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## Challenges for Human-Wildlife Coexistence Emerging from Increased Subdivision in the Huife Watershed

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## ABSTRACT

In the face of increasing subdivision and demographic shifts in the Araucanía region of Chile and specifically the Huife Watershed, conflicts between humans and mesocarnivores persist. We aimed to characterize the social changes associated with subdivision that are producing and exacerbating these conflicts by interviewing and surveying key actors of the area and their lands. We selected diverse subjects with varying backgrounds, properties, and occupations to elucidate causes, consequences, social characteristics, and possible solutions to foster healthy co-existence. Our actors reported several types of conflicts ranging from destruction of property to uncomfortable co-habitation. We first found that levels of interpersonal connectedness within a community, effective communication, and forms of education can influence a person's tolerance towards tension-causing predators. Migration, mainly from the metropolitan area of Santiago, and the corresponding reduction of long-term tenancy on lands can affect inherited knowledge of how to coexist with local mesocarnivores as well as their ecological importance. Both conventional and unconventional forms and origins of ecological knowledge contribute to attitudes and tolerance towards mesocarnivores. As migration continues, agricultural use decreases and lower reliance on livestock for livelihoods alters the nature of predator conflicts. The lack of livelihood-threatening losses leads to less intense conflicts. We found a difference in how our actors characterized their feelings and actions towards animals based on whether they were native or non-native. These interviews point to variables and connections that will only become more relevant as these trends continue worldwide and receive further examination.

## KEYWORDS

Subdivision, Migration, Tolerance, Predator, Coexistence

## RESEARCH PROBLEM

The growing population of Chile and internal migration patterns have caused increased subdivision in rural areas (Petitpas et al., 2010). Subdivision is the parcelling of land to sell or develop different parts of the area for human use. Through subdivision, once-large parcels of land are split into smaller pieces, which can then be developed for different uses. Agricultural land is typically subdivided and partially or totally converted into industrial, residential, or tourism uses. Overall trends for land use in Chile show a decrease in property size and an increase in population (Henriquez Jaramillo, 2013).

Increasing demographic shifts in the Huife watershed, which lies in the foothills of La Araucanía region of Chile, cause extensive subdivision and land-use changes. Between 1983 and 2007, the amount of rural land in La Araucanía decreased alongside an increase in residential land use (Petitpas et al., 2010). This indicates an increase in subdivision because as large rural parcels are split up and sold, developers use many of the smaller parcels for residential construction. In 1980, Decree Law 3516 was created to allow landowners to subdivide their land

so long as the resulting parcel is at least 0.5 hectares (Decree Law 3516, 1980). Legal subdivision proceeded rapidly at an unsustainable rate, to such an extent that the governor issued a measure to halt the issuing of permits to subdivide and sell rural land (Circ. No. 475, 2022). This process occurs because of and concurrently with an influx of people from the metropolitan center of Chile looking to live farther away from the city. This causes an overall trend of rural properties becoming more subdivided and more permeated by residents as migrants searching for rural amenities enter the area (Zunino & Hidalgo, 2010). Migrants to the area have come in waves over the past several decades, but this trend accelerated following the global COVID-19 pandemic (Ropert et al., 2021). We observe this phenomenon in the Huife watershed where amenity migration has been increasing the population in the area over time. Amenity migration refers to moving residency for quality of life reasons rather than purely monetary reasons (Hjerpe et al. 2020).

To study the effects of subdivision on wildlife and overall ecosystem health, we focused our research on mesocarnivores. We define a mesocarnivore as a small-to-mid-sized animal with a diet consisting mostly of meat. Healthy ecosystems require mesocarnivores, as they control populations, prevent overgrazing, control disease, cycle nutrients, and maintain biodiversity (Natural Resource Defense Council, 2011). They play a key ecosystem role in influencing trophic webs from the top down while protecting diverse niches and species richness (Roemer et al., 2009). Because people fear mesocarnivores or experience livestock losses, interactions with mesocarnivores are more salient than interactions with other species such as small herbivores or insects (Miller and Schmitz, 2019). Because of their important ecosystem role, their potential vulnerability or endangered status, and their notoriety to residents, mesocarnivores are an important animal category to study using social-ecological methods. When mesocarnivore populations are disrupted, the entire ecosystem becomes unbalanced and is less able to provide ecosystem services. Thus, it is important to understand specifically how human development patterns affect predators, if we hope to keep the ecosystems on which we depend intact.

Existing literature provides evidence that in areas of increased intensification of land use, mesocarnivore population levels decrease (Farris et al., 2017). Research specific to the Araucanía region coherently demonstrated that population levels of mesocarnivores tend to decrease as subdivision increases (Gálvez et al., 2021a). Studies have also demonstrated that in subdivided areas, the populations of mesocarnivore species present shift to a much larger proportion of domestic carnivores, such as dogs, and a decreased presence of native mesocarnivores (Gálvez et al., 2021b). As forested lands are subdivided into parcels and developed to varying degrees, interactions between humans and predators may also increase because as their habitats are encroached upon, they must exit their natural habitat and enter human regions. These interactions can be negative when predators attack livestock, trample gardens, or eat plants meant for subsistence.

