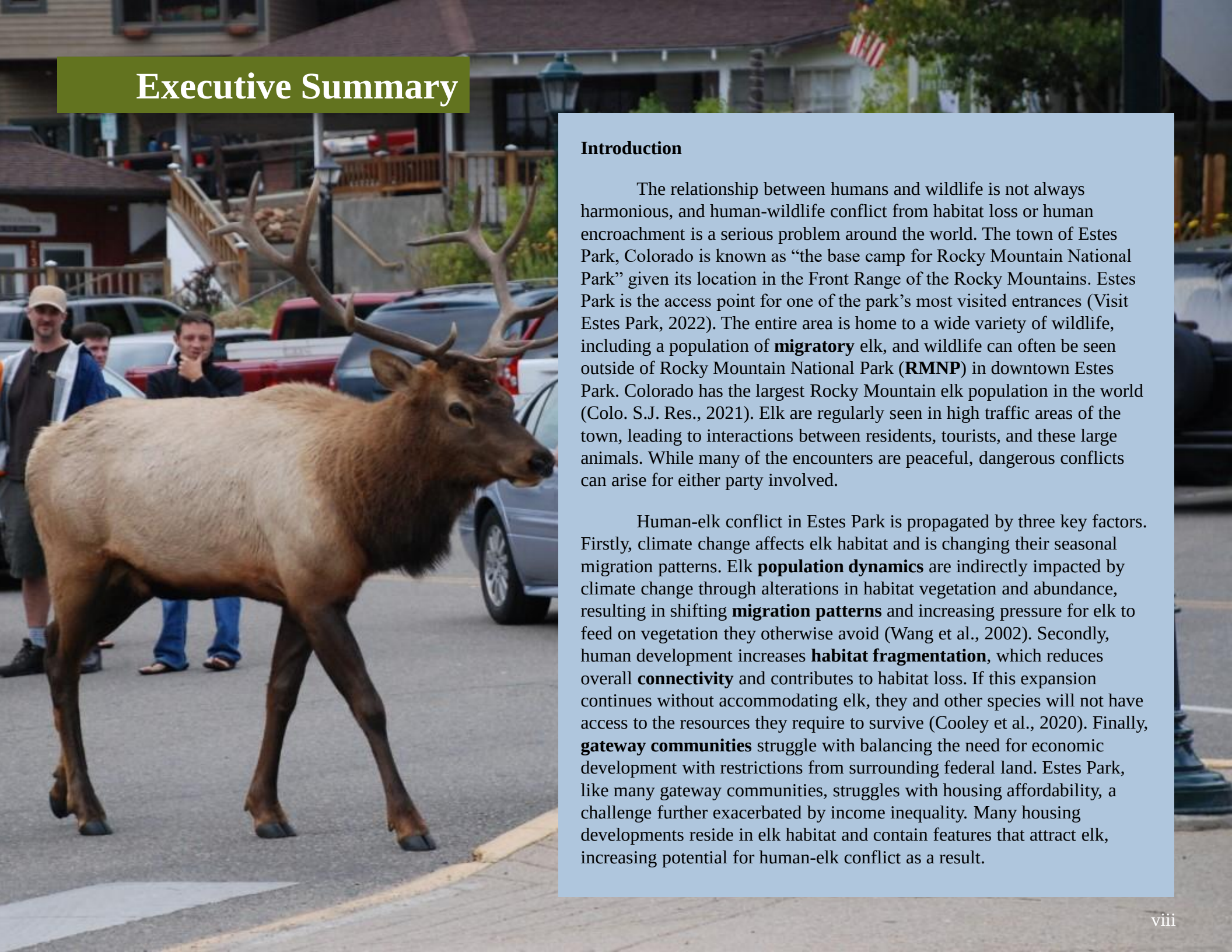
Howdy, My name is Maanav Iyengar and I'm from Chicago, IL. I'm currently a junior at WPI pursuing a major in Robotics Engineering. This project was a great experience for me as it really changed my perspective on just what human-wildlife conflict entails. It allowed me to get creative when dealing with this issue that is facing Estes Park and I really enjoyed the work we did here.

Hi, I'm Catherine Reynolds and I am from Concord, New Hampshire. I am currently a Biochemistry student and am planning on getting my masters in Biology and Biotechnology at WPI. I thoroughly enjoyed being in Estes Park and I have loved working on my project. I have really appreciated getting to know people from all different backgrounds and from all over the world. This project and project site allowed me to grow both personally and academically and I am grateful for being given this opportunity.

Greetings, I'm Luese Ufuah and I am from Franklin, New Jersey. I am currently an undergraduate student at WPI, majoring in Biomedical and Mechanical Engineering. I plan on obtaining a master's degree in biomedical engineering at WPI. Overall, my IQP at Estes Park was a tremendous experience and I really enjoyed participating in the project. I appreciated the beautiful views of mountains and wildlife and learning about a new culture of living.

Hello, I'm Benjamin Peters and I am from Southbridge, Massachusetts. I am currently studying Computer Science. I loved exploring Estes and Rocky Mountain National Park. I enjoyed learning about the issues facing Estes Park from multiple perspectives. This project enabled me to broaden my horizons on human-wildlife conflict and hopefully help the community of Estes Park.

Executive Summary



Introduction

The relationship between humans and wildlife is not always harmonious, and human-wildlife conflict from habitat loss or human encroachment is a serious problem around the world. The town of Estes Park, Colorado is known as “the base camp for Rocky Mountain National Park” given its location in the Front Range of the Rocky Mountains. Estes Park is the access point for one of the park’s most visited entrances (Visit Estes Park, 2022). The entire area is home to a wide variety of wildlife, including a population of **migratory** elk, and wildlife can often be seen outside of Rocky Mountain National Park (**RMNP**) in downtown Estes Park. Colorado has the largest Rocky Mountain elk population in the world (Colo. S.J. Res., 2021). Elk are regularly seen in high traffic areas of the town, leading to interactions between residents, tourists, and these large animals. While many of the encounters are peaceful, dangerous conflicts can arise for either party involved.

Human-elk conflict in Estes Park is propagated by three key factors. Firstly, climate change affects elk habitat and is changing their seasonal migration patterns. Elk **population dynamics** are indirectly impacted by climate change through alterations in habitat vegetation and abundance, resulting in shifting **migration patterns** and increasing pressure for elk to feed on vegetation they otherwise avoid (Wang et al., 2002). Secondly, human development increases **habitat fragmentation**, which reduces overall **connectivity** and contributes to habitat loss. If this expansion continues without accommodating elk, they and other species will not have access to the resources they require to survive (Cooley et al., 2020). Finally, **gateway communities** struggle with balancing the need for economic development with restrictions from surrounding federal land. Estes Park, like many gateway communities, struggles with housing affordability, a challenge further exacerbated by income inequality. Many housing developments reside in elk habitat and contain features that attract elk, increasing potential for human-elk conflict as a result.

Executive Summary

The goal of our project was to collaborate with the Estes Valley Watershed Coalition (**EVWC**) to examine human-elk conflict as a case study in Estes Park to support the town's futures planning. We achieved this by completing the following objectives:

1. Understand environmental pressure points for elk
2. Understand the development and educational pressure points in Estes Park
3. Rethink strategies for **coexistence** in Estes Park

Our work was designed to advance the conversation about reimagining the balance of human-elk coexistence in Estes Park through the following approaches:

Approach	Activity
Interviews	Residents, wildlife experts, human wildlife coexistence experts, co-owner of Estes Park News, board members of EVWC, representative from police department, town planner
Surveys	Residents, tourists, business owners and employees
Data Analysis	**CPW** species data using Google Earth
Safe Distance Field Test	Tourists were asked to stand where they believe was a safe distance from elk. Distances were recorded
Signage and Materials Assessment	Visitor center, downtown Estes Park, Bond Park, golf courses, street signs

Executive Summary

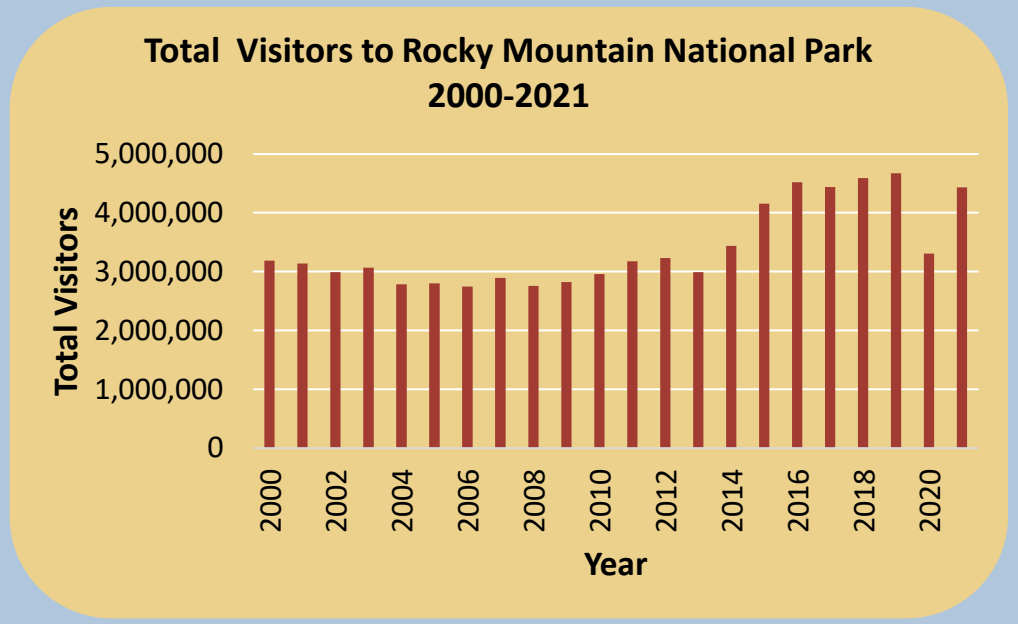
Discoveries and Implications

We found a bidirectional relationship between elk and humans and their impacts on one another, especially with ongoing changes in environmental conditions and human activity. Our interviews revealed that elk provide indirect economic benefits to Estes Park and these benefits, in part, have driven the development of the town. Our interviews revealed the need for different and more effective coexistence strategies.

Interviews with wildlife experts revealed that subtle changes in elk behavior throughout the year explained the variability of human-elk encounters. For example, elk are typically docile; however, they bear distinct seasonal behaviors that change their responses to encroachment. On a regional scale, human development and urbanization can prevent the movement of elk through Estes Park. That built environment also serves to funnel elk across major roadways and into town centers. In addition, recreation areas and town parks have inadvertently provided elk with large grazing spaces. This has attracted elk to high traffic areas. Concentrating elk in highly populated areas around town has resulted in cases where humans provoke elk and if an elk injures a human, provoked or not, the elk will be euthanized.

The events of the past 15 years have catalyzed serious housing and development pressures in Estes Park. The COVID-19 pandemic generated a surge of domestic travel. Visitation to Rocky Mountain National Park has grown by over 1.5 million since 2008, and as the number of visitors increases, the town is forced to address the need for more resources such as affordable accommodation, increases in the workforce, and visitor needs (National Park Service, 2022). As Estes Park is surrounded by federal land, the town's expansion opportunities are restricted. Yet at the same time, the growing demands on the local economy require a workforce to support it. Many local business employees and town officials live outside of Estes Park due to the high cost of living.

Figure E-1. Elk on the golf course in Estes Park (Hazelton, March 2022).



Executive Summary

The state of Colorado has recently enacted policies and bills that aim to preserve essential habitats and reduce fragmentation due to human development. The Land Conservation and Habitat Protection Policy of 2019 has been essential in funding and maintaining essential migration paths and habitats and increasing safety for elk (Skroch & Ellenberger, 2021). Locally, the Town of Estes Park has its own Development Code which includes a section on wildlife habitat protection. Certain site development applications require a Wildlife Conservation Plan, including for critical wildlife areas along waterways (*Estes Park Development Code*, 2022, Chapter 7.8). The goal of the wildlife habitat protection development code is to ensure that future development and land use plans maintain existing wildlife diversity and habitat (*Estes Park Development Code*, 2022, Chapter 7.8). However, despite these initiatives, most land and zoning policies in the state prioritize human needs for development, resources, and recreation over conservation of habitat, essential ecosystems, and wildlife migration routes.

Figure E-2. Permanent aggressive elk signage at Lake Estes.

Figure E-3. Permanent calving area signage at Lake Estes.

Much of the human-elk conflict in Estes Park can be attributed to lack of education about wildlife coexistence. Despite efforts by various organizations to improve education about elk behavior and safety, we only located a few permanent signs around town, such as wildlife crossing road signs and warnings of aggressive elk around Lake Estes. One of the most widespread coexistence strategies we researched is through tourist education, which is largely facilitated by volunteer groups. However, educators in Estes Park acknowledged that there is a problem of resources and a limited number of volunteers.

As we evaluated strategies for coexistence, we noted that residents and tourists hold diverse attitudes about the elk problem. Some residents consider elk to be a nuisance that causes annoying damage. Other residents expressed that people reside in elk habitat, and the damage that elk cause is not something to be held against the animals. These residents recognize that elk were here before people were and that they are living on land that belongs to the elk.

Executive Summary

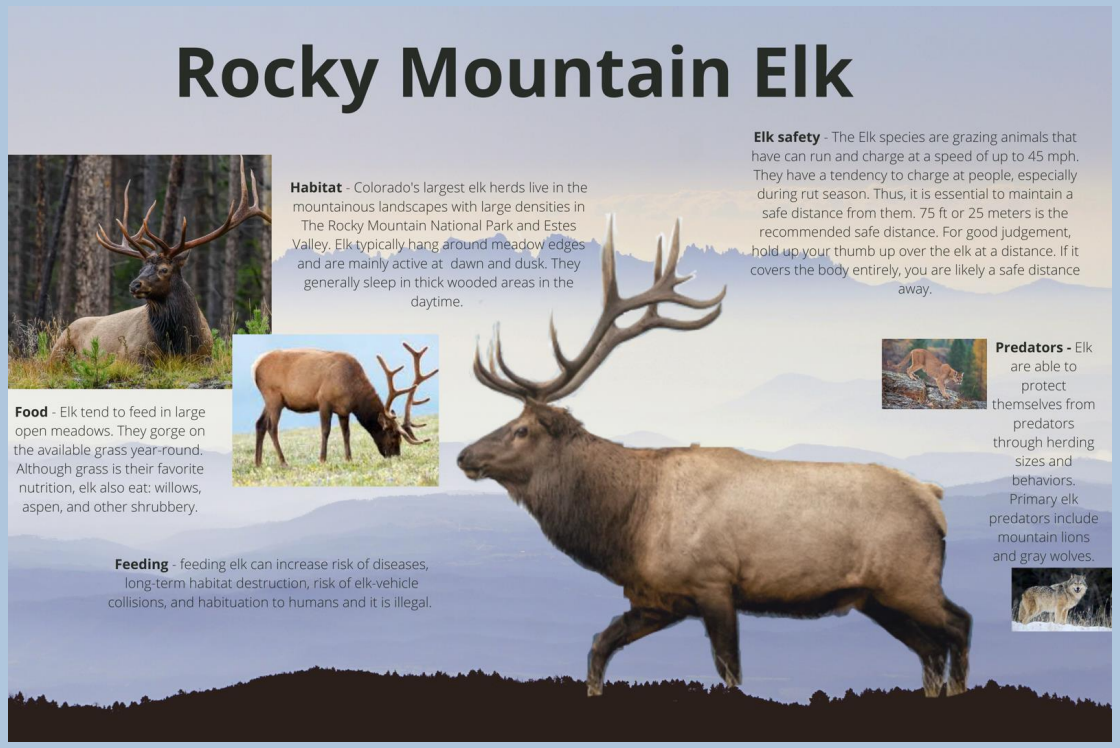
Suggested Action Plans

Our recommendations are designed to ease tensions in human-elk relationships. These recommendations approach the problem from many different directions, including education, development code changes, and futures planning.

Recommendation 1:

We suggest that the EVWC incorporate more relatable educational materials around Estes Park to increase the overall awareness of elk presence in the town and to build an appreciation for wildlife. We designed various prototypes, including a sign explaining elk behavior and their history in the region, wildlife harassment signs with fees, and posters and pop culture stickers that can be displayed, sold, or handed out in high-traffic tourist locations (Appendices J, L, K, M). We also recommend that the sponsor support a comedy show to educate tourists and the community on safe wildlife behavior to decrease instances of dangerous encounters (Appendix N).

Appendix L: Wildlife Harassment Signage



Appendix J: Educational Signage

Front

Back

Appendix M: Educational Stickers

Executive Summary

Recommendation 2:

We recommend that the EVWC promote wildlife friendly development code changes (Appendix O). Specifically, we suggest that conversations be convened to discuss the removal of the exception to require a Wildlife Conservation Plan for lots predating 2000, as well as require a habitat assessment for all future lots. We also recommend that there be stakeholder discussions about developments on critical elk habitat, including discussions about the development and submission of a Wildlife Conservation Plan that contains accurate and updated species data. Finally, we recommend that the EVWC work with local homeowners, developers, and landscape designers that focus on replacing ornamental shrubbery around town with indigenous aspen or ponderosa pine as to not further attract wildlife into the center of town. These recommendations all serve to support discussions and decision-making to decrease human impact on wildlife and to decrease instances of human-wildlife interaction.

B. **Applicability.** This Section shall apply to all applications for review of development plans, subdivision plats, planned unit developments, special review uses and rezonings. ~~**This Section shall not apply to development on lots that were approved for single-family residential use prior to the effective date of this Code.**~~

Chapter 7 Section 8 of the Estes Park Development Code

A Wildlife Conservation Plan shall be submitted for sites containing:

a. An endangered or threatened species,
b. Big Horn sheep or Big Horn sheep habitat, or
c. Riparian areas
d. Critical elk habitat, elk severe winter range, elk migration corridors.

Chapter 7 Section 8 of the Estes Park Development Code

1. **Application.** The Applicant shall submit a development plan, subdivision plat or sketch plan, as applicable, depicting the general location of the property, location of structures on the site, prominent natural areas such as streams and wetlands, a **description of the populations of wildlife species that inhabit or use the site, including a qualitative description of their spatial distribution and abundance,** and other features that Staff may require for review pursuant to this Section.

Chapter 7 Section 8 of the Estes Park Development Code

Executive Summary

Recommendation 3:

We recommend that the EVWC collaborate with the Estes Park Comprehensive Plan Advisory Committee to utilize an open forum to discuss futures planning regarding the intersection of development and coexistence with elk in Estes Park. Elk are a defining feature of Estes Park and are a draw for tourists who drive the town's economy. The intersection between **inexpensive housing** and elk is an emerging conversation that can help Estes Park achieve coexistence (Appendix P).

"

Estes Park Human-Wildlife Relationships
In what ways do you think Estes Park successful in human-wildlife relationships?
In what ways do you think the town of Estes Park improve their relationship with wildlife?

Development
How do you think development, wildlife, and the town's desires should be prioritized?

Coexistence
What will it take for Estes Park become a place to look to as a strong example when discussing human-wildlife coexistence?
Is this something that you as an Estes Park citizens want?

Future of Estes Park
What does an ideal future of Estes Park with elk look like to you?
What are reasonable goals for the town within the next 5 years?
10 years? 20 years?
What strategies do you suggest for balancing coexistence with wildlife and the development of Estes Park?
Are there any radical or more novel ideas you can think of?

"

Executive Summary

Final Thoughts

Estes Park is increasingly constricted by visitors, wildlife, and development pressures, which need to be harmoniously balanced as they are all essential aspects of Estes Park's identity. Accommodating these factors presents challenges for the community. For instance, the town of Estes Park, Colorado has an obvious and pressing need for housing, in large part because its economy relies on elk to bring in tourists. This presents opportunities to increase awareness of elk while also mitigating the impacts of development on elk and their habitat to help achieve a more equitable coexistence. Our research has shown that changes in precipitation have already had significant impacts on elk movement patterns. While climate change has impacts on vegetation, elk are able to adapt to and minimize the effect of climate change, but climate change is likely to continue to affect their grazing and migration patterns. Keeping track of how elk behavior and habitats change as a result can help inform future plans so that the town continues to mitigate human impacts on elk and their habitat.

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Glossary

Affordable Housing – single or multi-family units for households with an income less than or equal to 80% of the Area Median Income

AMI - Area Median Income , the midpoint of a region's income distribution

Attainable Housing – units meant for households with an income less than or equal to 150% of the Larimer County AMI

Bull – a male elk

Calf – elk that is less than one year old

Calving season – period in which cows give birth and become protective of their calves; takes place from May to late June

CCC – Canadian Climate Center

Coexistence - the optimal state in which humans and wildlife can adapt to living in a shared landscape in a dynamic yet sustainable manner

Cow – a female elk

CPW – Colorado Parks and Wildlife

Ecotourist - tourists interested in nature appreciation and supporting wildlife conservation efforts

Elk resident population – population of elk that remains in Estes Park year-round

Elk summer concentration area – habitat elk populate in the summer months

Elk winter concentration area – habitat that elk populate in the winter month

EVHA – Estes Valley Habitat Assessment

EVWC – Estes Valley Watershed Coalition

Futures planning –a shared vision of how a town wants to move forward

Gateway Community – towns or cities that lie just outside of major tourist locations such as national parks

Habitat Connectivity – the degree to which species can move between different habitats

Habitat Fragmentation – when habitats are broken up into smaller patches and compose a smaller total area

Harem – group of females during rutting season that bulls compete for

Inexpensive Housing – housing that is more affordable but not income dependent

Migration Corridors – area of land that species use to move between different habitats

Migratory – species that moves to different habitats based on the season

NPS – National Park Service

Population Dynamics - how and why a species' population size and composition changes over time

Riparian Habitat – the area along rivers and waterways containing higher levels of biodiversity compared to other habitats

RMNP – Rocky Mountain National Park

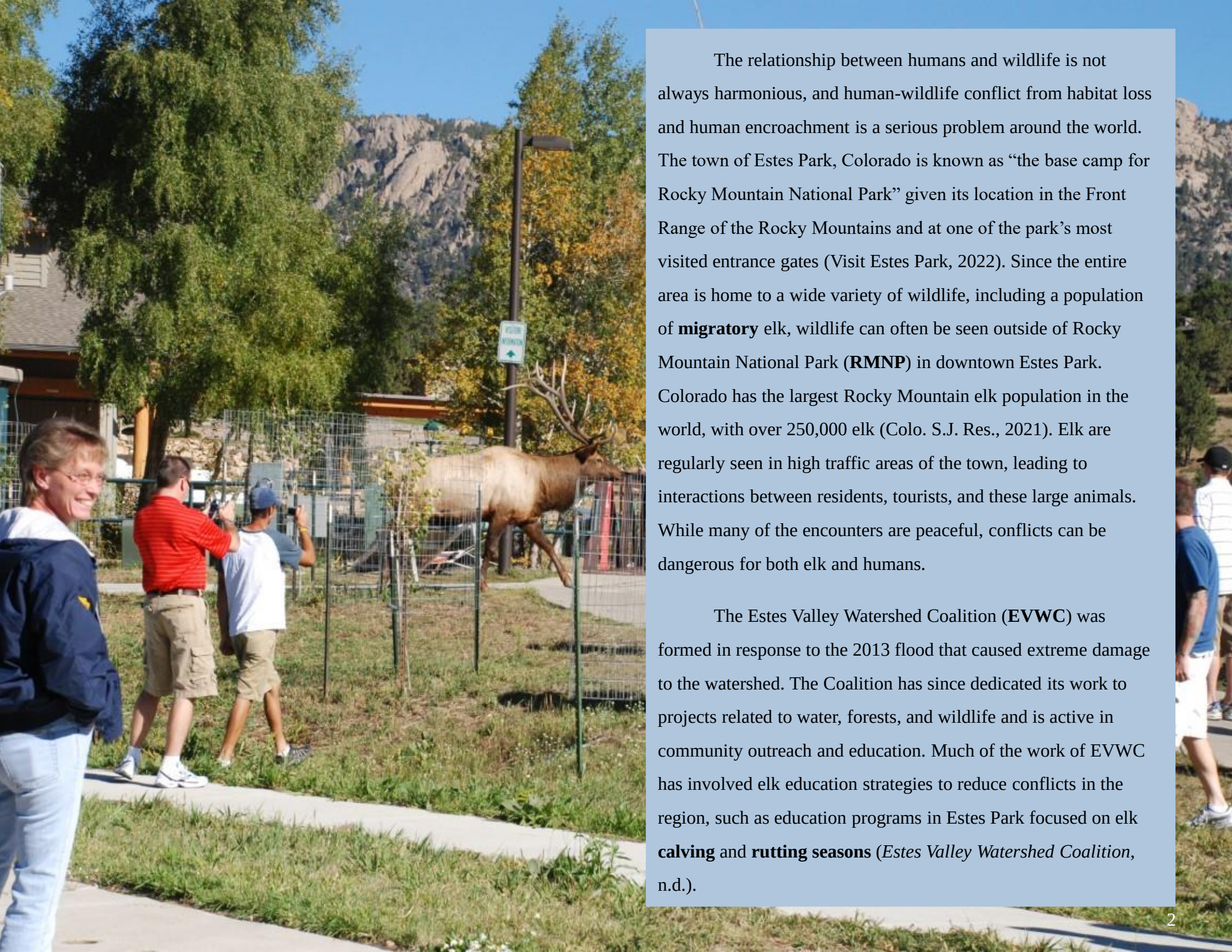
Rutting season - mating season; males compete for territory and females

Wildlife-friendly development - development that considers the impact building could have on the wildlife dependent on that habitat

Workforce Housing – housing for people employed within the Estes Park School District R-3 Boundary Map

1

The Need for Coexistence



The relationship between humans and wildlife is not always harmonious, and human-wildlife conflict from habitat loss and human encroachment is a serious problem around the world. The town of Estes Park, Colorado is known as “the base camp for Rocky Mountain National Park” given its location in the Front Range of the Rocky Mountains and at one of the park’s most visited entrance gates (Visit Estes Park, 2022). Since the entire area is home to a wide variety of wildlife, including a population of **migratory** elk, wildlife can often be seen outside of Rocky Mountain National Park (**RMNP**) in downtown Estes Park. Colorado has the largest Rocky Mountain elk population in the world, with over 250,000 elk (Colo. S.J. Res., 2021). Elk are regularly seen in high traffic areas of the town, leading to interactions between residents, tourists, and these large animals. While many of the encounters are peaceful, conflicts can be dangerous for both elk and humans.

The Estes Valley Watershed Coalition (**EVWC**) was formed in response to the 2013 flood that caused extreme damage to the watershed. The Coalition has since dedicated its work to projects related to water, forests, and wildlife and is active in community outreach and education. Much of the work of EVWC has involved elk education strategies to reduce conflicts in the region, such as education programs in Estes Park focused on elk **calving** and **rutting seasons** (*Estes Valley Watershed Coalition*, n.d.).

Their efforts are among many in the community, including a 2008 habitat assessment commissioned by Estes Park to identify and address open space and wildlife corridors for elk and other wildlife. The town, however, continues to experience problems with elk blocking roads, interactions in the center of town, and private property damage.

The goal of our project is to collaborate with the EVWC to examine human-elk conflict as a case study in Estes Park to support **futures planning** in the Estes Valley. We achieved this by completing the following objectives: 1) understand environmental pressure points for elk; 2) understand the development and educational pressure points in Estes Park; 3) rethink strategies for **coexistence** in Estes Park. Ideally, our work can support efforts to reimagine new forms of human-elk coexistence in Estes Park.

2

Pressures on Humans and Elk

This chapter explores the problem of human-wildlife conflict in greater depth. It provides a detailed site description of the Estes Valley and a discussion of the prominence of elk in the area. We addressed the current state of human-elk conflict in Estes Park with a focus on affected communities and populations, along with research on current policies regarding ecosystem protection and development pressures and impacts. We discuss the impacts of climate change and town development on elk populations.

The ecosystem of Estes Valley

The Estes Valley region is known for its beautiful scenery, diverse wildlife, and world-class recreational activities. RMNP attracts 4.5 million tourists to the area annually to enjoy hundreds of miles of pristine wilderness (National Park Service, 2022). The town of Estes Park is home to approximately 6,000 permanent residents, with an ever-growing population (*Census - Geography Profile*, 2020).

The town's ability to expand, however, is limited by the geography of the valley, the boundaries of RMNP and forest service land, and by conservation restrictions, all of which compete with identified needs such as essential infrastructure and **inexpensive housing**. Traffic, population growth, and the increasing popularity of the area as a tourist destination are putting pressure on critical wildlife habitat, which is leading to increasing incidences of human-wildlife interactions (*Estes Valley Habitat Assessment*, 2008). At the same time, one of the most positive wildlife experiences reported by visitors and residents of Estes Valley is the opportunity to view elk on a daily basis. These animals not only gather in the national park but are also routinely found along main roads in Estes Park, standing outside of shops, in parks, and at recreational spaces such as golf courses (Figure 1) (Visit Estes Park, 2020).

Colorado has the largest **resident elk population** in the United States (Rylands, March 28, 2022). Populations of elk, which are a migratory change throughout the year. Elk typically migrate to lower elevations in the winter and move to higher elevations in the summer. Currently, there are more than 2,400 elk that seasonally reside in Estes Valley and an average population density of 74 elk per square mile (*Estes Valley Habitat Assessment*, 2008; U.S. National Park Service, 2018; Visit Estes Park, 2020). The Colorado Parks and Wildlife District Wildlife Manager estimates there are approximately 200 to 300 elk that reside year-round in Estes Park (Rylands, March 28, 2022). There are also new populations that have begun to stay at lower elevations year-round due to flourishing crops and orchards (Rylands, March 28, 2022). Due to the ongoing drought, an increasing amount of vegetation is dry and therefore less nutritious for the elk. Therefore, small populations of approximately 30 elk have begun to reside in Loveland, Lyons, and Masonville throughout the year (Rylands, March 28, 2022).

Figure 1. Bull Elk Downtown (Kris Hazelton, March 30, 2022).

Elk have thrived in downtown Estes Park and the Estes Valley region over the last few decades, rebounding from overhunting in the late 1800s (U.S. National Park Service, 2018). In 1913, the Estes Valley Improvement Association and the U.S. Forest Service imported 49 elk from Yellowstone National Park to repopulate the Estes Valley region. When elk were first reintroduced, they were protected from hunters and their primary predators, gray wolves and grizzly bears, were being killed (U.S. National Park Service, 2018). Over time, the reintroduction of elk has raised problems, degrading local vegetation and other wildlife habitats (U.S. National Park Service, 2018).

Other factors exacerbate human-elk interaction in Estes Park. Each year, elk migrate and spend seven months in the foothills to winter, then spend three months at higher elevations during the summer, and two months in transition between the two habitats. The elk use wildlife corridors to travel between these essential habitats. Elk are fond of **riparian** corridors along major rivers, such as the Big Thompson River, and its drainages, including Fall River and Fish Creek. These water sources supply elk with preferred, highly nutritional vegetation (*Estes Valley Habitat Assessment*, 2008). These pathways are not just essential to elk, but also to other species that require seasonal habitat changes and specific vegetation. The growth in the elk population has damaged or destroyed some of these corridors, while human development has fractured corridors and led to elk and other species being stranded in one habitat.

Balancing the interests of residents, visitors, and elk in Estes Park

Elk, of course, are unaware of, and not deterred by, the boundaries of the town of Estes Park, even though their presence impacts local traffic and businesses. Surrounding habitats and wildlife are a prominent feature of Estes Park's identity. Residents juggle the need for a strong economy dependent on tourism with **wildlife-friendly development** (Lebeda, 2019). As a result, human-elk interactions have impacted economic development codes, conservation efforts, elk habitat, and daily life in Estes Park.

Interactions between elk and Estes Park residents are usually benign. However, interactions between tourists who lack awareness of elk safety and elk can be dangerous for both parties. Tourists can be classified into two distinct groups, each of which interacts differently with wildlife: **ecotourists**, whose motivation for travel is wildlife centric, and traditional tourists who come to vacation in Estes Park unaware of the abundance of elk in the town (R. Ames, March 17, 2022). Visitors with less awareness often get too close to elk, resulting in elk charging and sometimes tossing individuals, such as in Figure 2 (*Warning about Getting Too Close to Wild Animals*, 2019).

Figure 2. Elk charging at person (Kris Hazelton, 2022).

Harass – 'to unlawfully endanger, worry, impede, annoy, pursue, disturb, molest, rally, concentrate, harry, chase, drive, herd, or torment wildlife'

Colo. Rev. Stat. §33-1-101, 2021

To mitigate these interactions, the Town of Estes Park's website attempts to educate tourists on the dangers of inappropriate interactions with elk and warns that wildlife laws will be enforced by the Estes Park Police Department (Town of Estes Park, n.d.). For instance, a wildlife harassment citation is accompanied by a $100 fine and up to 10 license suspension points (Colo. Rev. Stat. § 33-6-128, 2021). Honking at an elk is also considered harassment of wildlife with a motor vehicle, which is punishable by a $200 fine and up to 10 license suspension points (Colo. Rev. Stat. § 33-6-124, 2021).

Tourism, and by extension the elk, are the main livelihood of much of Estes Valley (Persons, 2014). In 2012, an economic study looked at the economic impacts of tourism in Estes Valley. Researchers estimated that at that time 43-55% of jobs in Estes Valley were related to tourism (Persons, 2014). Since then, there has been an exponential increase in visitors (Rylands, March 28, 2022). Visitors make substantial contributions to local businesses and the state's economy, bringing in more than $62 billion dollars (Colo. S.J. Res., 2021). Most of the five million tourists to RMNP visit in summer and fall, but there has been a push by the town of Estes Park to increase winter and spring tourism to further support the local economy (*Operating & Marketing Plan*, 2017).

Changes in elk population could affect the local economy and even the "branding" of Estes Park as a gateway to the National Park (Visit Estes Park, 2021). Local businesses particularly rely on the elk population to draw in visitors and customers (Local Business Employees, March 22, 2022). Since the elk population increases drastically in Estes Valley during their rutting season in September, more tourists visit the town, funding the local economy in seasonal cycles. Resorts rely on the appeal of elk viewing from private cabin decks and the front lawns of the properties ("Where to View Elk in Estes Park," 2020).