Current literature proposes that increased land subdivision is directly correlated with a greater number of social anthropogenic threats to mesocarnivores including land use intensification, competition with and disease transmission by domestic carnivores owned or abandoned by people, as well as killings by farmers in response to livestock predation (Gálvez et

al., 2021c). In our research, we explore how increased migration and land subdivision leads to social anthropogenic threats to wildlife. Researchers assume that denser populations of people lead to increased conflicts with animals, because of the greater number of people and their property, such as dogs (Gálvez et al., 2021c). In our research, however, we explore through a social lens how subdivision and migration are causing more conflicts between humans and wild animals, without assuming that more humans automatically cause more conflicts. As migration to rural areas increases alongside land subdivision, the demographics of those areas change, altering community structures and compositions. Furthermore, the range of attitudes and tolerances towards mesocarnivores expands. From a human-wildlife perspective, tolerance is the passive acceptance of a wildlife population (Bruskotter and Fulton, 2012), and attitude is an individual's personal evaluation, factual or otherwise of an animal or species, whether that be positive, negative, or neutral (Marchini et al., 2023). Attitudes have been shown to influence the interactions that promote or reject coexistence (Min Ngo et al., 2022), indicating that changing attitudes have implications for human-wildlife conflicts. In our research, we consider how these social variables related to subdivision-associated demographic shifts affect human-wildlife interactions.

Given the documented subdivision that decreases the presence of mesocarnivores in the Huife watershed, we plan to further investigate the social variables related to subdivision as an explanation of this phenomenon. In doing so, we hope to propose potential solutions to improve human-wildlife coexistence in the presence of land subdivisions.

## RESEARCH QUESTION

How do the social characteristics associated with increased land subdivision affect interactions between people and mesocarnivores in the Huife Watershed?

## RESEARCH OBJECTIVES

1. Identify different cases of land subdivision to explore qualitative land use and ecological characteristics associated with each area.
  - a. Some examples of characteristics include the number of people and residencies, domestic dog presence, the presence of livestock, and the division of property by fences.
2. Determine variances in human-wildlife interactions encountered within each study area.
3. Evaluate how different societal and familial backgrounds influence attitudes towards wildlife.
  - a. How their attitudes and intentions both affect and are influenced by their interactions with wildlife.
4. Identify possible societal steps to mitigate human conflicts with wildlife and further research questions.

## THEORETICAL FRAMEWORK

In current literature, subdivision is treated as a black box; the phenomenon of subdivision and its effects on wildlife are recognized, but the exact mechanisms that cause those effects remain understudied. Our theoretical framework approaches the issue from different lenses to understand what makes subdivision so damaging to wild predators.

Social systems are interconnected with ecological systems and can vary over social-temporal scales. These scales themselves can change based on emergent properties from interactions of actors on the land, such as memory, cohesion, co-existence, or conflict (Parrot and Meyer, 2012). When conducting our research, it is necessary to understand how present ecological problems have roots in social problems or phenomena, one must consider not only their biological and physical effects but also the social dynamics that have enabled them to arise (Bookchin, 1993). We want to explore the connection between demographics, land use, and ecology. When humans choose to purchase land, it can be used for different purposes, such as conservation or the direct use of space and resources. Understanding these different uses can help elucidate the cultural and socioeconomic backgrounds of the people living in an area and determine how they use the land (Erb et al., 2016).

### Attitudes, Tolerance, and Actions

We are approaching each subject using tolerance as a lens of study. Tolerance can be shown through attitude, such as the judgments surrounding a species, as well as behavioral forms, like the killing of an animal (Marchini et al., 2023). Coexistence is a dynamic and overarching concept that involves humans and wildlife sharing a landscape in which neither is inhibiting the livelihood of the other. This is formed by the coalescence of tolerance and acceptance (Glikman et al., 2021). It's important to note how cyclical this process is. Human-wildlife interactions have shown to influence attitudes toward wildlife (Rais Mir et al., 2015), while at the same time, attitudes have proven to influence the interactions that promote or reject coexistence (Min Ngo et al., 2022). Tolerance for wildlife is determined by many social factors, which may include one's demographics and community structure. Positive or negative interactions then cause a feedback loop which will affect attitudes and future behavior (Silva dos Santos et al., 2020).

Each actor in the Huife watershed has experiences that inform their feelings and actions towards wildlife. Within our research, we explore the differing social aspects and personal identities associated with the people residing in different circumstances, in order to draw connections between attitudes and interactions people have with predators. Interactions between humans and wildlife refer to any encounter between the two, but specifically within the scope of our research, we are looking at the conflict that arises when the two overlap in habitat. Attitudes however, do not necessarily determine intentions or actions towards wildlife, but can influence them. Actors require the perceived ability to act in addition to a negative attitude towards an animal before pursuing negative interactions with wildlife. As such, it is critical to consider more

aspects of the human dimension to understand human-wildlife interactions, which we have outlined below.

## **Demographics**

Social systems are inherently linked to the ecological systems around them, so it is vital to understand what aspects make up a human community to grasp the web of connections between the two systems. By approaching our study with a focus on demographics, we can analyze how a person's or community's background may affect their relations with nature. Social backgrounds shape the way people perceive and interact with the other-than-human species they share the land with (Parreñas, 2018). Contextualizing the system is necessary to understand how and why it works the way it does. Societies can develop in starkly different ways depending on the environment, the same way humans and wildlife develop differently depending on their environment. Education, religion, politics, and more, are all factors that can influence a person's outlook on the world. Lived experience can also play a role in influencing outlook. For example, people who have resided in an area for generations, in comparison to people who have recently migrated, may differ in various social factors, including opinions and attitudes. The Pucón area, which contains the Huife Watershed, has experienced increased migration in the past decades and that change accelerated during COVID-19 due to pressures from amenity migration (Zunino, 2010; Tironi, 2021). This demographic shift has converted large amounts of farmland into tourism infrastructure and homes (Jaramillo, 2013).

## **Generational Knowledge and Implemented Education**

To understand how social and familial backgrounds influence wildlife interactions, it is important to explore the concepts of generational knowledge and education. A major component of social backgrounds is how generational knowledge about the ecology of that land—which accumulates in a precise location through tenured residents—affects an actor's present-day interactions. When evaluating the social context of our study areas, we consider the amount of generational knowledge inherited by our actors.