The Estes Valley Habitat Assessment

In 2008, the Estes Valley Habitat Assessment (**EVHA**) was conducted to evaluate the landscape and ecosystem of Estes Valley and to propose infrastructure that allows native plants, animals, and ecosystems to thrive. The study, conducted by the EDAW consulting firm, for the Town of Estes Park informed conservation plans for a series of habitat patches and wildlife corridors necessary for ecosystem health in the region (*Estes Valley Habitat Assessment*, 2008).

The study explained that while **habitat fragmentation** can be a natural occurrence and an ever-important factor in evolutionary processes, humans have sped up the process of fragmentation to a rate faster than species are able to adapt (*Estes Valley Habitat Assessment*, 2008). Examples of habitat fragmentation due to infrastructure development in Estes Valley include road and structure building, river and creek damming or diverting, land clearing, and environmental degradation. The EDAW study suggested that habitat fragmentation can be remedied by the development and protection of several critical habitat pathways that connect remaining habitats (*Estes Valley Habitat Assessment*, 2008).

The Comprehensive Plan for the Protection of Wildlife **Habitat Connectivity**, or Comprehensive Plan, utilized findings from the 2008 habitat assessment, but has since expired. The Comprehensive Plan is a form of **futures planning** where the town comes up with a shared goal for the future of Estes Park which is then used to inform policy decisions. In the years following the expiration of the Comprehensive Plan, some residents of Estes Park have questioned whether the town's intention was to protect wildlife and the environment of the Valley or to seek commercialization as a priority (Gootz, 2019). Estes Park and Larimer County have recently begun the process of renewing and revising the Comprehensive Plan. The town of Estes Park has requested an update of the EVHA from the Logan Simpson consulting company, to report on major environmental changes since 2008, whether that be habitat designation , disturbance, or destruction (Formeller, April 18, 2022).

Impacts of climate change on RMNP elk population dynamics

Large herbivores have strong influences on native plant abundance, distribution, and diversity. A study in RMNP shows that factors that influence ungulate populations, such as climate change, have the potential to have drastic effects on elk populations and vegetation quality (Wang et al., 2002). This study compiled climate change and elk population data from 1965-1999 and proposed two models, both adapted from Hadley and Canadian Climate Center (**CCC**) global climate models, to assess the state of elk **population dynamics** (Wang et al., 2002). The models predicted the impact different climate change scenarios had on elk populations. Different climate parameters were applied to the two adapted models to predict herd sizes, sex, and age composition from data collected by the National Parks Service (**NPS**) (Wang et al., 2002).

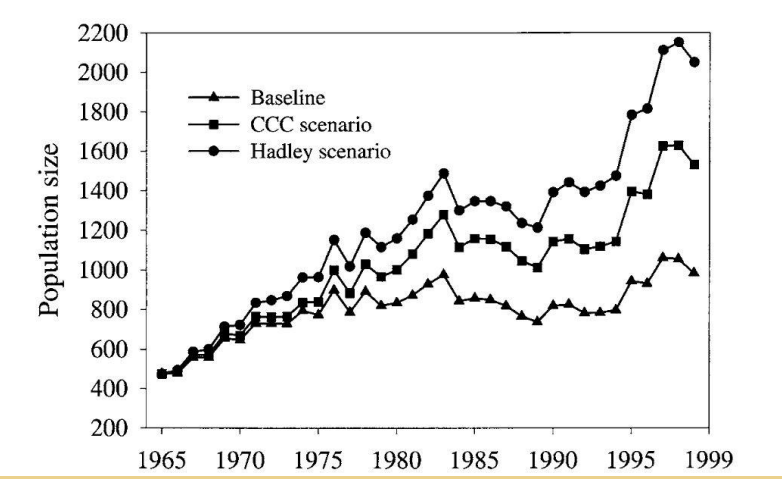


Figure 3. Projection of elk population dynamics using the Hadley and CCC model-based scenarios for the future climate change. Baseline is the prediction of elk population sizes using historic weather data (Wang et al., 2002).

The most accurate model for elk populations between 1965 and 1999 based on climate information at that time included summer temperatures and summer precipitation parameters (Wang et al., 2002). The CCC model predicted that by 2035, summer temperature would increase by 2.7°C and winter temperature would increase by 2.6°C on average. It also predicted dry years, in which summer monthly precipitation would decrease by 2.6 cm by 2035 and winter mean precipitation would decrease by 0.86 cm (Wang et al., 2002). The CCC model also predicted that the maximum population of elk in RMNP would reach 1,600. With unadjusted climate data and current population trends, the estimated elk population is only 1,000, which Wang, et al. (2002) suggest highlights the impact climate change can have on elk populations in RMNP.

The results of the RMNP study conclude that warmer, drier conditions during summer slows population growth, while these conditions accelerate population growth in the winter. Climate change also indirectly impacts elk population dynamics through alterations in habitat vegetation and abundance. These changes to summer and winter climates also cause coniferous forest expansion and the decrease of tundra and grassland habitats. All these factors result in decreased food nutrition, forcing elk to feed on less nutritious shrubs and plants they otherwise avoid (Wang et al., 2002). If climate change occurs as predicted, or worsens, the study suggests that the NPS find ways other than relying on severe winter weather to regulate ungulate populations (Wang et al., 2002).

These climate predictions through 2035, along with current elk population statistics, can be used to assess how accurate the study has been so far in predicting elk populations. In 2018, the elk population in Estes Valley was reported to be 2,400, significantly larger than the CCC model predicted. Even though the study was published in 2002, and the maximum population predictions were not accurate, climate change and its impact on elk populations are still highly relevant. This framework may be useful in projecting future impacts of climate change on elk population and habitat.

Climate change also has other impacts on the environment. Wildfires in the region have been larger and more frequent (Higuera et al., 2021). According to the Colorado Department of Parks and Wildlife (2021), however, in the short term, this has not yet impacted the elk. The extensive Cameron Peak fire of 2020 did not inhibit the elk from reaching their winter rang habitat or impact calving or rutting.

It is unclear, in the long term, whether migration patterns may be affected by wildfires (Colorado Parks and Wildlife, 2021). Climate change has also resulted in the abundance of mountain pine beetle outbreaks. These beetles kill large swaths of forest, opening up the forest canopy. While harmful to the health of forests, the opening of forest canopy leads to increased forage vegetation for elk (Cascaddan, 2018). In the short term, elk are relatively unaffected by climate change.

The housing deficit and development pressures in Estes Park

Gateway communities are often surrounded by public lands and other natural amenities (Stoker et al., 2021). These communities highly value their identity as a gateway community, so maintain that identity is an important consideration in development planning. Another important factor for gateway communities is housing affordability. In 2021 a study was conducted on planning and development in gateway communities in the western Unites States, such as Jackson, Wyoming and Aspen, Colorado. All but one of the gateway communities sampled identified housing affordability as a critical issue in their community (Stoker et al., 2021). The study found that a large cause for concern was gateway communities having at least 25% of their housing devoted to seasonal residents and short-term rentals (Stoker et al., 2021). The challenge to provide adequate housing is further exacerbated by income inequality, with much of communities' workforces unable to afford to live in the community, since most work in gateway communities consists of lower-paid service and tourism jobs (Stoker et al., 2021). The study identified the importance of futures planning in gateway communities to be able to possibly address growth pressures.

Estes Park is surrounded by the Roosevelt National Forest on the south and east and Rocky Mountain National Park on the north and west. These topographic and government boundaries have prevented intense development and sprawl that are common in many metro-area Front Range communities. Nevertheless, one of the main development pressures in Estes Park is the need for inexpensive housing, which the town has made various efforts to address A significant portion of Estes Park's housing market caters towards luxury buyers and renters, leaving few housing options for middle-class and lower income residents who work and live in town (Estes Park Area Housing Needs Assessment, 2016). The 2020 census revealed that the median household income in Estes Park was $54,925, significantly lower than the state median household income of $75,231. The median gross monthly rent in 2020 was $888 which is 19.4% of Estes Park's median household income, slightly less than the state median of $1,335, which is 21.3% of the state's median household income. The median value of owner-occupied housing units was $449,100 which is higher than the state median value of $369,900 (Census - Geography Profile, 2020). According to realtor.com, as of April 2022, there were 60 homes listed for sale, with a median listing price of $745 thousand dollars (Estes Park, CO Real Estate Market, 2022).

Larimer County defines **affordable housing** as single or multi-family units for households with an income less than, or equal to, 80% of the Area Median Income (**AMI**) (Affordable Housing Policy, 1999). While affordable housing options are important, many people who do not qualify for affordable housing still need access to inexpensive housing. Therefore, Estes Park has designated two additional forms of housing, **workforce housing** and **attainable housing** in the Development Code. Attainable housing is similar to affordable housing but has fewer restrictions. Attainable housing is defined as units meant for households with an income less than, or equal to, 150% of the Larimer County AMI (Estes Park Development Code, 2022, Chapter 11.4). Unlike affordable or attainable housing, workforce housing is not income-based and is intended to provide housing to residents employed in the Estes Park School District R-3 Boundary Map, shown in Figure 4 (Estes Park Development Code, 2022, Chapter 11.4). Attainable and workforce housing options offer a similar opportunity to affordable housing, but they include a greater range of socioeconomic statuses.

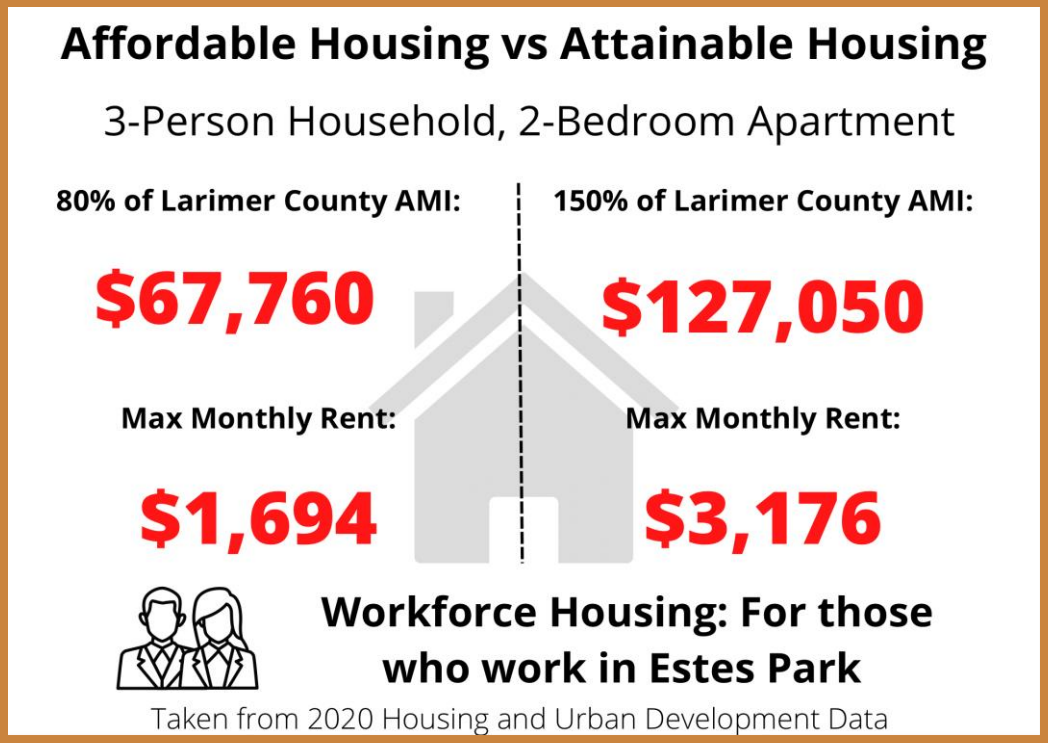


Figure 4. Housing designations in Estes Park.

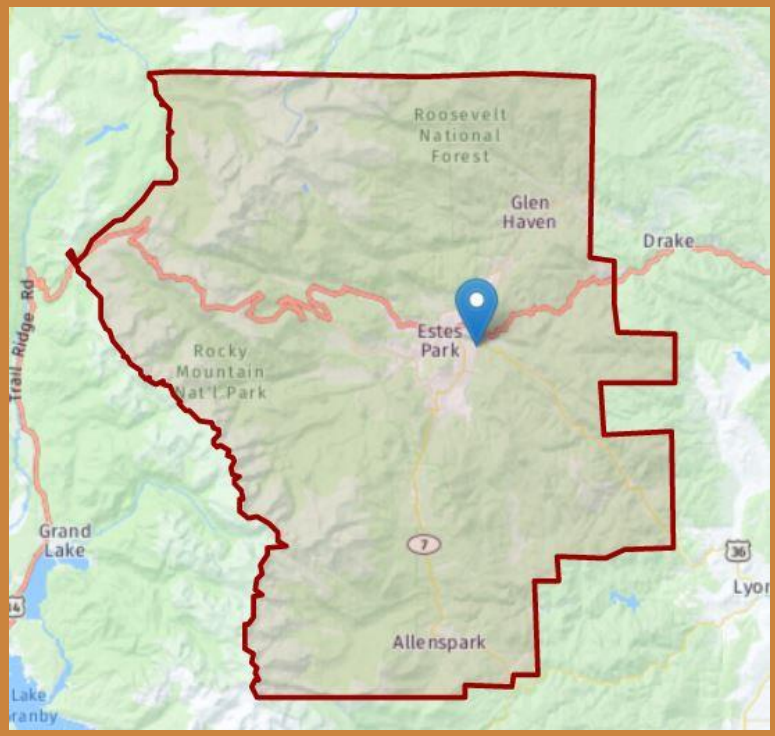


*Figure 5. Estes Park R-3 Boundary Map (*Estes Park High School Estes Park, CO School Boundaries Map & School Profile, *2022).*

A lack of inexpensive, affordable, or attainable housing options limits hiring options for local businesses and has had a negative effect on the staffing population within Estes Park (Mosier, 2021). Given that tourism and service jobs are seasonal and dominate Estes Park's economy, meeting seasonal employment needs is critical to sustaining the economy. To meet these needs, Estes Park must fill approximately 3,000 jobs every summer (US Department of Housing and Urban Development, 2018). The housing deficit has compounding effects on the local economy. There is also a higher commuter population, burdening the town's workforce with the cost of long-distance commuting, leaving them with less income to spend on other essential and discretionary expenses. The inadequacy of housing options is exacerbated by to the town's isolation from other communities (Hawf & Damweber, 2021).

Housing needs in the community have been formally assessed on four separate occasions: 1990, 1999, 2008, and 2016. The first three assessments identified that an additional 800 housing units were needed. The 2008 recession and the 2013 Colorado Flood hindered the construction of additional housing, while the need for inexpensive housing only increased (Hawf & Damweber, 2021). The 2016 housing assessment found that an estimated 1,480 to 1,690 housing units were needed to address workforce housing shortages at that time to keep up with increased demand (*Estes Park Area Housing Needs Assessment*, 2016).

Town Of Estes Park Grants Funds To Estes Park Housing Authority

Screen capture from (Town Of Estes Park Grants Funds To Estes Park Housing Authority, 2020)

The town of Estes Park has made several attempts to address the housing deficit, including the recent development of three major housing projects: the Falcon Ridge Apartments and Townhomes, The Pines Apartments, and the current planning of a new workforce housing property (Estes Park Housing Authority, n.d.). As of April 2022, planning is underway for a new development known as the Fish Hatchery Workforce Housing (Fish Hatchery Workforce Housing, 2022). This will be the first town-owned development that is classified as workforce housing. This workforce housing development is expected to be able to address approximately 15% of workforce housing needs in Estes Park, with 190 units, mostly one- or two-bedroom apartments. Rent at the Fish Hatchery development will range from $1200-$2500 a month (Rigby, 2022).

"The Pines is directly across the street from the paved bike path AND the 18 hole golf course. If viewing interests you, the deer and elk are often on the property or traveling through."

Screen capture from (The Pines Apartments | Estes Park Housing Authority, n.d.)

Estes Park is utilizing undeveloped land owned by the town to meet affordable and workforce housing needs (*Estes Park Housing Authority*, n.d.). Many of these housing developments reside on elk habitat and contain features that attract elk. The Fish Hatchery property will reside on the border of the elk winter concentration area. Most of the affordable housing is just outside of downtown Estes Park, which overlaps with elk winter concentration areas and elk resident population areas. Many of these complexes also boast about having elk and deer on the property, with well-maintained lawns and ornamental shrubbery that attract the wildlife.

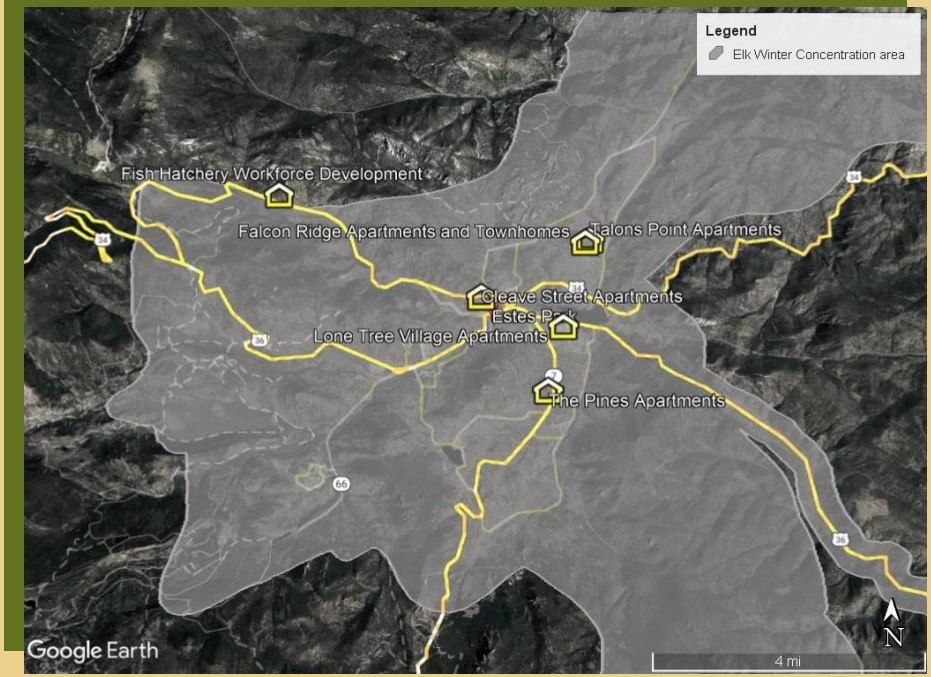


Figure 6. Map of current affordable housing developments in Estes Park (Colorado Parks and Wildlife, 2021).

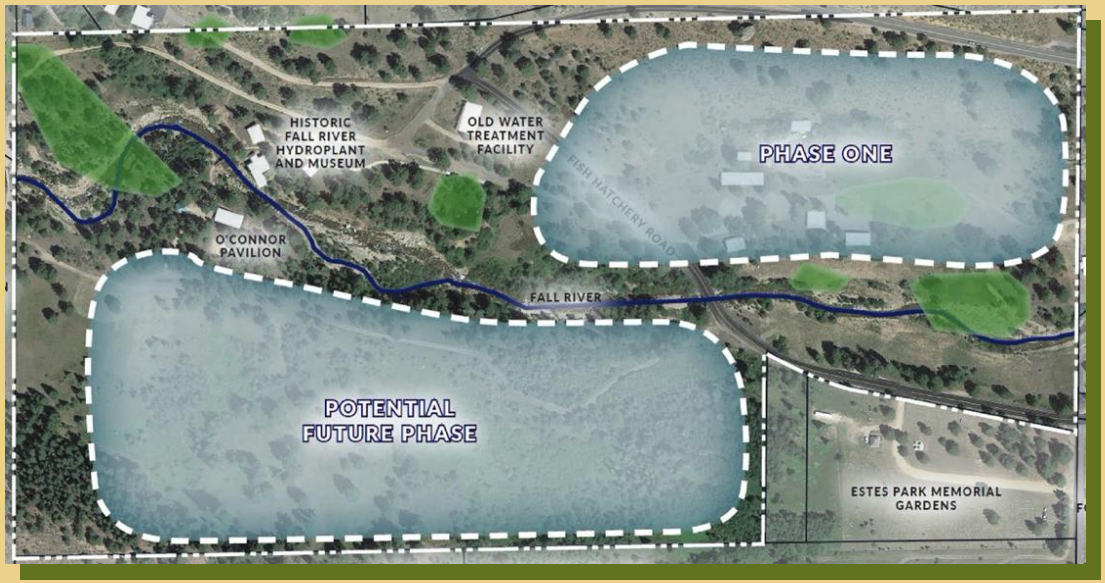


Figure 7. Preliminary plan for Fish Hatchery Property (Fish Hatchery Workforce Housing, 2022).

Construction of "Homes at Fish Hatchery" could begin in 2023

ESTES PARK Trail Gazette

Screen capture from (Rigby, 2022)

Land and wildlife protection policies

Housing and infrastructure development in the fragile ecosystem in Estes Park has had repercussions for both elk and human habitats. Some of the threats to elk identified by Colorado Parks and Wildlife (**CPW**) include destruction and loss of habitat caused by increases in human activity and development (Cooley et al., 2020). According to CPW, if expansion continues without accommodating elk, they and other species will not have access to the resources they require to survive (Cooley et al., 2020).

Highways and busy roadways that cross elk migration routes pose a danger to both humans and elk (Skroch & Ellenberger, 2021). A 2020 report found that vehicular collisions with wildlife have been on the rise as human populations are increasing and further encroaching on wildlife habitats and migration paths (Cooley et al., 2020). Elk and other big game animals are especially dangerous, as collisions with them are more likely to cause significant damage or be fatal to either party. Many roads are at lower elevations, in valleys, and along riparian corridors that often coincide with winter habitat or corridors that are critical to elk and other species. This infrastructure fragments animal habitats and increases fatalities of species populations (Figure 4) (Cooley et al., 2020). CPW's goal is to bring awareness and personal responsibility to mitigate the harm humans can cause the wildlife they are living alongside so that it may be avoided in the future. For instance, because elk do not discriminate between private and public property, they can end up trapped in household items such as tire swings, volleyball nets, and hammocks (Hazelton, 2018). As a result, CPW recommends not leaving out items that the elk can easily get tangled in, especially during the fall, when elk are more aggressive (Hazelton, 2018).

In the last century, economic and community development policies in Estes Park often prioritized growth over wildlife protection. In 1937, for example, the Colorado-Big Thompson Project was approved for the U.S. Bureau of Reclamation to dam the Big Thompson River to create the man-made Lake Estes, in order to bring water to Estes Park and the Front Range (Lebeda, 2019). This engineering project drastically changed the landscape of Estes Valley and how the elk used the habitat. Shifting to a more balanced planning model, the state of Colorado has more recently enacted policies and bills that aim to preserve essential habitats and reduce fragmentation due to human development. These policies include actions stemming from state legislation, county-wide guidance, and local development codes.

The Land Conservation and Habitat Protection Policy of 2019 has been essential in funding and maintaining essential migration paths and habitats and increasing safety for elk (Skroch & Ellenberger, 2021). This order directed the CPW to compose a report of current migratory patterns and to incorporate this information into public education. The order also directed CPW to devise a plan for safe animal passage around major highways to reduce wildlife-vehicle collisions (Skroch & Ellenberger, 2021).

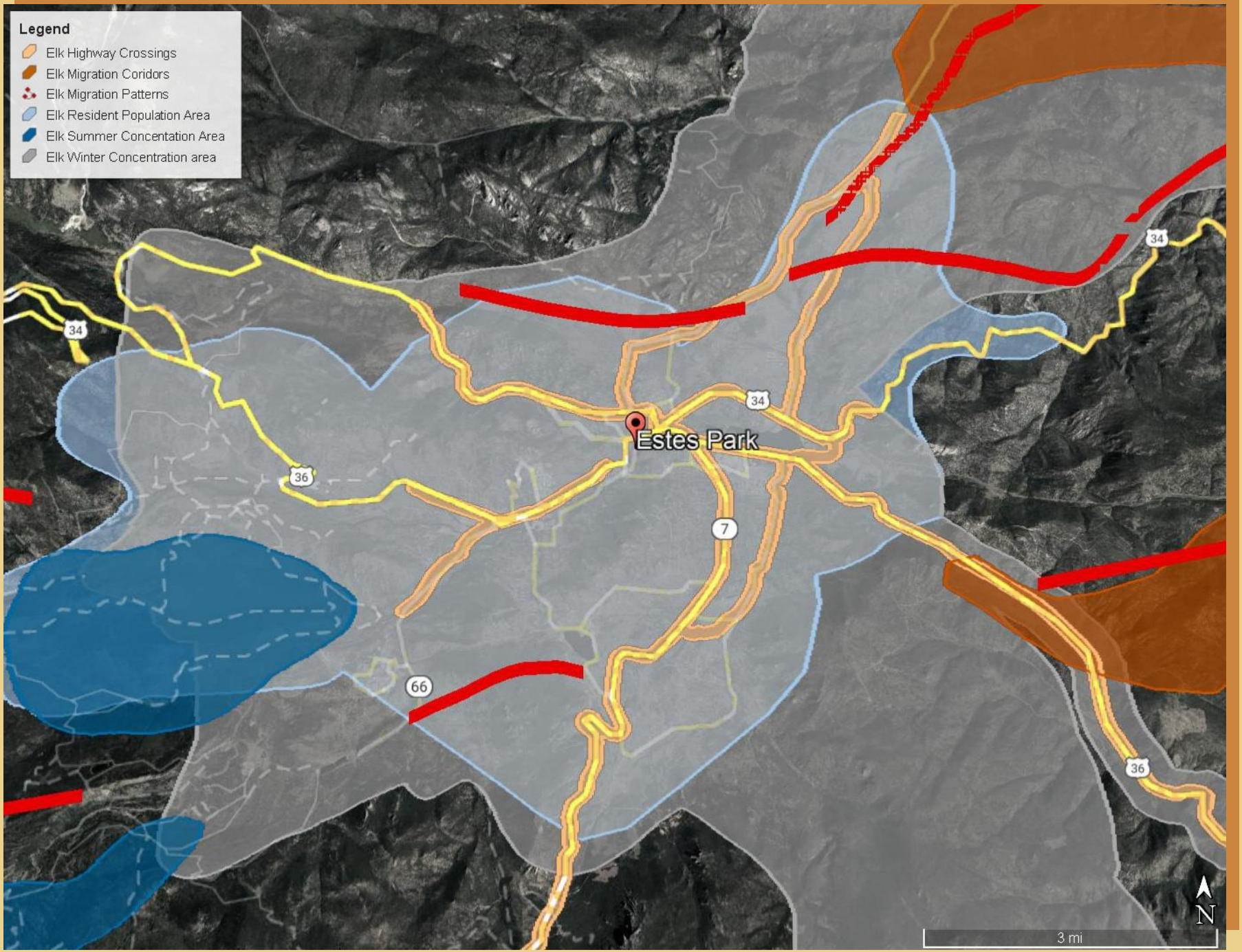


Figure 8. Intersection of elk habitat and movement corridors with the center of Estes Park (Colorado Parks and Wildlife, 2021).

Figure 9. Bull elk tangled in Christmas lights (Hazelton, 2018).

As a result, the Colorado Department of Transportation, with the help of wildlife state officials and experts, constructed a wildlife overpass and underpass system along Highway 9, approximately 50 miles southwest of Estes Park. These passageways have reduced vehicle collisions in the area by 90% and have been used by a variety of wildlife species, including elk, deer, bighorn sheep, mountain lions, turkeys and many others (*Wildlife Crossing Project*, 2021). As a part of this initiative, the state is also identifying and prioritizing areas with high rates of wildlife-vehicle collisions to implement a similar strategy.

Finally, the State of Colorado has also passed an initiative to mitigate habitat fragmentation. The Colorado Habitat Connectivity Senate Joint Resolution in 2021 was designed to raise efforts to protect the region's plants and animals through conserving wildlife connectivity (Colo. S.J. Res., 2021). This bill calls for the governor, local governmental organizations, Indigenous communities, recreational agencies, and stakeholder groups to contribute to the preservation of wildlife corridors and habitat connections throughout the state. This initiative aims to maintain or increase connectivity of habitats, while reducing fragmentation caused by major highways and human development.

Locally, the Town of Estes Park has its own Development Code which includes a section on wildlife habitat protection. Certain site development applications require a Wildlife Conservation Plan, including for critical wildlife areas along waterways (*Estes Park Development Code*, 2022, Chapter 7.8). The goal of the wildlife habitat protection development code is to ensure that future development and land use plans maintain existing wildlife diversity and habitat (*Estes Park Development Code*, 2022, Chapter 7.8). However, despite these initiatives, most land and zoning policies in the state prioritize human needs for development, resources, and recreation over conservation of habitat, essential ecosystems, and wildlife migration routes.

Understanding habitat fragmentation

Recent research has highlighted the importance of landscape connectivity and reducing habitat fragmentation for species survival. Landscape connectivity refers to the ease of movement within and between landscapes whereas habitat fragmentation refers to the division of existing habitats. Fragmentation results in smaller habitats with different ratios of interior to border. Both properties can be influenced by both human activity and natural events such as floods, fires, and blights (Millhouser, 2019). This study investigated correlations between fragmentation and changing connectivity and found that human development and population increases influenced changes in surrounding habitats and landscapes as well as increased instances of human-animal conflict (Millhouser, 2019).

The research indicated that between 1990 and 2018, there was a 150% increase in human population in the Roaring Fork and Eagle Valleys in Colorado, where development is geographically limited similarly to Estes Park (Millhouser, 2019). In addition, development on federal land, which surrounds both regions, is practically impossible. The study found that human impact on the landscape accounted for much of the variation in species population growth (Millhouser, 2019). The study also found that increases in fragmentation of summer habitats and corridors were much more pronounced. This gives rise to concern about the impact of fragmentation on the summer range, which had previously been less fragmented than the winter range. The Millhouser (2019) study concludes that increased fragmentation may have changed the stability and resiliency of the elk population in this region. This research may help inform how habitat fragmentation and habitat connectivity may be further influenced by human development in the town of Estes Park.

Summary

Estes Park is a popular tourist destination and home to a variety of wildlife, including elk. Elk have a substantial presence in the town and frequently interact with tourists and residents, resulting in human-elk conflict. A review of published literature and research revealed three important points: 1) climate change affects elk habitat and is changing their seasonal migration patterns, which is increasing human-elk conflict in the region; 2) human development is increasing habitat fragmentation, which reduces overall connectivity and 3) gateway communities face housing deficits and struggle to balance the need to develop with restrictions from surrounding federal land. By understanding natural pressure points for elk and humans and identifying strategies for coexistence, futures planning in Estes Park may involve a re-assessment of priorities and the impacts of human development on the region.

3

Our Approach to Understanding Human-Elk Conflict in Estes Park

This project examines human-elk conflict as a case study in Estes Park to support futures planning in the Estes Valley. We structured our work around three objectives:

- Understand environmental pressure points for elk
- Understand development and educational pressure points in Estes Park
- Rethink strategies for coexistence in Estes Park

We used a mixed methods approach to achieve these objectives.

Understand environmental pressure points for elk

We documented environmental pressure points for elk by utilizing informal on-the-street interviews, in-depth interviews with wildlife experts, elk population data from CPW, and news and social media documentation.

We used a sample of convenience to interview owners and employees of local businesses to gather their perspectives on common or seasonal elk stressors in downtown Estes Park (see Appendix A for interview guide). These interviews helped us understand the impact of elk and tourists on local businesses and gain insight into resident perspectives on elk in Estes Park.

A key aspect in minimizing human-elk conflict is identifying spaces for elk movement and habitat. Much of this work was completed by EDAW Inc. in the 2008 Estes Valley Habitat Assessment, however the results of the study are out of date. Many of the wildlife corridors identified in the study have shifted while growth and human development have increased in the region. To assess how corridors have shifted since the completion of the 2008 assessment, we used 2021 CPW species data as well as Colorado Hunting Atlas data, which highlight elk migration patterns and summer and winter ranges. These data were compared to the results of the 2008 study to gauge the magnitude of corridor shifts. We used Google Earth and the Colorado Hunting Atlas to develop a broad understanding of changes in land use from multiple perspectives.

Figure 10. Elk grazing at the golf course in Estes Park.

Identifying changes in habitat was essential to understand where elk typically reside in Estes Park and where conflicts are most likely to arise. We interviewed local wildlife experts using structured interview questions to determine how habitats have changed or been lost. These experts included ecologists, local wildlife officers, and other people who are knowledgeable about the local environment. We conducted a key informant interview with Chase Rylands, a CPW District Wildlife Manager, to gain insight on changes to elk populations and movement (see Appendix B for interview guide). Mr. Rylands is responsible for responding to Larimer County's human-wildlife conflicts and has experience managing human-wildlife conflicts and educating the Estes Park community on mitigation strategies.

Understand development and educational pressure points

To understand development pressures, we conducted interviews to elicit the perspectives of residents, tourists, planners, and developers. Additionally, we investigated local real estate data and public planning maps. To understand educational pressures, we interviewed elk education experts.

We conducted interviews with local business owners and employees, residents, and tourists to understand how elk affect their daily lives. Although Estes Valley hosts both resident and tourist populations, these groups and subgroups interact with wildlife in vastly different ways. Interviews with a range of people who interact with elk provided different perspectives that furthered our understanding of human-elk conflict. We classified residents as those who have lived in Estes Valley for more than six months, while tourists were classified as those who were visiting for a few days, weeks, or months. We further subdivided the tourist category based on whether they were in Estes Park to visit RMNP or for another reason. We included demographic and background questions to gain context for each interviewee (Appendix C and D). Interviews with residents and tourists were conducted by approaching people in downtown Estes Park using a sample of convenience. These interviews revealed which groups are most affected by elk, and/or educated about elk behavior in Estes Valley.