In addition to inherited knowledge, educational background can affect actors' present interactions. Education can take the shape of formal schooling, information passed through families or communities, or knowledge that accumulates through lived experience. To inform our evaluations, we explored how education on wildlife has been used in the past. The efficacy of different educational initiatives has been disputed in the literature (Foerster, 2021) and researchers remain divided on how to implement programs that reduce conflicts. When examining present interactions between humans and wildlife, as well as proposing potential solutions, it is important to keep in mind the effect of education on ecological knowledge and awareness. Throughout our project, we will consider the efficacy of different ways of attaining ecological knowledge, as well as the effects of past educational backgrounds on present interactions.

## METHODOLOGICAL FRAMEWORK

### I. Study Areas

In La Araucanía, the process of subdivision has been shown to negatively affect native wildlife. Populations of güiñas, pumas, native foxes, and hog-nosed skunks have been shown to decrease as human residences increase in number and proximity to each other (Gálvez et al., 2021b). Studying interactions in the Huife watershed thus provides an exemplary setting to study the effects of land subdivision on human-predator interactions, through considering all of the interconnected parts associated with subdivision. With this project, we observed four different examples of land subdivisions and compared the amounts of mesocarnivores present. Our study sites included a land fragment used for forest conservation and eco tourism (Likén Lodge), a large plot of land subdivided for low-density housing (Kawellucó), and a farm area subdivided but still owned by the same family. We supplemented these study areas with an interview with another local actor whose family has similarly experienced subdivision of their land but has not sold off any of their land. Our study areas were all located in or near to the Huife watershed. This region has faced increased land subdivision over time and is still occurring at a fast rate today (Henríquez Jaramillo, 2013). Within the Araucania region, native forest cover has decreased significantly (63%), and what remains is not intact, but rather fragments that vary greatly in size and form. The rest of the land not occupied by the native forest consists mainly of forest plantations, agriculture, and residential developments (Fleschutz et al., 2016; Henríquez Jaramillo, 2013).

We chose our study areas not only for differing land-use characteristics, but to be able to speak with a diverse group of local actors. These sites were proposed by our advisors after explaining to them our goals of making meaningful comparisons. Beginning this project, we wanted to explore the story of how land subdivision affected local actors and their relations with local wild predators. By conversing with a mix of local actors who had lived on the land for various amounts of time, and who used their lands for different purposes, for economic and conservation purposes, we hoped to find common themes and determine key factors influencing the quality of human-wildlife coexistence. Given our time constraint, we could only interview five local actors. We chose to interview two actors who had lived on the land their whole lives, and who could tell us both about their own property and their personal interactions with wildlife, but also about the history of the land around them in the context of land subdivision. The other interviews we conducted were with people using their land in experimental ways, trying to balance financial gain with the preservation of local ecological systems on their land. By getting a broader story and also exploring current efforts to use land sustainably amid subdivision, we hoped to both understand relevant social-ecological variables and also, at a broad level, the story of land subdivision in the Huife watershed.

### II. Interviews

Our main method of data collection was through semi-structured interviews, which were voice-recorded for further analysis. We chose to employ semi-structured interviews because they

allowed us to ask a mix of closed and open-ended questions, allowing for follow-up questions (Adams, 2015). We entered each conversation with a set list of questions, but allowed the interviewee to pivot the conversation. We ensured that by the end of our visit, all of the set list of questions were answered so that we had a baseline comparison between the different study areas. The set list of questions pertained to how many people live on the property and for how long, how many hectares the land is, how they use the land as well as how their use differs from that of their neighbors, and whether or not they plan to subdivide their land and/or pass it down generationally.

Additionally, each interviewee received slightly different questions based on their different backgrounds we understood existed between them before we entered the discussion. Two of the people we interviewed were residents who have lived in the area their whole lives and who have generational ties to the land. We asked questions such as: how many generations their family has lived on the land if they could describe how the surrounding land has changed throughout their life, and their opinions on overall land changes from subdivision by their neighbors. The other three interviewees were from Santiago and were living on land subdivided into parcels or for ecotourism: Isabel from Liken, Sofia from Kawellucó, and Joshua from Kawellucó respectively. For Isabel, we asked questions about the overall goal of Liken as an ecotourism destination. We were interested in learning why they chose to migrate to the south, how their neighbors felt about their use of the land, and what condition the land was bought as well as who it was purchased from. For the Biodiversity Committee, we also asked about their mission as a whole. We then asked questions about the feelings of neighbors about their use of Kawellucó, whether or not the land had rules based on its environmental designation, and the demographics of residents living on the land.

After asking set questions about the land, we transitioned into our free list activity highlighting mesocarnivores they encountered on their land. This redirected the conversation to wildlife and began to elicit an understanding of their perception of and relation to local mesocarnivores. After free listing, we transitioned into a conversation about wildlife interactions. We waited until after the free listing activity to talk about this to minimize bias or skew in the free list. The questions we asked relating to wildlife included: what wildlife challenges they have faced and how they address these issues, personal encounters with wildlife they listed in the free list, and if not initially mentioned; if they have had issues with cats or dogs. The questions previously listed do not reflect the full scope of questions we asked, and that the conversations were much more fluid than the list, as the interviewees often had an idea about what they felt was the most pertinent issue or animal to them.

### **III. Coding**

After completing and transcribing the interviews, we analyzed and coded the transcripts with the following codes to better organize and understand the common themes.

- Subdivision [SBD]
- Land succession [LDS]
- Present Land Use [PLU]

- Basic Info [BIF]
- Huife watershed history [WSH]
- Property History [PPH]
- Neighbor relations [NBR]
- Species of animals [ToA]
- Feelings/tolerance for animals[FLA]
- Interactions w/ animals [INA]
- Animal History [ANH]

#### **IV. Free Listing**

In the middle of our interview, we used free listing to transition the conversation to wildlife interactions. Through this method, we were able to understand which predators are present in the interviewee's land and elicit which interactions are most important in the person's life and land based on the order in which they listed species (Chaves et al., 2019).