To gain insight into current educational strategies, we interviewed Rachel and Andy Ames, EVWC board members and RMNP volunteers who have lived in the region for more than 35 years. Rachel Ames is an avid wildlife photographer, and both she and her husband have witnessed human-elk interactions and have experience as wildlife education volunteers (see interview guide in Appendix E). Kris Hazelton, co-owner of the Estes Park News and devoted advocate for wildlife in the Valley, gave us insight into pressure points for conflict and everyday interactions between humans and elk in Estes Park (see interview guide in Appendix E). Alex Bergeron, one of three Estes Park town planners, gave us insight into the housing pressures and the current development code regarding wildlife-friendly development in Estes Park (see interview guide in Appendix F).

Rethink strategies for coexistence in Estes Park

To rethink strategies for coexistence we needed an understanding of how residents and visitors in Estes Valley currently perceive and are informed about human-elk conflict. We utilized in-depth interviews with police contacts to gain insight on the current state of human-elk conflicts. Additionally, we investigated existing platforms that promote coexistence with nature and interviewed experts on strategies for future consideration.

Determining the frequency and severity of human-elk conflicts was important for determining the scale of this issue in Estes Park. We interviewed a representative from the Estes Park Police Department to get data on reported conflicts and an understanding of the work the Estes Park Police Department is doing to support coexistence with the elk (see Appendix G).

Figure 11. Practicing the thumb rule on the cardboard elk.

Figure 12. Team picture with 'Kle', the life-size cardboard elk we used for our safe-distance experiment.

Maintaining safe distances from elk is the first step people can take to limit human-elk conflict. To test and assess current education levels on safe coexistence, we purchased a cardboard cutout of an elk and brought it to downtown Estes Park (Figure 5). We used a sample of convenience of passersby as a study set for distance testing. Each participant was asked to stand at a point that they believed was a safe distance from the elk (Appendix H). To promote safe practices, we measured the distance and showed participants the location of a safe distance, 75 feet away. We used a sample of convenience to interview residents and tourists to assess the current education levels on elk safety and identify opportunities for improvement.

We assessed and documented existing platforms that promote a culture of coexistence with elk, noting signage, pamphlets, posters, websites, local building policies, and dog laws. We asked residents and experts for their vision for Estes Park's ideal future and how they see the community achieving that future to identify approaches to a more harmonic future for Estes Park.

Figure 13. Discussing visions for Estes Park's future

Figure 14. Interviewing experts from University of Colorado Boulder

Finally, to gain insight into strategies to mitigate human-wildlife conflict, we interviewed experts from the University of Colorado Boulder and Colorado State University Department of Human Dimensions of Natural Resources that primarily research and teach the public about human-wildlife conflicts. Our questions were designed to generate ideas for promoting coexistence (see Appendix I).

4

Discoveries and Implications

Our findings revealed a bidirectional relationship between elk and humans and their impacts on one another, especially with ongoing climate change and other shifts in environmental conditions and human activity. Elk clearly provide indirect economic benefits to Estes Park and these benefits in part have driven the development of the town. The relationship between elk and humans in Estes Park is a complex, nuanced one that reveals the town's needs for coexistence strategies.

Understand environmental pressure points for elk

Approach	Activity	Why
Interviews	Local business employees, Chase Rylands	To understand their perspectives on elk and tourists and elk population dynamics and human-wildlife conflicts
Data Analysis	CPW species data using Google Earth	To understand current elk migration patterns and seasonal habitat

Our interviews with wildlife experts revealed subtleties about elk behavior throughout the year that explained the variability of human-elk encounters. Elk are typically docile; however, they bear distinct seasonal behaviors that change their responses to encroachment. During the fall, for example, elk participate in rut, during which testosterone levels in **bulls** increase drastically. This can result in unpredictable, dangerous behaviors (Jackson, March 21, 2022). Bulls will recruit, protect, and compete for **harems**, groups of females they mate with, from early September to late October. During this time, bull elk are much more aggressive, more likely to charge, and are consequently more likely to get tangled in items such as swings, nets, and other household items (Hazelton, March 15, 2022). Similarly, **cow** behavior changes during **calving season** in the spring. Cows will often leave their young hidden in tall grass, rendering them difficult to see. If humans inadvertently get too close to a **calf**, the protective mother will charge. These seasons both increase the elk-driven tourism to Estes Park and the risk of dangerous encounters between humans and elk in Estes Park (Representative of the Estes Park Police Department, April 12, 2022).

Figure 15. A bull bugling with his harem of cows and calves (Aaron Jackson of vicarious-photography.com).

Our findings confirmed that humans have created small and large-scale environmental pressure points for elk. For example, it is illegal to feed elk as doing so can result in stomach blockages and starvation if elk consume unsafe foods (Rylands, March 28, 2022). Some residents of Estes Park, however, intentionally feed elk by leaving out hay bales or salt blocks. Their motivation is to keep them around on the belief they are helping the elk, especially in winter when food is scarce (Rylands, March 28, 2022). Communal feeding can increase disease transmission by concentrating species feeding in one area and build a reliance on non-native food sources. As an indirect consequence of housing and commercial development, elk also feed on ornamental shrubbery, particularly chokecherry trees, which have been planted to contribute to the aesthetic of commercial and private properties. These food sources taste sweeter than others and attract elk to more populated places throughout town, increasing instances of human-elk interactions and dependency (Rylands, March 28, 2022).

On a regional scale, human development and urbanization can prevent the movement of elk through Estes Park, but it can also funnel elk across major roadways and into town centers. Open recreation areas in town have inadvertently provided elk with large grazing spaces. This has attracted elk to high traffic areas including local golf courses, Lake Estes, the Bird Sanctuary, and even Bond Park in the center of town (A. Ames, March 17, 2022). Concentrating elk in highly populated areas around town has resulted in cases where humans provoke elk and if an elk injures a human, provoked or not, the elk will be euthanized (Representative of Estes Park Police Department, April 12, 2022).

> *"It was the person's fault, but the elk pays the ultimate price in their life"*
>
> Kris Hazelton – Estes Park News

Bull Elk Attack Forces CPW to Euthanize Animal

Screen capture from (Hazelton, 2017)

Understand development and educational pressure points in Estes Park

Approach	How/Where/Who	Why
Interview	Residents - Downtown Estes Park	To understand resident perspectives on elk as an identity, human-elk encounters, and visions for Estes Park's future
Interview	Tourists - Downtown Estes Park	To understand their wildlife safety education level, perspectives on elk, and reasons for coming to Estes Park
Interview	Education Experts: Rachel and Andy Ames - Estes Valley Watershed Coalition Board Members Kris Hazelton –Estes Park News	To understand current educational strategies, everyday interactions between elk and humans, and current volunteer programs in Estes Park
Interview	Town Planner: Alex Bergeron – Town Planner	To understand development plans and the current development code in Estes Park

Our interviews with town officials confirmed that the events of the past 15 years have catalyzed housing and development pressures in Estes Park. The COVID-19 pandemic generated a surge of domestic travel. Visitation to Rocky Mountain National Park has grown to five million visitors a year (Rylands, March 28, 2022), many of whom pass through or stay in town. As the number of visitors increases, the town is forced to address an influx of accommodation needs, workforce, and visitor resources.

Development

As Estes Park is surrounded by federal land, the town's expansion opportunities are restricted. Yet at the same time, the growing demands on the local economy require a workforce to support it. We found that there is a lack of available inexpensive housing. Many employees of local businesses and town officials that we spoke with live outside of Estes Park due to the cost of living. This can result in long commutes.

> *"I don't live in Estes Park. I commute here two to three times a week, it's an hour each way. And that's because of our severe housing shortage, which is not unique among resort towns in the west"*
>
> Alex Bergeron – Estes Park Town Planner

Estes Park local governance policy actively supports the idea of coexistence with nature in all development, but implementation can be inconsistent. Wildlife friendly developments uphold Estes Park's branding as an intersection between the built and natural world (Bergeron, April 7, 2022). Requirements are in place in the Estes Park Development Code and Estes Park Municipal Code regarding fencing around properties, ensuring elk and other animals have adequate space to move between and within properties (Bergeron, April 7, 2022). This is especially important for elk because fencing can result in elk antlers getting tangled and elk movement being inhibited (Rylands, March 28, 2022). New developments or changes to existing developments are required to submit a Wildlife Conservation Plan if sites contain big horn sheep habitat, endangered or threatened species, or riparian areas, but not elk (*Estes Park Development Code*, 2022). It would be beneficial if an updated Wildlife Conservation Plan included an analysis of adverse impacts of the proposed development to wildlife both on and off site; proposed mitigation measures; and a plan for implementation, maintenance, and monitoring of the proposed measures. However, any changes to lots that were approved for single-family residential use prior to February 1st, 2000, do not need to submit a Wildlife Conservation Plan (Bergeron, April 7, 2022). Furthermore, the Development Code is not always enforced, and with high staff turnover rates in town offices, development records can end up lost or incorrectly filed (Bergeron, April 7, 2022). Estes Park has an existing wildlife-friendly development code but lacks explicit protection of elk and their habitat.

> *"People come here for the wildlife and the wild lands"*
>
> Alex Bergeron – Estes Park Town Planner

Figure 16. Elk in Estes Park ("Where to View Elk in Estes Park," 2020).

Education

Our observations led us to believe that much of the human-elk conflict in Estes Park can be attributed to lack of education about wildlife coexistence. We found that various organizations have attempted to improve education about elk behavior and safety. For example, the local newspaper, Estes Park News, has published articles warning about seasonal dangers regarding elk. The editor, Kris Hazelton, has posted educational videos on social media (Hazelton, March 15, 2022). Organizations such as the Estes Valley Watershed Coalition along with the Estes Park Police Department have handed out informational cards (Figure 6) at events and the visitor center (Hazelton, March 15, 2022). In our site assessments, we could only locate a few permanent signs around town, such as wildlife crossing road signs and warnings of aggressive elk around Lake Estes.

Figure 17. Informational card from Estes Park Police Department.

Our interviews revealed that the town organizes events at various venues and encourages independent groups to participate in educational programming about elk. Festivals including Elk Fest, which occurs during the rut in the fall, are opportunities both to bring tourists into Estes Park and to educate visitors (Hazelton, March 15, 2022). Many wildlife education campaigns run by organizations such as the Elk Bugle Corps and the Wandering Wildlife Society are carried out by volunteers who talk to people about proper etiquette around elk. The Elk Bugle Corp works in the national park to keep traffic flowing and prevent elk jams, in addition to educating tourists (A. Ames, March 17, 2022). The Wandering Wildlife Society works in and around Estes Park to help keep tourists a safe distance away from elk in high conflict areas (Jackson, March 21, 2022). We found residents also warn tourists when they are encroaching on the elk (A. Ames, March 17, 2022; Jackson, March 21, 2022). Auxiliary Police officers, a trained volunteer police force, also provide education while responding to calls about large elk herds in

town or people getting too close to the elk (Estes Park Police Informant, April 12, 2022). Additionally, CPW conducts local outreach to residents of Estes Valley, educating them on the impacts of their actions, such as feeding elk (Rylands, March 28, 2022). Despite the town's education efforts, our site assessments revealed that key locations for tourists, such as the town's visitor center, lacked elk educational information.

We also found a lack of essential safety education. To conduct a simple assessment of current understanding of safe distances from wildlife, we performed a field test examining measured distances of tourists from elk using an elk cardboard cutout (Figure 7). Participants were asked to stand where they felt was a safe distance from the elk cutout. In this figure, the heads represent test subjects and the distance they stood from the elk. The figure below shows that most of our subjects chose a "safe zone" that was much closer than the recommended 75 feet. In real life, the temptation to photograph or view the elk brings visitors even closer to the wildlife (Hazelton, March 15, 2022).

> *"There's a reason it's called wildlife, because they're wild"*
>
> Kris Hazelton – Estes Park News

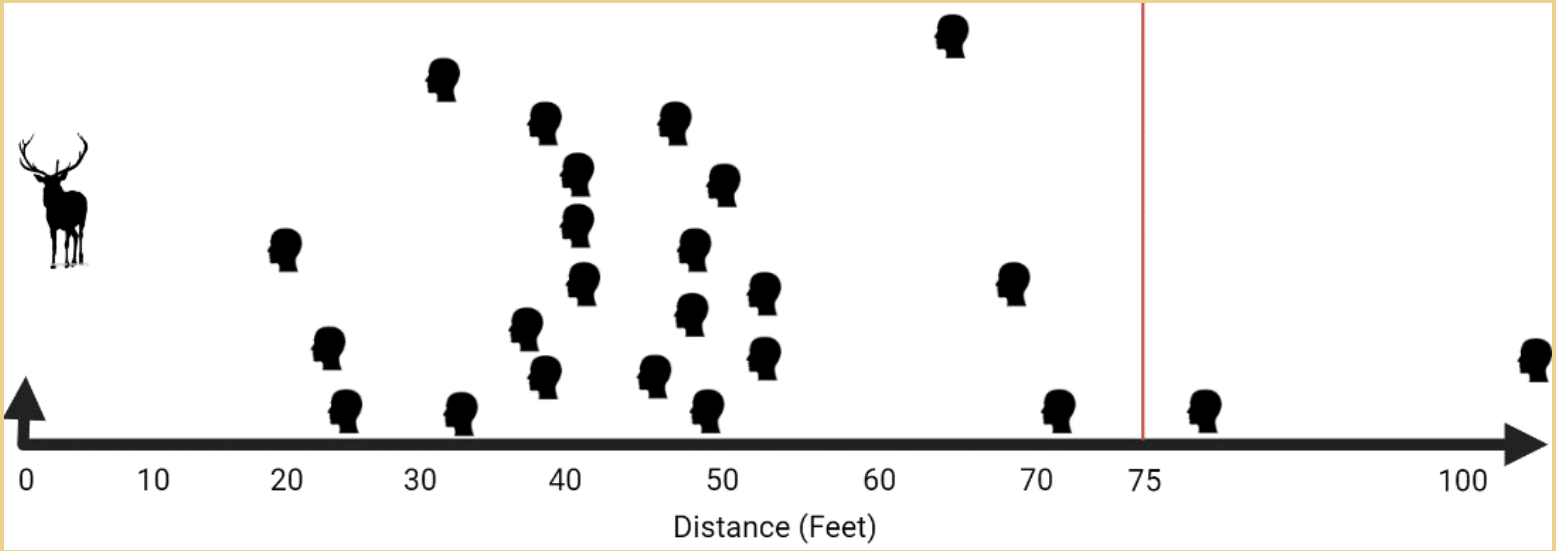


Figure 18. Safe Distances Field Test. Head silhouettes represent the distances from the elk study subjects deemed a 'safe distance'.

Various education experts thought that many visitors have a false sense of security and treat the wildlife in Estes Park like a zoo (R. Ames, March 17, 2022). The CPW District Wildlife Manager noted that these visitors do not understand the danger elk can pose humans and therefore do not respect their space. Even some who know the dangers elk can pose believe that incidents will not happen to them (Rylands, March 28, 2022). From the perspective of education experts, a combination of interest in posting elk sightings on social media and the belief that there is safety in numbers seems to contribute to tourist-elk conflict in Estes Park (Hazelton, March 15, 2022; A. Ames, March 17, 2022).

Rethink strategies for coexistence in Estes Park

Approach	How/Where/Who	Why
Interview	Police Department contact	To understand the frequency, location, and severity of human-elk encounters in Estes Park
Safe distance field test	Tourists were asked to stand where they believe was a safe distance from elk. Distances were recorded	To understand and identify gaps in current education levels on elk safety
Signage and materials assessment	Visitor center, downtown Estes Park, Bond Park, golf courses, street signs	To assess current strategies for promoting education on elk behavior and overall elk awareness
Interview	Coexistence experts: Karen Bailey – Environmental Studies professor at CU Boulder Stephanie Shwiff – Research leader in human-wildlife conflicts at CU Boulder	To understand preliminary strategies for coexistence and how it can be promoted in Estes Park

"If the elk are reacting to you, you're too close"

Aaron Jackson – Estes Park Resident

March 21st, 2022

In our evaluation of coexistence strategies, we noted that residents and tourists hold diverse attitudes about the elk problem. Some residents reported that elk are a nuisance and the damage they cause is annoying. Other residents expressed that humans are living in elk habitat, and the damage that elk cause is not something elk are responsible for. These residents recognize that elk were in the area before people and that humans are living on land that belongs to the elk. Among the 15 residents we surveyed, 13 had a high level of respect for elk and their rights as living creatures, and the majority think that elk deserve to be left alone (Jackson, March 21, 2022; A. Ames, March 17, 2022; R. Ames, March 17, 2022; Employees and Residents, March 22, 2022).

Instigators of Conflict

10 out of 15 residents we interviewed expressed concern that tourists see the elk as a form of entertainment. This perspective highlights the differences in tourist and resident behaviors around wildlife. They report seeing tourists ignoring warning signs, walking past police tape, crossing barriers, and ignoring volunteers trying to protect specific areas. The perception is that tourists appear more interested in ensuring they have an exciting vacation than they are about making sure the elk do not experience any undue stress. Due to the constraints of the study period, we did not have the opportunity to closely observe this interaction.

> *"Volunteer groups usually only last the season or so, because the people we try to talk to, to educate, get angry"*
>
> Kris Hazelton – Estes Park News
> March 15th, 2022

Figure 19. Common tourist misconceptions of elk local business owners and employees find themselves answering frequently.

The most commonly reported negative interactions between elk and humans in Estes Park include attacks, vehicle collisions, traffic jams, entanglements, and the destruction of lawns and gardens. While getting attacked by an elk might be a terrifying experience, it is uncommon and, in most cases, people are injured by avoiding a charging elk (R. Ames, March 17, 2022). Traffic due to elk is also a frequent occurrence. Some of this traffic is caused by elk being on the road and is often difficult to avoid. During busier seasons, traffic jams are often caused by people stopping to view the elk from the road, and when there is not enough space to pull off, in the middle of the road (Estes Park Police informant, April 12, 2022). Even during the study period, in the off season, we observed elk jams caused by tourists stopping in the middle of the road to take pictures of elk, which contributed to unsafe road conditions. In addition to traffic, wildlife-vehicle collisions are a risk that drivers face in Estes Park. One of the largest factors in wildlife vehicle collisions is distracted driving and speeding since elk can come out of nowhere and collisions often result in serious injuries or fatalities for both parties (Rylands, March 28, 2022).

Barriers to coexistence

In an effort to understand visions for the future of coexistence, we found a range of answers. Some eco-centric residents said that the Estes Park community should do whatever it can to accommodate the elk and that the community has a responsibility to minimize conflict for the sake of the elk (A. Ames, March 17, 2022). More human-centric answers included a shared belief from many residents and tourists that Estes Park has achieved coexistence between elk and humans. A few residents acknowledged that humans do have an impact on the elk and this impact should be minimized where possible.

One of the most widespread coexistence strategies is through education for tourists, largely facilitated by volunteer groups talking to tourists and handing out pamphlets. Both educators noted that approaching tourists and explaining elk behavior using parallels of human behavior was an effective method to educate and build respect for the animals. However, educators acknowledged that there is a problem of resources with this method with the limited number of volunteers. Use of pamphlets and signage is only moderately effective. Most pamphlets and signs are easily ignored and elk signage in Estes Park is mainly seasonal (Rylands, March 28, 2022).

Many residents and employees call the police when people are encroaching on elk. In peak tourist season, the police department receives as many as 10-12 calls a day regarding potential elk conflicts. In a year, there are more than 500 elk-related calls, with as many as half of them result in a dangerous encounter (Estes Park Police Informant, April 12, 2022). This puts additional strain on local law enforcement, especially during the busy seasons.

Mitigation strategies such as hunting was identified as an important tool in managing the elk population size. While hunting is an effective tool to manage population size, recently direct management of the population through hunting has been getting harder because fewer hunters are applying for tags (Rylands, March 28, 2022).

Figure 20. Elk Bugle Corps volunteers (Rocky Mountain National Park, 2012).

Coexistence Tactics and Strategies

To foster a more equitable coexistence with elk, tourists and residents suggested that educational materials such as pamphlets, signs, and stickers be placed in locations around town such as the Estes Park Visitor Center, Lake Estes, Bond Park, and hotels and motels. In early trials, several people noted that some of our prototype educational materials were overly aggressive and "scary." One person suggested that educational material should not shame tourists. Instead, it would be more helpful to educate tourists without making them feel stupid. That resident claimed that tourists will not behave better by insulting them; however, others appreciated sharper and humorous messages because they thought those message styles were an effectives way to get the message across.

Regarding our "thumb rule" sticker, we were told that most people, residents included, would not be familiar with the thumb rule and that it should be explained on the back of the sticker. The newspaper editor, Kris Hazelton recommended a scare tactic making use of wildlife harassment fees (Hazelton, March 15, 2022). Andy Ames suggested removing the grass at Bond Park and replacing it with natural vegetation, to limit the attractiveness of Bond Park to the elk (A. Ames, March 17, 2022). Mr. Ames also suggested a dedicated volunteer group to keep traffic moving and avoid 'elk jams' to reduce the impact of elk on traffic and accidents (A. Ames, March 17, 2022). Another suggestion was to implement separate daytime and nighttime speed limits to help limit collisions with wildlife (Rylands, March 28, 2022). While residents and the town of Estes Park is very invested in achieving coexistence between elk and humans, it is a very complex issue that does not have any easy answer. This was reflected in the responses we received from residents, tourists, and experts alike. When asked directly about what changes need to be made to achieve coexistence, they did not know what the next step for Estes Park should be. This implies that the conversation about futures planning regarding coexistence is not yet happening and there is a real opportunity for that in Estes Park.

Figure 21. Informational sticker drafts with thumb rule explanation on the back.

Discussion

We can see that Estes Park has a pressing need for housing, but its economy also relies on the draw of elk to bring in tourists. When developing, being aware of and mitigating the impacts of development on elk and their habitat can help achieve coexistence. For example, properties that contain non-native plants often attract elk. Being conscious about how landscaping choices can impact elk behavior may help reduce the impact animals and humans are having on each other. Additionally, increased building density and fencing can severely limit the ability of elk to move through Estes Park. Ensuring the ability to move in and through Estes Park could help minimize the amount of time elk spend traveling along streets. Changes in precipitation have significant impacts on elk movement patterns. Keeping track of how elk habits change as a result, can help inform futures planning so that the town of Estes Park continues to mitigate human impacts on elk and their habitat.

Figure 22. Bull elk in elk jam in Estes Park.
(Aaron Jackson of vicarious-photography.com).

Estes Park is increasingly getting constricted by visitors and wildlife, essential aspects of Estes Park's identity, and development pressures, which need to be harmoniously balanced. Accommodating these factors present a uniquely challenging situation for the community.

We observed that the residents of Estes Park were enthusiastic about our project and the questions we were raising. They gave valuable feedback on our deliverables and generally interested about our project and our progress. This means that our project and our recommendations have the capacity to resonate with people and make change in the community.

5

Suggested Action Plans and Final Thoughts

This section details recommendations and actions for EVWC that support coexistence with elk in the face of development pressures in Estes Park. These 3 recommendations are designed to ease tensions in human-elk relationships, and they approach the problem from many different directions, such as education, development policy, and futures planning strategies.

Recommendation 1. Create and Distribute Relatable Educational Materials

Signage:

Who:

We recommend that the EVWC collaborate with the Estes Park Parks Division, the Estes Valley Recreation and Parks District, the Estes Park's Visitor Services Division to help fulfill their mission of protecting and improving the wildlife habitats of the Estes Valley.

What:

We recommend adding that the EVWC continue to test our prototype educational tools, with the potential to distribute them around town. In its wildlife projects, the EVWC might be interested in incorporating signage that explains elk behavior and their history in Estes Park. We drafted a sample sign with a format similar to existing signs for the Nature Sanctuary around Lake Estes (Figure 8). The second type of signage that might be of interest to the EVWC is posters that can be displayed in locations where tourists frequently visit within Estes Park. And the final type of signage would be road signs warning about wildlife harassment fees.

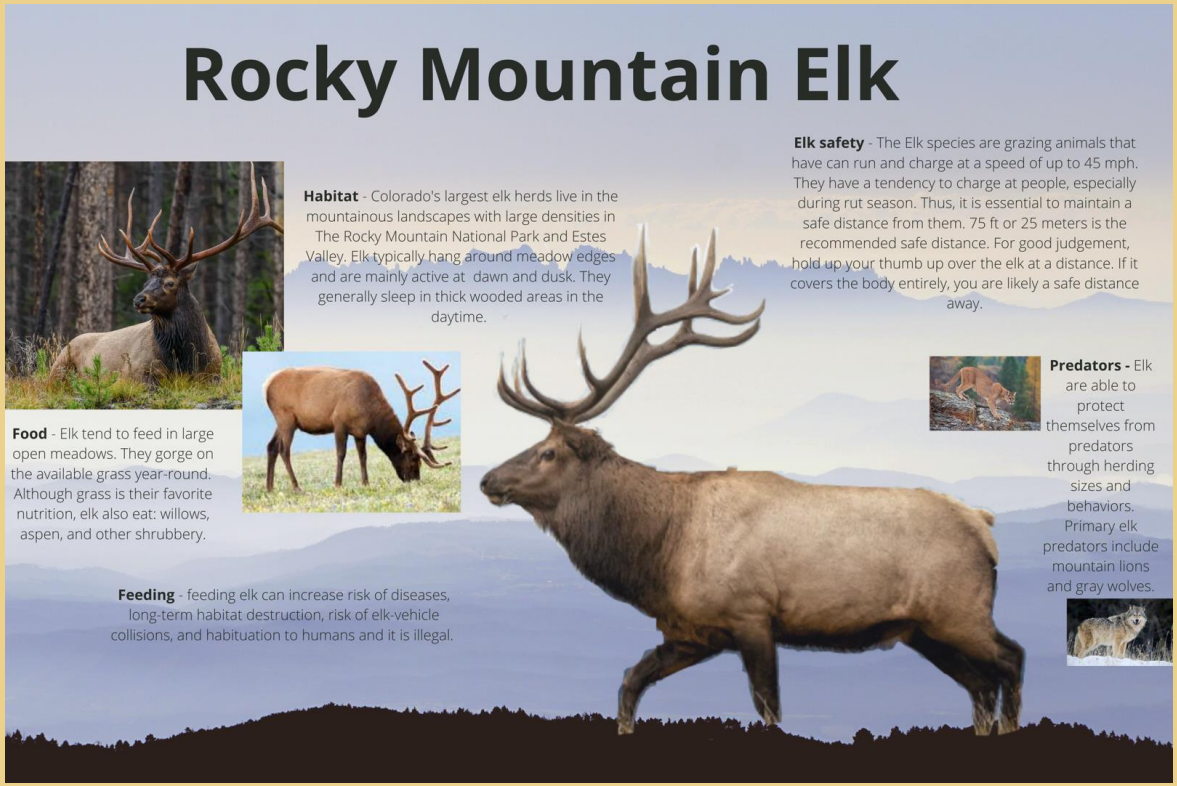


Figure 23. Prototype trail sign about elk history and safety.

Why:

It is difficult to educate tourists who are in Estes Park for a short time and are often not open to being educated by residents and volunteers because they are on vacation. We recommend that the EVWC pursue a multifaceted approach to spreading information about elk and safe behavior. Our prototype signs was designed to build awareness and understanding in an effort to inspire visitors to feel a personal connection to nature while also ensuring their personal agency when interacting with wildlife. Additionally, adding signs around town to warn people about the existence of wildlife harassment laws and its punishment aims to have visitors think twice about approaching elk and be more patient with elk blocking traffic. Tourists will hopefully understand how their actions impact elk and respect safety cautions to take when interacting with the animals.

How:

The EVWC might support the installation of large permanent signs (Appendix J) at elk hotspots, such as around the Lake Estes trail, in Bond Park, and near the golf courses, to support visitor awareness. We recommend these large signs be at least 24”x36”. Posters (Appendix K) could be placed in tourist locations including the Estes Park visitor center, local businesses, lodging, and rental properties. We recommend printing these posters as 11”x17”. The information on these signs can be composed by the Estes Valley Watershed Coalition or by local students as a school project. Signs about wildlife harassment laws (Appendix L) can be designed and ordered from websites such as roadtrafficsigns.com. The smaller 12”x18” signs should be placed around downtown Estes Park and the larger 30”x30” along roads entering Estes Park so that visitors are aware of the fines before arriving downtown and having an opportunity to approach elk.

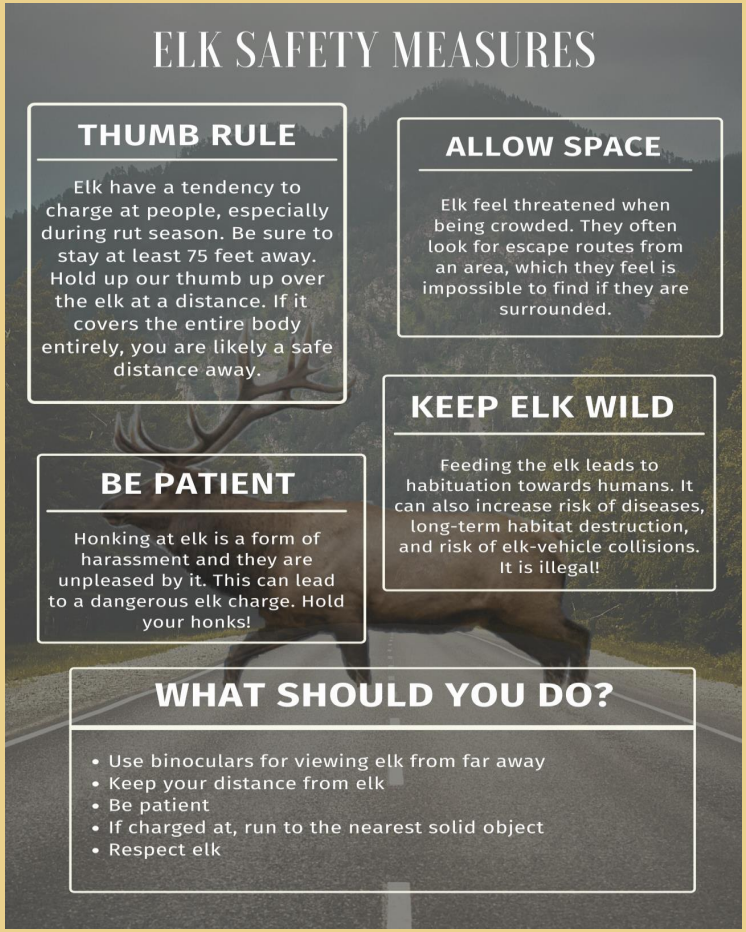
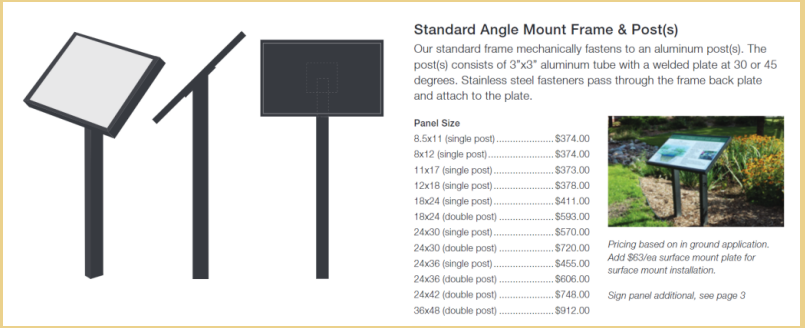


Figure 24. Infographic with elk safety information.

Cost:

For a 24”x36” sign it will cost approximately $1000 from Vacker Sign (see Appendix J for details). For the large sign we could not get a cost estimate. The unit cost for a full-color 11”x17” poster from Staples is $0.80. Road signs can be purchased online from roadtrafficsigns.com. For the 12”x18” signs they can be ordered for $27.75 each. The 30”x30” signs can be ordered for $114.45 apiece.

1/8” High Pressure Laminate (non-self-supporting)
Printing cost is $367



Standard Angle Mount Frame & Post(s)

Our standard frame mechanically fastens to an aluminum post(s). The post(s) consists of 3”x3” aluminum tube with a welded plate at 30 or 45 degrees. Stainless steel fasteners pass through the frame back plate and attach to the plate.

Panel Size	
8.5x11 (single post)	$374.00
8x12 (single post)	$374.00
11x17 (single post)	$373.00
12x18 (single post)	$378.00
18x24 (single post)	$411.00
18x24 (double post)	$593.00
24x30 (single post)	$570.00
24x30 (double post)	$720.00
24x36 (single post)	$455.00
24x36 (double post)	$606.00
24x42 (double post)	$748.00
36x48 (double post)	$912.00

Pricing based on in ground application. Add $63/ea surface mount plate for surface mount installation.

Sign panel additional, see page 3

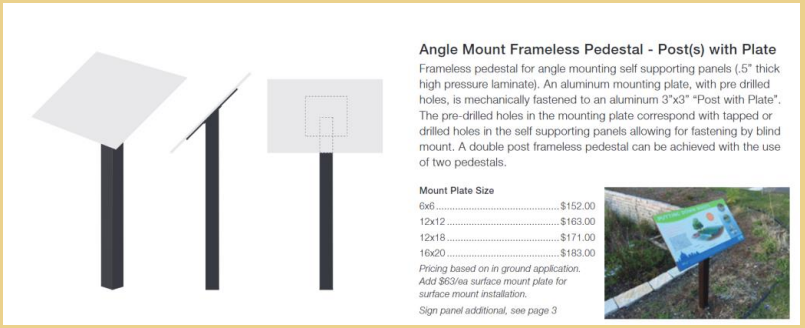
Angled Mount Frame with Sleeve for Lumber Post(s)

An angled frame welded to a sleeve that fits over a recycled plastic lumber or wood 4”x4” post. The pre-drilled holes in the sleeve allow the frame to be secured to the post with spax screws.