#### **V. Guided Tour**

Another method we used, sometimes concurrently with our interviews, was a walkthrough of the property with the respective actor. This prompted responses that further elucidated their connection with the land and brought new anecdotes to light. This allowed the actor to describe exactly where on their property they experienced conflicts with wildlife.

## **RESULTS**

Our first objective was to identify different cases of land subdivisions to explore qualitative land use and ecological characteristics present in each area. This was accomplished through our selection of interview sites which ensured diversity in characteristics. While there, we noted important aspects that could contribute to the types of human-wildlife interactions there. These notes included the number of people living there, geography, size of the property, land use, number of buildings, etc. Our four interview sites covered a wide geographic area of the Huife watershed as shown below.

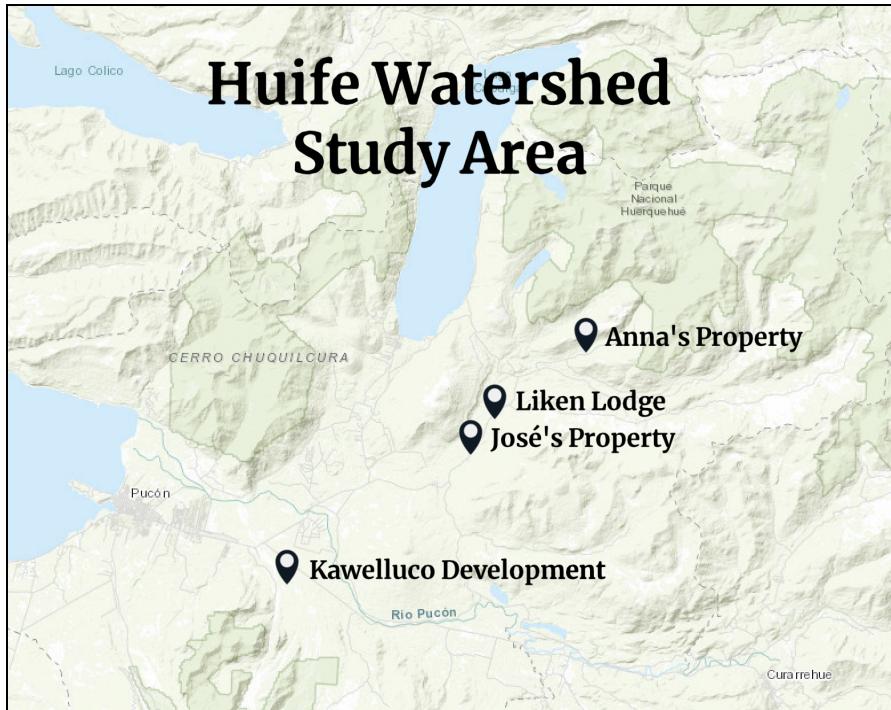


Figure 1: Map of Interview Sites in the Huife Watershed

*\*fake names used to maintain the anonymity of interviewees*

### Ana

We had the opportunity to meet with Ana whose family has resided in the Huife watershed for generations. They live there year-round. Ana and her sister are situated on five and a half hectares of land and she subsists through the raising of sheep and chickens and has a substantial garden on her property. Her home borders the Río Nevado. The land fronting the river was forested while the pastures had some small trees but were mostly open. By interviewing Ana, we were able to gain the perspective of a long-time resident who has seen new trends in wildlife interactions and land use change. Ana's family formerly owned much more land but over the past decade has slowly sold pieces to an influx of migrants. She maintains a garden and still raises sheep to continue the tradition of her father, who used to run their property. While in the past, her family's land was split up, Ana maintains her land and has not sold it into parcels, she has resisted the wider trend of subdivision in the area. Ana remarked that when the time comes to divide her land between her children, she hopes they will continue to keep the land for their family and not sell it.

### José

José has lived on a small plot of land further down in the Huife watershed for his entire life. Owning 8 hectares, he has seen the transformation of the valley and experienced the tensions associated with subdivision and wildlife conflicts firsthand. Unlike Ana, his family has not sold off parcels of their land but has instead increased the number of houses as their family has grown. In contrast, José told us how he has seen neighbors in the region sell their land in parcels, only to be left with little land and a less economically secure position. He keeps sheep,

and chickens, and has subsistence agriculture. Still, as more family houses have been built on the property, space for agriculture or raising livestock has decreased. José formerly raised cattle as well as sheep, but because of his growing family, he no longer had the space that cattle require and therefore switched to sheep.

### **Liken Lodge**

We then toured Liken Lodge, an eco-tourism retreat on the outskirts of Pucon. We were greeted by Isabel who owns and runs the lodge with her family. She moved from Santiago a few years ago to create both a tourism venture and a conservation project in one. Located on 16 hectares of land, there are 3 cabins to rent (space for 11 people) as well as her own family home. In addition to the cabins, the property includes a greenhouse where she grows much of her own food and a large segment of personally protected forest. She does not raise animals there because of the aesthetic degradation they would cause. Before purchasing the land it was a forestry plantation and had been damaged so heavily that Isabel signed an acknowledgement before purchase. This lodge served as an example of a property that was recently bought and transformed into a conservation effort, allowing us to observe the perspectives held by someone who migrated to the area and has a strong interest in environmental protection. Isabel has children, and she told us that she hopes they will continue to work on this land and conserve the forest fragment on it. Still, she expressed concerns that her family may prefer to move to an urban area, leaving the land for sale and therefore vulnerable to subdivision.

### **Kawellucó Biodiversity Committee**

We visited the community of Kawellucó. Situated close to Pucón at the western extent of the Huife watershed, the project has existed for over 20 years but is still in its first stage of development, with over two-thirds of the land still in the planning stage. Primarily occupied by wealthier Chileans looking for summer homes, with a much smaller portion of residents staying there year-round. Kawellucó provided an excellent case study of the demographic trends of the area; the massive 1200-hectare plot, however, is also the site of a major conservation project and has measures in place with the goal of sustainable subdivision. Less than 300 hectares of the land will be eventually allocated to plots with a minimum lot size of one hectare. The remaining area will remain undeveloped but private. Residents have formed multiple committees addressing aspects of life in Kawellucó. We learned that the development largely attracts landowners who are interested in environmental well-being and the natural character of the area. There are no livestock present but community members own horses which are allowed to roam through a large portion of the land. We were able to first meet with the chair and co-founder of the Biodiversity Committee, Sofia, who gave us a background on the area. Later, to further clarify what we learned at Kawellucó we spoke with another member of the committee, Fin. He elaborated on what the committee's role is in the community. The mission of the committee is to inform residents on how choices they make in managing their properties can affect the species living in the area. This is achieved primarily through collected camera trap footage from around the Kawellucó area that is then shared with residents in their community WhatsApp group chat. Their hope by doing this is to foster a deeper sense of connection with surrounding wildlife so

that residents make decisions regarding property management with wildlife in mind. This is supplemented by oral presentations on local wildlife and guidelines for coexistence. Similar to Liken Lodge, this development allowed us to analyze Human-wildlife interactions in areas void of livestock with residents who were not born there.

Regarding subdivision, Sofia primarily showed concern over the influx of new residents to Kawelluco and how that would affect community spaces. She mentioned that it was “very important” to have “territory to really be a community.” Currently, in the new stages of development for Kawelluco, Sofia expressed concerns that there was not enough community space to support a large influx of people.

Through both our diverse site selection and thorough general survey of characteristics, we completed our first objective and provided a test area to adequately analyze human-wildlife interactions in the Huife watershed. Our interviewees use their land for subsistence farming, tourism, and housing. Some have subsisted from the land for their entire lives while others are recent migrants. Because of our limited sample size, we were not able to isolate each variable but through well-formulated interviews, we could ascribe the effects these variables had on our actors.



Figure 2: Ana's property in the upper Huife watershed.

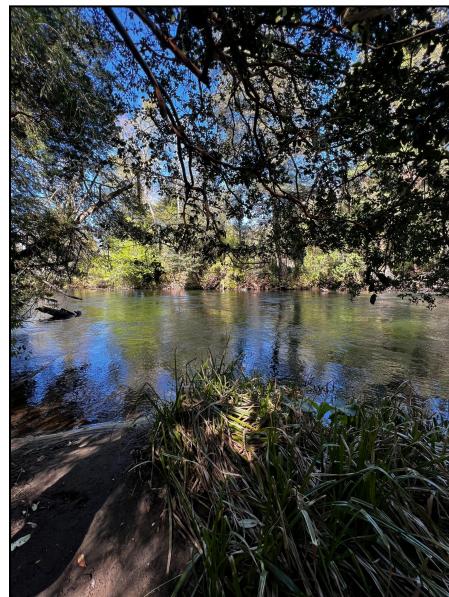


Figure 3: The river that fronts Liken Lodge and the entry point of the problematic mink



Figure 4: Liken Lodge property with supplemental agriculture (greenhouse)



Figure 5: ‘Granjero’ House in Kawellucó Development (Cazú Zegers)

Our second objective was to determine variances in human-wildlife interactions encountered within each study area through our interviews and guided tours. We heard about interactions between humans and different species of mesocarnivores and learned how these interactions differed depending on the type of land use in the study area. The first conflict between humans and wildlife we encountered was the predation of livestock by predatory animals. For three of our study areas, our interviewees told us about different ways in which they dealt with the threat of predation of their livestock.

José’s family depended on farming and livestock for their livelihood, which created a conflict when wild predators attacked his livestock. A key animal mentioned was the Harris’s Hawk *Parabuteo Unicinctus*. José told us that during the winter months when there is less prey available in the forested hills, these birds of prey come down into low-lying areas to hunt, which brings them to rural properties in the Huife Watershed. Multiple times, the peuco has attacked his family’s poultry. Being a local to this land for his whole life, and a guide at the local conservation area, José was reluctant to harm wildlife and reported that his last resort was killing the peuco. On the other hand, he told us that it was common for his neighbors to shoot and kill birds of prey that attacked their livestock.

Ana’s family experiences occasional predation of their sheep by pumas. In our interview, we learned that to avoid killing the puma, they keep their sheep inside or close to their house during the night. She told us that “la única forma” [the only way] to keep livestock safe from predators was to keep them close and protect them well. She did not mention trying to kill the puma as a way of preventing predation.

In addition to José and Ana's conflicts with the Harris's Hawk and Puma, all three interviewees noted having negative interactions with the *Neovison visón*, the mink. Isabel shared with us a story of how the mink had attacked her poultry to the point where it was not worth trying to raise livestock at all anymore. She explained "No tienen depredadores y se comen todo. Yo tenía muchas gallinas. Tenía patos. Al final ya me aburrí de tener.."["They have no predators and eat everything. I had a lot of chickens. I had ducks. In the end, I got tired of having them because the minks come and kill everything."]

José noted that the mink had also attacked his livestock, including sheep, lambs, and poultry. Ana similarly mentioned that she had suffered great losses to her livestock because of the mink. Our interviewees characterized the mink as a menace and an invasive species without natural predators, and when it entered into livestock areas, we heard multiple times that the vision would kill "everything" it could. While Ana, Isabel, and José all tried to employ traps to control the mink, none of them had any success. For Ana, the traps given out by the Chilean government were not easy to assemble and use, and for Isabel, trapping one animal did not help because more would always come to take their place. Isabel and Ana's properties both fronted a river which gave the mink, an aquatic animal, easy access.