Sign panel additional, see page 3

Panel Size	
8.5x11 (single sleeve)	$224.00
8x12 (single sleeve)	$224.00
11x17 (single sleeve)	$224.00
12x18 (single sleeve)	$228.00
18x24 (single sleeve)	$262.00
18x24 (double sleeve)	$292.00
18x36 (double sleeve)	$375.00
24x30 (double-sleeve)	$472.00
24x36 (double sleeve)	$367.00
24x42 (double sleeve)	$448.00
24x48 (double sleeve)	$512.00
36X48 (double sleeve)	$642.00

1/2” High Pressure Laminate (self-supporting):
Printing cost is $577



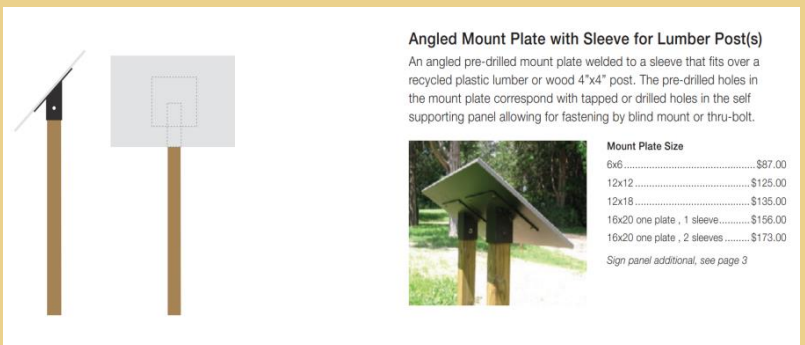
Angle Mount Frameless Pedestal - Post(s) with Plate

Frameless pedestal for angle mounting self supporting panels (.5” thick high pressure laminate). An aluminum mounting plate, with pre drilled holes, is mechanically fastened to an aluminum 3”x3” “Post with Plate”. The pre-drilled holes in the mounting plate correspond with tapped or drilled holes in the self supporting panels allowing for fastening by blind mount. A double post frameless pedestal can be achieved with the use of two pedestals.

Mount Plate Size	
6x6	$152.00
12x12	$163.00
12x18	$171.00
16x20	$183.00

Pricing based on in ground application. Add $63/ea surface mount plate for surface mount installation.

Sign panel additional, see page 3



Angled Mount Plate with Sleeve for Lumber Post(s)

An angled pre-drilled mount plate welded to a sleeve that fits over a recycled plastic lumber or wood 4”x4” post. The pre-drilled holes in the mount plate correspond with tapped or drilled holes in the self supporting panel allowing for fastening by blind mount or thru-bolt.

Mount Plate Size	
6x6	$87.00
12x12	$125.00
12x18	$135.00
16x20 one plate , 1 sleeve	$156.00
16x20 one plate , 2 sleeves	$173.00

Sign panel additional, see page 3

Figure 25. Cost estimates for laminated trail signs and stand.

Stickers:

Who:

We recommend that the EVWC collaborate with local businesses and volunteer education groups to help fulfill their mission of protecting and improving the wildlife habitats of the Estes Valley.

What and Why:

We recommend the use of stickers with catchy slogans placed in popular tourist areas. Stickers with quirky messages can quickly grab people's attention and get them interested in learning more without overwhelming them with information. Stickers also reach more than just the person who has it because other people see them also. These stickers offer an entertaining way of educating tourists.

How:

Stickers (Appendix M) could be handed out or sold in popular tourist areas and include short blurbs and sayings regarding elk safety and respect. The designs for these stickers can be made in free software such as Canva, and there are websites such as comgraphx.com that allow for printing educational information on the backing of the sticker. For less self-explanatory stickers, such as the "Don't be Dumb Use Your Thumb" sticker in Appendix M, the sticker backing could be printed with educational information or include a QR code on where to learn more. The unit cost for a 3"x3" sticker printed from comgraphx.com ranges from $2.24-$0.33 depending on the quantity ordered (50-5000).

Figure 26. Drafts of stickers to be sold or distributed.

Example Prompts:

Improv
Interactive, on the spot skit with audience member(s) appearance on stage for a more personal connection
Make a skit about unaware tourists getting too close to elk and the encounter going poorly

Role Play
Have a participant role play as the elk to make the perspective of wildlife more relatable
Have a participant role play what they would do if they would do if they are in a wildlife encroachment situation
Have a participant role play giving out a wildlife harassment citation

Stand-up
One-man show with volunteer comedians expressing elk safety and awareness through comedy

Figure 27. Elk Fest logo ("Elk Fest Celebrates the Majestic Elk Rut in Estes Park," 2021)

Comedy Show:

Who:

We recommend that the EVWC collaborate with the Town of Estes Park's Events Division and volunteer education groups to help fulfill their mission of protecting and improving the wildlife habitats of the Estes Valley.

What and Why:

We recommend the use of a public comedy show in the community to educate tourists on safe behavior (Appendix N) and open a discussion about coexistence with elk. Comedy is often a way to start a dialogue about something that people do not otherwise want to talk about, which makes it a workaround solution to the feeling that tourists do not want to be educated.

How:

The comedy show could be run on weekends during the summer or at festivals such as Elk Fest. Volunteer groups could put together short skits and performances on the topic of safe or unsafe behavior and coexistence with wildlife. These shows can take place in popular downtown areas such as Bond Park or the Riverwalk. Using the existing infrastructure of Elk Fest or other events, there are minimal direct costs associated with the comedy show, such as the cost of a booth or supplies.

Recommendation 2. Wildlife Friendly Development Code Changes

Who:

We recommend that the EVWC collaborate with partner organizations to open a discussion with the community and the town of Estes Park's Town Planning Commission.

What:

We recommend that the EVWC's partners host listening sessions and focus groups regarding possible wildlife-friendly changes to the development code. We recommend discussing the possibility of removing the exemption to requiring a Wildlife Conservation Plan for single-family residential lots predating 2000. Additionally, we suggest that the EVWC's partners host conversations with invested stakeholders such as the Town Planning Commission about adding a requirement to submit a Wildlife Conservation Plan for development on critical elk habitat. We also suggest hosting conversations about requiring a site description be submitted for any development regardless of whether the lot requires a Wildlife Conservation Plan. Finally, we recommend the EVWC work with homeowner to replace ornamental landscaping with indigenous plants and educate homeowners and landscaper designers on the impacts of non-native plants on elk.

A Wildlife Conservation Plan shall be submitted for sites containing:

a. An endangered or threatened species,
b. Big Horn sheep or Big Horn sheep habitat, or
c. Riparian areas
d. Critical elk habitat, elk severe winter range, elk migration corridors.

Chapter 7 Section 8 of the Estes Park Development Code

1. Application. The Applicant shall submit a development plan, subdivision plat or sketch plan, as applicable, depicting the general location of the property, location of structures on the site, prominent natural areas such as streams and wetlands, a **description of the populations of wildlife species that inhabit or use the site, including a qualitative description of their spatial distribution and abundance,** and other features that Staff may require for review pursuant to this Section.

Chapter 7 Section 8 of the Estes Park Development Code

B. **Applicability.** This Section shall apply to all applications for review of development plans, subdivision plats, planned unit developments, special review uses and rezonings. ~~**This Section shall not apply to development on lots that were approved for single-family residential use prior to the effective date of this Code.**~~

Chapter 7 Section 8 of the Estes Park Development Code

Why:

We recommend discussing changes to the Development Code to further protect elk and promote coexistence. We came up with a few suggestions to catalyze the conversation around wildlife-friendly development. The reasoning for these changes is as follows. Removing the exception for lots that predate 2000 located on critical habitat included in the Wildlife Habitat Protection section of the Development Code could decrease the impact of further development of old plots on wildlife. This would help to preserve endangered and threatened species habitat, Big Horn sheep habitat, and riparian vegetation. Including a requirement to submit a Wildlife Conservation Plan for developments on critical habitat for elk winter survival and movement could help ensure that the impacts that development has on elk specifically, are minimized. Additionally, requiring all developments to submit a habitat description of the plot could help make residents and the town aware of the habitat that is being developed on and the species that rely on it. Finally, limiting ornamental landscaping that attracts elk could reduce the temptation of elk to graze and browse in more central and residential locations.

How:

Our recommendations for the EVWC's partners are to initiate conversations about changes in Estes Park's Development Code such as those in Appendix O. This document outlines the specific changes and the exact spots that they are located in section 7.8 of the Development Code. To get the community to understand why removing and avoiding ornamental landscaping is important, the EVWC can host workshops and bring in wildlife experts, such as Chase Rylands, to discuss the impacts of ornamental landscaping on wildlife. The EVWC can also work with homeowners to brainstorm alternatives to ornamental landscaping like chokecherry trees and encourage replacement with plants such as aspen or ponderosa pines to limit the attractiveness of properties to elk.

Cost:

The are no direct costs associated with code changes. To purchase a seedling aspen tree from Arbor Day Foundation's tree nursery, it is $16.99 and a seedling ponderosa pine is $8.99.

Recommendation 3. Futures Planning Involving Development and Elk

Who:

We recommend that the EVWC collaborate with the Estes Park community and Comprehensive Plan Advisory Committee.

What and Why:

We recommend starting a discussion about futures planning regarding the intersection of development and coexistence with elk in Estes Park. Elk are a defining feature of Estes Park and are a draw for tourists who drive the town's economy. However, there is also a lack of available inexpensive housing that needs to be addressed. The intersection between inexpensive housing and elk is an emerging conversation that can help Estes Park achieve coexistence.

How:

We recommend utilizing the open forum created by the Estes Park Comprehensive Plan Advisory Committee to prompt new discussions using questions similar to those outlined in Appendix P. There is no direct cost associated with this recommendation .

Estes Park Human-Wildlife Relationships
In what ways do you think Estes Park successful in human-wildlife relationships?
In what ways do you think the town of Estes Park improve their relationship with wildlife?

Coexistence
What will it take for Estes Park become a place to look to as a strong example when discussing human-wildlife coexistence?

Future of Estes Park
What does an ideal future of Estes Park with elk look like to you?
Are there any radical or more novel ideas you can think of?

Other Observations

Estes Park currently takes an education-first approach to most unsafe interactions with elk. While we agree with this approach, our interviews with experts have led us to believe that citing tourists more often after a first offence may help to reduce more occurrences of human-elk conflict. This could build an understanding from tourists that there are consequences for their actions of approaching elk. Additionally, it would likely be beneficial to implement reduced nighttime speed limits. This can aid in limiting wildlife-vehicle collisions and protecting both people and wildlife as it seeks to reduce frequency and severity of collisions.

We also suggest updating habitat maps based on the most recent species data because they are from 1996 and there have been changes to wildlife since then. To update the habitat data, a consulting company, Logan Simpson, can be contracted to complete another Estes Valley Habitat Assessment within the next couple of years. This information can be used by the town to update the habitat data in the Estes Park Development Code to ensure that the correct locations of habitats are being conserved for elk and other wildlife.

Final Thoughts

In light of the ongoing impacts of climate change, Estes Park is at a critical point in planning for its future. Our recommendations aim to balance the need for sustainable economic development, inexpensive housing in Estes Park and the needs of elk. Due to changing elk habits as a result of climate change, now is an important time for the EVWC to instigate and lead conversations about ideal visions of coexistence. Estes Park has the potential to be a novel example of rethinking human-wildlife relationships and how to achieve coexistence. Lessons learned from Estes Park could be adapted to help address other human-wildlife conflicts around the world.

This project addresses the following UN Sustainable Development Goals: decent work and economic growth (8) and life on land (15). The decent work and economic growth goal promotes sustainable economic growth, such as sustainable tourism. This project addresses this goal by identifying strategies that allow Estes Park's economy to grow without harming the wildlife population. The life on land goal promotes conservation and sustainable use of land. This project intersects with this goal by considering strategies that promote wildlife-friendly development and protect important habitat in Estes Park.

8 DECENT WORK AND ECONOMIC GROWTH

Promote inclusive and sustainable economic growth, employment and decent work for all (United Nations, n.d.).

15 LIFE ON LAND

Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss (United Nations, n.d.).

Photo Credit

Kris Hazelton:

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Aaron Jackson of vicarious-photography.com:

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Concerning the Revision of the Subject Matter Contained in Articles 1, 2, 6, 7, 8, 20, 21, 22, 23, 30, 31, and 42, a Partial Revision of Article 4, and the Repeal of Article 43 of Title 33, Colorado Revised Statutes, as Amended, Relating to the Powers, Duties, and Functions of the Divisions of Wildlife and Parks and Outdoor Recreation Specified in Such Articles, 33 Colo. Rev. Stat. § 33-6-128 (2021).

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Appendices

Appendix A: Business Owner and Employee Surveys

Background Questions

How long have you been operating or working at this business in Estes Park?

Who are your primary customers?

How important are tourists to your business?

Elk Interaction Questions

How does elk presence in Estes Park affect your business?

What are the benefits and challenges the elk pose?

What does coexistence with elk look like to you?

What sacrifices do humans need to make to achieve coexistence?

Education Questions

Do you find yourself answering questions about elk or correcting customers about their behavior with elk?

What are common questions you tend to answer?

What misconceptions do you have to provide clarification on?

How many times a week/month do you find yourself answering these questions or providing clarification?

Appendix B: Wildlife Expert Interviews

Background Question

What are common questions you tend to answer about elk?

Elk Population Questions

What factors have had a heavy influence on elk populations in the past decade?

How has the changing elk populations impacted the local ecology? Elk movement and elk encounters?

Elk Movement Questions

Where are critical habitats for elk located in Estes Valley and what times of year are they in these areas?

Where are the most used migration routes for elk?

Elk Encounters Questions

What techniques would you recommend for mitigating wildlife-vehicle collisions and mitigating other traffic interruptions involving elk?

On what kinds of roadways do elk pose a higher danger for drivers?

Where are these roadways located?

How severe are these accidents/collisions for all parties involved?

What are some of the recurring conflicts that you respond to or hear about?

What is the frequency, location, and severity of these human-elk conflicts?

Are you aware of any housing pressures the town of Estes Park is under?

How does this impact elk/how are elk impacting this dynamic?

Future Questions

What is your ideal future with elk? How can we as a society achieve this?

What would it take to get there?

Appendix C: Resident Surveys

Background Questions

How long have you lived in Estes Park for?

Education Questions

What current education platforms on elk safety and behavior are you aware of?

How would you like to be educated on elk safety and behavior?

Elk Interaction Questions

What is your perception of elk?

Can you describe any encounters you or anyone you know has had with elk?

Encounter: a situation where either party must change their behavior

What specific places have you witnessed or heard of these human-elk encounters taking place?

How many times a week/month do you witness or hear of these human-elk encounters taking place?

What strategies do you use or know of to avoid conflict with elk?

What differences have you noticed between tourist-elk encounters and resident-elk encounters?

What does coexistence with elk look like to you?

What sacrifices do humans need to make to achieve coexistence?

Appendix D: Tourist Surveys

Background Questions

Where are you visiting from?

What brought you to Estes Park?

Elk Interaction Questions

Can you describe what you know about elk to us?

What is your perception of elk?

Can you describe any encounters you have or anyone you know has had with elk while in

Estes Park?

What does coexistence with elk look like to you?

What sacrifices do humans need to make to achieve coexistence?

Education Questions

How were you educated on elk behavior before or when you got to Estes Park?

What safety measures do you know to take when encountering elk in Estes Park?

Appendix E: Education Expert Interviews

Human-Elk Conflict Questions

What is the difference between resident-elk and tourist-elk encounters in Estes Park?

Where are the areas where the most elk are located or pass through?

What are some of the recurring conflicts that you hear about?

How have human-elk conflicts changed in the last 5-10 years?

How has Covid-19 impacted the severity/frequency of conflicts?

How has social media played a role in the perception of elk?

How has social media played a role in the perception of elk conflicts?

Human-Elk Roadway Conflict Questions

On what kinds of roadways do elk pose a higher danger for drivers?

Where are these roadways located?

How severe are these accidents/collisions for all parties involved?

What techniques would you recommend for mitigating wildlife-vehicle collisions and mitigating other traffic interruptions involving elk?

Estes Park Coexistence Questions

What strategies had been utilized so far to mitigate the human-elk conflict?

How effective were they?

What does coexistence with elk look like to you?

What do you think needs to be done for coexistence to be achieved?

What sacrifices do humans need to make to achieve coexistence?

Education Questions

What are common areas of knowledge that tourists are lacking?

What do you think the most effective way to relay educational information is?

Where do you think elk safety information is being lost in transferring it to the general public?

What kinds of elk safety resources do you think local businesses should distribute?

What forms of elk safety resources do you think should be provided?

How do you think communities would respond to them?

How effective do you believe the existing elk signage is?

What has proven to be more effective, fear-based signage/education or respect/appreciation-based signage/education?

Appendix F: Town Planner Interviews

Background Questions

What does your job entail?

Do you live in Estes Park? If so, for how long?

Development Questions

Has the presence of elk “branded” the town of Estes Park? What does that mean for development?

What opportunities do you see in future development?

What type of housing is allowed in each type of zoning area?

What type of housing is predominantly built in Estes Park today?

What is the distribution of housing needs in Estes Park? (Affordable, workforce, inexpensive)

What type of person is affordable housing built for? Workforce housing? (Families, single person?)

Rate the most important factors considered for a new development.

Coexistence Questions

How does the balance of space for wildlife and development for the community in this town feel to you right now?

What does an ideal future in Estes Park look like to you? For the people? For the elk? For both?

What is more important as you think about the future: maintaining a balance between wildlife and people? Creating better housing opportunities?

What tools does the department have to achieve a balance between the built and natural environments? How do they use these tools to achieve this?

Does the Planning Department consider the impact of new developments on elk and elk habitat? Wildlife in general?