Sofia from Kawellucó had a different perspective from the rest, as she lived in a residential development rather than an agricultural one, and as a result, she did not have any livestock to be preyed upon. Still, she experienced issues with free-roaming domestic dogs which our other interviewees would mention as well. In Kawelluco, the biodiversity committee has recognized through existing literature and personal experience that domestic dogs have negative effects on local fauna. Additionally, she reported that residents of the housing development are often scared by packs of domestic dogs roaming around the property. For these reasons, they have focused much of their efforts on trying to convince residents to keep their dogs inside at night and not allow them to roam freely. Especially as more residents move into Kawelluco, the number of dogs in the area increases, which worsens these burdens on the natural and community infrastructure of Kawelluco. In our interview with him, Joshua expressed interest in the creation of community spaces within Kawellucó that are kept free of dogs.

José noted that there was an attack on his sheep and lambs by free-roaming domestic dogs. He told us that these dogs come from neighbors that let their dogs roam freely, or from the streets, roaming without owners. Similarly to Ana, he noted that a step his family takes to reduce predation of his livestock is to keep them better protected. Primarily during the night, he told us how important it is to keep sheep in an enclosed space. During the day, he said that many neighbors employ guard dogs as well, and fences could help as well. but with very limited success.

Isabel reported trying to keep these free-roaming dogs off her property by using fences but having limited success. Because Liken has an area devoted to habitat restoration and conservation, domestic dogs pose a threat to this project. Now she is considering the construction of electric fences to keep dogs out.

As expanded on below, a final notable case of human-wildlife interactions in our interviews was caused by bats nesting in walls. According to Sofia, bats find the warm walls of wooden houses ideal for nesting, which sets up a conflict when humans try to remove them. In one instance early on in Sofia's time living in Kawellucó, she found over 200 bats living in the walls of her house. Without knowing the right time to do so, she called someone to remove the bats. Unfortunately, the bats had recently birthed offspring and the juvenile bats were vulnerable. When the adults were expelled from the walls, many of the juveniles were abandoned. After this event, she reached out to an expert who informed her of the grave consequences of her actions. Because of this, she began efforts to educate the community about how to properly remove bats from houses without killing them by bringing in a local expert.

Our third objective was to evaluate how different societal and familial backgrounds influence attitudes towards wildlife. We wanted to learn how their attitudes and intentions both affect and are influenced by their interactions with wildlife. People are inherently influenced by the environment around them, both socially and physically. Perspectives and feelings are developed over time as experiences and interactions shape the way a person thinks. Our goal was to explore how the attitudes of residents in the Huife Watershed differ due to their personal histories. Through our interviews with four residents, we discovered different ways that a person's background affects the way they view wildlife and the interactions they have with them. Our interviewees were from a range of geographic areas, some being local to the watershed and some having moved from Santiago. Their differing perspectives and interactions with wildlife were prevalent after answering our questions.

Jose and Ana were born and raised on the land they live on now and continue to raise their families there. Jose pointed out a complex relationship he has with the Harris's Hawk, a hawk that has caused problems with his livestock. He describes the Harris's Hawk as "Mi mayor enemigo, pero el ave en la cual yo tengo un tremendo respeto" [my greatest enemy, but the bird with which I have tremendous respect]. He admitted that he has even tried to kill the bird on various occasions, although unsuccessful. Jose recognizes that we as humans are living in the same habitats as wildlife so we need to learn to coexist with them. As José lives in the Cañí area and works for the sanctuary, he has developed a deep understanding of the network of animals that live there. This background gives him the motivation to utilize methods in his agriculture that support the ecosystem. He understands that as well as an ecosystem role, mesocarnivores are special animals that help secure his job as an El Cañí.

Ana comes from a long line of campesinos that have resided in the valley where she lives now, so she has learned some of the most tried-and-true ways of dealing with livestock predation. Minks have been a pervasive issue for her because they attack her chickens, but because she did not know how to set up the traps given to her by the government, she has not been able to kill them. Additionally, she has refrained from trying to kill the Harris's Hawks. Ana mentioned that she takes steps to protect her livestock and keep them close as opposed to killing them, showing that she takes a non-confrontational approach as opposed to killing upon first sighting. The way she approaches these potential conflicts reveals something about her tolerance and is an example of the idea explored in the theoretical framework wherein a person needs the

ability to act on top of an already negative attitude for them to take action against the species they are experiencing problems with. Ana also talked about the puma endearingly, despite it being a dangerous predator. Overall, Ana understands that needing to take preventative measures is a part of rural life and living within nature, and she appreciates native fauna. When asking Ana about her neighbors and if their attitudes and interactions with wildlife contrast with hers, she mentions that people who haven't lived on the land as long don't understand the best way to handle interactions with wildlife. She comments that they may jump to kill the puma or fox "Porque no saben tanto de eso" [because they don't know that much about it].

Our third interviewee, Isabel, comes from a different background as she moved to the Huife Watershed from Santiago around 8 years ago. She didn't grow up learning about the wildlife around her, but quickly educated herself upon arrival at the Huife Watershed. At University in Santiago, she received a formal scientific education which gave her background for what she learned. She valued the animals on her land differently; she mentioned liking the fox because they control the rabbit population that eats her plants, but, similarly to Ana, she strongly dislikes the mink. Isabel emphasizes how she sees the mink as a plague because "No es que se comen una gallina y se la lleven, sino que se maten al gallinero y matan todo lo que pueden. Entonces es una tremenda pérdida" [It's not that they eat a chicken and take it away, but they go into the chicken coop and kill everything they can. So it's a tremendous loss] to her. Her attitude towards the mink is negative because it damages so much of the ecosystem. In contrast, her attitude towards the fox is one of appreciation as they "son parte del ecosistema. Ellos viven acá desde siempre, así que mantienen el equilibrio que que tiene que haber" [are part of the ecosystem. They have always lived here, so they maintain the balance that has to be there]. Through her formal education and learning by doing, she has come to respect the foxes for the role they play in supporting the ecosystem.