Appendix G: Law Enforcement Interviews

Background Questions

Do you live in Estes Park? For how long?

What does your job entail?

Elk Incidents Questions

What kinds of wildlife calls do you typically respond to?

How often do you get calls about elk?

How does the frequency correlate with tourism – are tourists typically the ones you respond to and do the calls increase with tourist seasons?

Who do these calls typically come from? (Business owners, residents, tourists?)

How often do these calls result in citations or legal action?

Where are the major hotspots that you get recurring calls to?

How would you describe the severity of most calls you respond to?

How often do severe incidents occur?

Education Questions

What are the current efforts of the police department to distribute elk educational materials?

Are there any current elk/wildlife educational programs?

Estes Park Coexistence Questions

How does the balance of space for wildlife and development for the community in this town feel to you right now?

What tools does the department have to achieve a balance between humans and wildlife? How do they use these tools to achieve this?

What does an ideal future in Estes Park look like to you? For the people? For the elk? For both?

How do you see this future being achieved?

What is more important as you think about the future: maintaining a balance between wildlife and people? Creating better housing opportunities?

Appendix H: Field Test Surveys

The elk used for field testing was a cardboard cutout of a young bull

Field Test Questions:

- Would you mind standing what you think is a safe distance away from the elk?
- How far away do you think you are from the elk?

Appendix I: Human-Wildlife Coexistence Expert Interviews

Opening Question

We're looking at Estes Park and it's facing terrible development pressures, like most front range communities, while also being a gateway community to wildlife. How does your expertise make you see the future of towns like these where wildlife and humans have to coexist? What will it take to get there?

Background Question

What is your experience with human-wildlife conflict?

Conflict Trends Questions

How have human-wildlife conflicts changed in the last 5-10 years?

How has Covid-19 impacted the severity/frequency of conflicts?

What are the general trends you are seeing with human-wildlife conflicts?

Education Questions

What role does education play in human-wildlife conflict?

What do you think the most effective way to relay educational information is?

Human Behavior Questions

We understand that to solve human-wildlife conflict, humans need to modify their behavior. What are general human attitudes towards wildlife and wildlife-related issues and how can we start to influence human behavior to benefit wildlife?

What are the social factors underlying human-wildlife conflict?

Appendix J: Proposed Educational Materials (Trail Sign)

Rocky Mountain Elk

Habitat - Colorado's largest elk herds live in the mountainous landscapes with large densities in The Rocky Mountain National Park and Estes Valley. Elk typically hang around meadow edges and are mainly active at dawn and dusk. They generally sleep in thick wooded areas in the daytime.

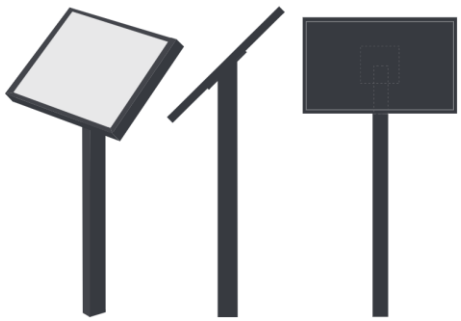
Elk safety - The Elk species are grazing animals that have can run and charge at a speed of up to 45 mph. They have a tendency to charge at people, especially during rut season. Thus, it is essential to maintain a safe distance from them. 75 ft or 25 meters is the recommended safe distance. For good judgement, hold up your thumb up over the elk at a distance. If it covers the body entirely, you are likely a safe distance away.

Food - Elk tend to feed in large open meadows. They gorge on the available grass year-round. Although grass is their favorite nutrition, elk also eat: willows, aspen, and other shrubbery.

Predators - Elk are able to protect themselves from predators through herding sizes and behaviors. Primary elk predators include mountain lions and gray wolves.

Feeding - feeding elk can increase risk of diseases, long-term habitat destruction, risk of elk-vehicle collisions, and habituation to humans and it is illegal.

1/8” High Pressure Laminate (non-self-supporting) Printing Cost: $367



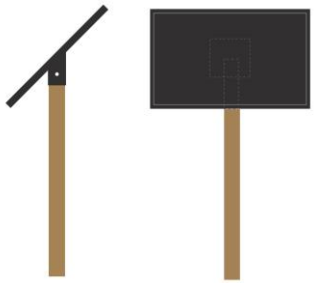
Standard Angle Mount Frame & Post(s)

Our standard frame mechanically fastens to an aluminum post(s). The post(s) consists of 3”x3” aluminum tube with a welded plate at 30 or 45 degrees. Stainless steel fasteners pass through the frame back plate and attach to the plate.

Panel Size	
8.5x11 (single post)	$374.00
8x12 (single post)	$374.00
11x17 (single post)	$373.00
12x18 (single post)	$378.00
18x24 (single post)	$411.00
18x24 (double post)	$593.00
24x30 (single post)	$570.00
24x30 (double post)	$720.00
24x36 (single post)	$455.00
24x36 (double post)	$606.00
24x42 (double post)	$748.00
36x48 (double post)	$912.00

Pricing based on in ground application. Add $63/ea surface mount plate for surface mount installation.

Sign panel additional, see page 3



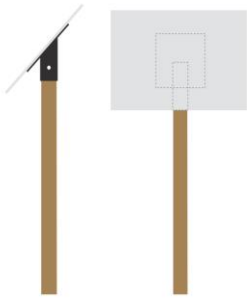
Angled Mount Frame with Sleeve for Lumber Post(s)

An angled frame welded to a sleeve that fits over a recycled plastic lumber or wood 4”x4” post. The pre-drilled holes in the sleeve allow the frame to be secured to the post with spax screws.

Panel Size	
8.5x11 (single sleeve)	$224.00
8x12 (single sleeve)	$224.00
11x17 (single sleeve)	$224.00
12x18 (single sleeve)	$228.00
18x24 (single sleeve)	$262.00
18x24 (double sleeve)	$292.00
18x36 (double sleeve)	$375.00
24x30 (double-sleeve)	$472.00
24x36 (double sleeve)	$367.00
24x42 (double sleeve)	$448.00
24x48 (double sleeve)	$512.00
36X48 (double sleeve)	$642.00

Sign panel additional, see page 3

1/2” High Pressure Laminate (self-supporting) Printing Cost: $577

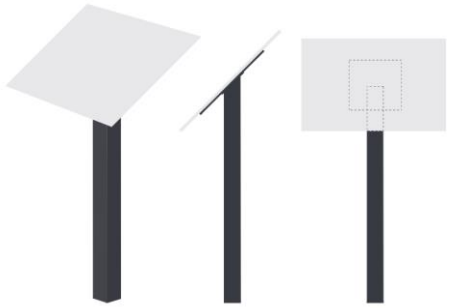


Angled Mount Plate with Sleeve for Lumber Post(s)

An angled pre-drilled mount plate welded to a sleeve that fits over a recycled plastic lumber or wood 4”x4” post. The pre-drilled holes in the mount plate correspond with tapped or drilled holes in the self supporting panel allowing for fastening by blind mount or thru-bolt.

Mount Plate Size	
6x6	$87.00
12x12	$125.00
12x18	$135.00
16x20 one plate , 1 sleeve	$156.00
16x20 one plate , 2 sleeves	$173.00

Sign panel additional, see page 3



Angle Mount Frameless Pedestal - Post(s) with Plate

Frameless pedestal for angle mounting self supporting panels (.5” thick high pressure laminate). An aluminum mounting plate, with pre drilled holes, is mechanically fastened to an aluminum 3”x3” “Post with Plate”. The pre-drilled holes in the mounting plate correspond with tapped or drilled holes in the self supporting panels allowing for fastening by blind mount. A double post frameless pedestal can be achieved with the use of two pedestals.

Mount Plate Size	
6x6	$152.00
12x12	$163.00
12x18	$171.00
16x20	$183.00

Pricing based on in ground application. Add $63/ea surface mount plate for surface mount installation.

Sign panel additional, see page 3

Appendix K: Proposed Educational Materials (Poster)

Appendix L: Wildlife Harassment Signs

Appendix M: Proposed Educational Materials (Stickers)

Front

Back

Appendix N: Comedy Show at Elk Fest

Improv
Interactive, on the spot skit with audience member(s) appearance on stage for a more personal connection
Make a skit about unaware tourists getting too close to elk and the encounter going poorly

Role Play
Have a participant role play as the elk to make the perspective of wildlife more relatable
Have a participant role play what they would do if they would do if they are in a wildlife encroachment situation
Have a participant role play giving out a wildlife harassment citation

Stand-up
One-man show with volunteer comedians expressing elk safety and awareness through comedy

Appendix O: Updates to Estes Park's Development Code

Changes to Section 7.8: Wildlife Habitat Protection have been indicated as follows: ~~struck through red text~~ for a deletion of existing language in the code and underlined blue text for an addition to the code.

A. **Purpose.** To maintain the diversity of wildlife species and habitat that occur in the Estes Valley, and to plan and design land uses to be harmonious with wildlife habitat and the species that depend on this habitat for the economic, recreational and environmental benefit of the residents of and visitors to the Estes Valley.
(Ord. 05-10 §1)

B. **Applicability.** This Section shall apply to all applications for review of development plans, subdivision plats, planned unit developments, special review uses and rezonings. ~~This Section shall not apply to development on lots that were approved for single-family residential use prior to the effective date of this Code.~~

C. **Exemptions.** The procedures and regulations contained in this Section shall not apply to:

1. Agricultural activities such as soil preparation, irrigation, planting, harvesting, grazing and farm ponds;
2. Maintenance and repair of existing public roads, utilities and other public facilities within an existing right-of-way or easement;
3. Maintenance and repair of flood control structures and activities in response to a flood emergency;
4. Maintenance and repair of existing residential or nonresidential structures; or
5. Activities undertaken pursuant to a wildlife conservation plan approved under this Section.

D. **Other Regulations.** This Section of the Code does not repeal or supersede any existing federal, state or local laws, easements, covenants or deed restrictions pertaining to wildlife. When this Section imposes a higher or more restrictive standard, this Section shall apply.

E. **Wildlife Habitat Data Base.** The following sources shall be used to identify important wildlife habitat areas for purposes of review under this Section:

1. Wildlife Habitat map (dated December 1996), as set forth in the Estes Valley Comprehensive Plan, as amended from time to time.
2. Colorado Division of Wildlife habitat maps for Larimer County, as amended from time to time.
3. Colorado Natural Heritage Program Maps dated December 1996, or as amended from time to time.
4. Other information and maps as Staff or the Estes Valley Planning Commission may from time to time identify in cooperation with the Colorado Division of Wildlife, such as wildlife maps produced specifically for the Estes Valley. Said maps shall be applicable only following adoption of an amendment to this Code.
5. Wildlife habitat information required by this Section is intended for general planning purposes. Obvious errors or omissions may be corrected by the Staff.

F. **Review Procedures.** The following procedures shall apply to all applications for development:

1. **Application.** The Applicant shall submit a development plan, subdivision plat or sketch plan, as applicable, depicting the general location of the property, location of structures on the site, prominent natural areas such as streams and wetlands, a description of the populations of wildlife species that inhabit or use the site, including a qualitative description of their spatial distribution and abundance, and other features that Staff may require for review pursuant to this Section.

A Wildlife Conservation Plan shall be submitted for sites containing:

   a. An endangered or threatened species,
   b. Big Horn sheep or Big Horn sheep habitat, or
   c. Riparian areas adjacent to rivers and streams and wetlands identified on the maps set forth in Appendix A of this Code.
   d. Critical elk habitat, elk severe winter range, elk migration corridors.

2. **Preliminary Review.** Staff shall refer the submitted plan or plat to the Colorado Division of Wildlife for review. Applicants are also advised to consult with the Colorado Division of Wildlife and other agencies responsible for regulation of wildlife and habitat, such as the U.S. Fish and Wildlife Service, U.S. Department of the Interior-Rocky Mountain National Park, U.S. Forest Service and Colorado Natural Heritage Program. These agencies may maintain maps and databases that can aid in the site-specific confirmation of the presence or absence of wildlife and habitat on a specific site.
3. **Review Determination.**
   a. The Review and Decision-Making Bodies shall issue a finding as to whether the application, including the wildlife conservation plan, complies with the requirements of this Section.
   b. Wildlife studies and mitigation plans found to be adequate by the Decision-Making Body shall become binding upon the Applicant.
   c. Applications that do not comply with Section 7.8 of this Code shall be denied.
4. **Waivers.** Staff may waive or approve minor modifications of any development standard or review criteria contained in this Section upon a finding that such waiver or modification:
   a. Is consistent with the stated purposes of this Section;
   b. Will have no significant adverse impacts on wildlife species or habitat;
   c. Any potential adverse impacts will be mitigated or offset to the maximum extent practicable; and
   d. Application of the standard or criteria is not warranted based on the location of the development, the absence of a particular species on the site or other relevant factors.

G. **Review Standards.** The following review standards shall apply to all development applications as specified, unless Staff determines that a specific standard may be waived pursuant to subsection F.5. above. It is the intent of this Section that these standards be applied in a flexible fashion to protect wildlife habitat and wildlife species in a cost-effective fashion.

1. **Review Standards.**
   a. Buffers. All development subject to a wildlife conservation plan shall provide a setback from any identified important wildlife habitat area, in accordance with any recommendations in the wildlife conservation plan.
   b. Important Wildlife Habitat. Restricted to native species on Recommended Plant List. There shall be no introduction of plant species that are not on the approved landscaping list in the "ComDev Recommended Plant List" on any site containing any important wildlife habitat area. Plans approved under provisions of this Code shall show existing herbaceous and woody cover on the site maintained and removal of native vegetation minimized in connection with development

c. Fencing.
    i. No fencing on a site containing important wildlife habitat shall exceed forty (40) inches in height, except to the extent that such fencing is approved by Staff to confine permitted domestic animals ~~or to protect permitted ornamental landscaping or gardens.~~
    ii. Fences higher than forty (40) inches may be allowed if adequate openings are provided for the passage of deer, elk or other identified wildlife. These openings shall be at least six (6) feet wide and spaced a maximum of fifty (50) feet apart along continuous fence lines exceeding this length.
    iii. No fencing using barbed wire shall be allowed.
    iv. The type of fencing (materials, opacity, etc.) shall be determined by Staff or the Decision-Making Body as appropriate for the wildlife species on the site.
d. Refuse Disposal. Developments on sites containing important wildlife habitat, such as black bear, must use approved animal-proof refuse disposal containers. With Division of Wildlife approval, refuse disposal containers and enclosures may be electrified.
e. Domestic Animals. Development applications for property that includes important wildlife habitat must include a plan with specified enforcement measures for the control of domestic animals and household pets. The plan must include provisions to prevent the harassment, disturbance and killing of wildlife and to prevent the destruction of important wildlife habitat.
f. Exterior Lighting. Use of exterior lighting shall be minimized in areas of important wildlife habitat, and lighting shall be designed so that it does not spill over or onto such critical habitat. See also §7.9 below.

H. **Wildlife Conservation Plans.**

1. **Plan Preparation.** A wildlife conservation plan required by this Section shall be prepared for the Applicant, at the Applicant's expense, under the responsible direction of a qualified person who has demonstrated expertise in the field.
2. **Plan Content.** Any wildlife conservation plan required to be prepared pursuant to this Section shall include the following information at a minimum. Specific requirements may be waived by Staff due to the location of the development, the previous use of the site, the size and potential impact of the development, the absence of particular species on a site, the prohibition of a reasonable use of the site and other relevant factors.
    a. A description of the ownership, location, type, size and other attributes of the wildlife habitat on the site.
    b. A description of the populations of wildlife species that inhabit or use the site, including a qualitative description of their spatial distribution and abundance.
    c. An analysis of the potential adverse impacts of the proposed development on wildlife and wildlife habitat on or off site.
    d. A list of proposed mitigation measures and an analysis of the probability of success of such measures.
    e. A plan for implementation, maintenance and monitoring of mitigation measures.
    f. A plan for any relevant enhancement or restoration measures.
    g. A demonstration of fiscal, administrative and technical competence of the Applicant or other relevant entity to successfully execute the plan.

Appendix P: Questions to Facilitate Futures Planning Discussion

Estes Park Human-Wildlife Relationships

In what ways do you think Estes Park successful in human-wildlife relationships?

In what ways do you think the town of Estes Park potentially harm or interfere with wildlife's natural course?

In what ways do you think the town of Estes Park improve their relationship with wildlife?

Development

How pressing is the town's need for developing inexpensive housing?

How do you see the town of Estes Park liking to develop?

i.e. does the town of Estes Park want more housing? Where? Does the town want to densify? Build up?

Do you want to take the impact of development on wildlife into consideration more?

How do you think development, wildlife, and the town's desires should be prioritized?

What are ways you think Estes Park can further take elk into consideration when developing?

Coexistence

What will it take for Estes Park become a place to look to as a strong example when discussing human-wildlife coexistence?

Is this something that you as an Estes Park citizens want?

What are you willing to give or sacrifice to attain this?

Future of Estes Park

What does an ideal future of Estes Park with elk look like to you?

What are reasonable goals for the town within the next 5 years?

10 years? 20 years?

What strategies do you suggest for balancing coexistence with wildlife and the development of Estes Park?

Are there any radical or more novel ideas you can think of?