In Kawelluco, Sofia offers new perspectives since the land she lives on is for residential development, not self-sustaining farms. Since living there for around 4 years, after moving from Santiago, she has had experiences that have taught her how to live within nature. For instance, Sofia's experience with the bats affected her emotionally—she felt guilty for causing the young bats to die. When she shared this story with other members of Kawellucó they revealed that they had been doing the same without consideration or knowledge of the possible harm. Most residents in Kawelluco are from Santiago or live there seasonally, and therefore do not reliably have interactions with wildlife over a long period of time. Joshua mentioned that the Biodiversity Committee had more difficulty engaging residents who were from the local area and community. He believes this was due to residents with different backgrounds moving in distinct social spheres and that these cultural divergences posed a challenge to cohesion. Joshua also mentioned how residents from Santiago are more willing to cooperate with guidelines about keeping their dogs indoors and there was more pushback from local residents.

Our final objective was focused on finding potential solutions to mitigate conflicts between humans and wildlife, and foster positive coexistence. Through our interviews, we not only learned of various practices that each actor implemented to evade conflicts but also their visions and opinions on how we can work towards adapting an attitude of tolerance and coexistence.

In our first interview with José, we asked if he had any suggestions on how he would like to see people live and interact with wildlife. He explained that he has respect for all of the wildlife on his property, despite the troubles they may cause him, and believes this perspective is vital for positive human-wildlife interactions. Furthermore, he expanded on the concept of the importance of education regarding coexistence:

“La educación es fundamental para que se genere un cambio también en cómo debemos comportarnos con el entorno, o sea, un entorno sin aves, por ejemplo, no me lo imagino o un entorno sin árboles, por ejemplo, no me lo imagino.”

[“Education is fundamental to generate a change in how we should behave with the environment, that is, an environment without birds, for example, I can't imagine it, or an environment without trees, for example, I can't imagine it.”]

José emphasized that with increased education on this topic, people may be more inclined to care about the wildlife they interact with. He has learned to love these predators because he understands their ecological importance and the benefits they provide. He felt that if people come to understand the positive aspects of these predators, they can foster a relationship of coexistence:

“Mientras aprendemos a convivir no nos generan un daño al ser humano, por ejemplo. Pero si no sabemos convivir con ellos, sí, entonces normalmente lo que más sabemos es lo negativo, pero es más positivo que negativo el convivir con con todo este tipo de especies.”

[“As long as we learn to coexist with them, they don't generate harm to human beings, for example. But if we do not know how to coexist with them, yes, then normally what we know most is the negative, but it is more positive than negative to coexist with all these types of species.”]

When speaking with Isabel, of Liken Lodge, we discussed the presence of environmental action related to wildlife preservation at both the individual and the community level. She explained that within her neighbors, most conservation measures were implemented by individuals who are engaged in environmental issues. Although there is some community cooperation in the form of boards of directors, in her perspective any tangible action was at the hands of individuals. She added that this form of “environmental consciousness” that leads people to take action such as those she has taken, is a concept that has arisen from individual interest as it has not been prominent in mainstream education until recently:

“En Chile, recién ahora están haciendo como educación ambiental a los chicos en la escuela, les están enseñando, están hablando de la biodiversidad, del bosque nativo. Eso cuando yo fui al colegio jamás me hablaron de nada. Entonces hay que crear eso. Ni eso ni eso. Entonces hay que generar conciencia en las personas, hay que, hay que comunicarle, hay que contarles cómo cuidar, qué está bien, qué no.”

[“In Chile, they are just now doing environmental education, they are teaching children at school, they are talking about biodiversity, about native forests. When I went to school they never talked to me about anything. So we have to create that. So we have to raise people's awareness, we have to, we have to communicate, we have to tell them how to take care, what is good, what is not.”]

Isabel's notion of environmental awareness and the importance of caring for nature as a catalyst for action was seconded by our interviews with Sofia and Joshua of Kawellucó. Both our interviewees, who make up part of Kawellucó's Biodiversity Committee, expressed how they had put much thought and consideration into how best to foster human-wildlife coexistence. The major issue they have seen is the abundance of dogs allowed to roam free by their owners. To address this problem, they have approached it from an angle of education and awareness, providing information on the effects of free-roaming pets during community meetings, but also emphasizing the rich biodiversity and species of wildlife that surrounds them. By taking this stance of promoting awareness, Joshua explained that they strive to “build connections with species there so people are more inclined to love native fauna.” Both Sofia and Joshua touched on the use of this group chat as a resource to promote wildlife appreciation but also have noticed the increasing use of the chat to condemn dog owners who allow their pets to roam free. In this way, our interviewees noted that the use of the chat has resulted in mounting social pressure for residents to control their pets in order to avoid this condemnation.

## DISCUSSION

In analyzing our results, we return to our original research question: how do the social characteristics associated with increased land subdivision affect interactions between people and mesocarnivores in the Huife Watershed? In analyzing this question, we isolate three main lenses and analyze their effects on human-wildlife interactions: community structure, migration and land ownership continuity, and changing dependencies on land. Additionally, we discuss a distinction in our results between native and non-native mesocarnivores.

### Community Structure

Our research indicates that community connectedness and the presence or absence of communication of information between neighbors can affect human-wildlife interactions. The types of community structure differed between our interviews. We compare the private

organization and active participation of homeowners in Kawellucó, to a local rural community of independent property owners.

The Kawellucó Biodiversity Committee's use of their WhatsApp group chat provides an example of informal community education on conservation. This space allows for an open exchange of information regarding the management of wildlife, to foster better interactions and ecological outcomes. When Sofia made the mistake of removing juvenile bats too early from her walls, she was able to share this knowledge she learned with other community members in hopes of preventing them from making the same error. This was displayed through the committee's sharing of camera trap footage, allowing residents to view the local wildlife of Kawellucó and leading to increased interest in learning proper land management. As such, information passed through communities that promote healthy relationships with wildlife can be a powerful factor in determining healthy human-wildlife interactions. In contrast, we examine Jose's less connected community and hypothesize that with a more stable, connected community, people would have a greater ability to educate their peers on ecological values and thereby decrease the direct killing of mesocarnivores by farmers.

Aside from facilitating education, community connectedness also allows for informal enforcement of guidelines that control land use and behavior towards wildlife. In Kawellucó, there is little formal enforcement of measures to force residents to act in a way that preserves biodiversity. Still, informal methods have emerged with the creation of the Biodiversity Committee. As we learned in our interviews, social pressure has caused residents to control pet dogs and prevent them from roaming freely within the Kawellucó development area. Still, Joshua told us that while this social "enforcement" has been effective to a certain extent, it does have its drawbacks. Residents are dissuaded from acting in a way that harms local wildlife through fear of condemnation by their neighbors, leading some to become defensive and not change their behavior. Aside from digital communication, physical community spaces are emphasized in Kawellucó, further facilitating sharing of ecological knowledge. As more residents move into Kawellucó, the Biodiversity Committee has expressed a plan to create more of these community spaces for residents of Kawellucó that are kept free of dogs, exemplifying another effort to promote community connectedness while enforcing biodiversity protection. Overall, Kawellucó exemplifies success in the informal enforcement of guidelines that protect biodiversity, which is made possible by their cohesive community structure.

Jose's neighborhood exemplified a lack of community structure resulting in increases in human-wildlife conflicts and more subdivisions. With a lack of strict zoning laws to prevent subdivision or dictate land use in rural areas ("The Governance of Land Use: Country Fact Sheet Chile," 2017), the rate of subdivision has been high, and with it migration of people that are not yet integrated into the community. This results in a lack of communication and connectedness within his rural neighborhood. In the absence of formal enforcement, this community disconnectedness also makes informal enforcement difficult. Concerning free-roaming domestic dogs, this disconnected neighborhood structure has not allowed a social pressure such as that at Kawellucó to form. With this lack of social pressure, there has not been a decrease in conflicts caused by free-roaming dogs attacking livestock.

## Migration and Land Ownership Continuity

Subdivision occurs alongside an influx of wealthy people from Santiago, Chile's metropolitan center, to rural areas. Many of these migrants move away from the city, looking to live more closely with nature, which they likely were not exposed to on a regular basis before moving to a more rural area (Heberlein & Ericsson, 2005). This is just one cause of subdivision, but this new demographic can affect the interactions with wildlife in the area. Through our interviews, we have seen that there can be a hurdle when learning to coexist with wildlife. An example of this was when Sofia, from Kawellucó, inadvertently killed the baby bats living in her walls. While this could have been avoided by consulting an expert, her inexperience living in the area led to more negative consequences from this conflict between herself and the wild animals. Still, the event propelled her desire to learn more about the local fauna of the area and, importantly, educate her neighbors as well. Isabel from Liken, recently moved from Santiago to the Huife watershed. In her case, she was drawn in by the idea of living in pristine nature, but as she told us, when she first moved onto the land she knew little about local flora and fauna. As she lived on her new property, however, her enthusiasm for nature developed into deeper knowledge on local flora and fauna, and dedication to environmental protection. This resulted in the creation of Liken, where she hopes to combine ecotourism with conservation to spread awareness and foster interest in and respect for nature and wildlife.

Another relevant factor affecting human-wildlife interactions amid a trend of subdivision is land ownership continuity. Ana and José's families had both lived on their land for generations. A main factor preventing them from splitting their land into parcels to be sold off was a commitment to keeping the land in their family and the recognition that losing land had severe economic consequences. In Liken Lodge, Isabel and her family have only owned their land for 6 years and are already considering how to preserve it for their children. Isabel hopes that her children will share the same love of the land that she has fostered, as she knows that if it is sold, it will no longer remain protected and will most likely be used for forestry. At Kawellucó, there was not a familial commitment preventing land from being sold off in parcels; however, the housing development was organized in a way that prevented pieces of land from being sold to outside parties or being developed in unsustainable ways. In this way, there is still land ownership continuity here. The continuity of land ownership exhibited by our actors prevents further subdivision of their land, thereby preventing the associated negative effects on wildlife.

Aside from preventing further subdivision of land, continuity of land ownership allows for the retention and accumulation of tolerance and ecological knowledge. In the Kawellucó development, because the community of people has remained there over the years and the land has been maintained under continuous ownership, the people there have been able to learn more about local flora and fauna and share that knowledge with each other. This communal learning has manifested in the formation of the biodiversity committee, which has in turn further contributed to the accumulation of knowledge on how to sustainably interact with local wildlife and has facilitated increased tolerance for these animals.

Both longtime locals of this area, Ana and José had more of an inherited tolerance for local predators, such as the puma or Harris's Hawk, even though these animals prey on their livestock. Given her long history with the land, Ana has developed a deep connection to it that guides the way she interacts with the wildlife and nature around her. On her property, she has refrained from cutting a grove of roble (oak) trees from a grazing area for her sheep because they host digüeñas, which her family has foraged for generations. Additionally, her tolerance for the puma was inherited from her father, who affectionately called the animal "gatito" and understood that it needed to eat too. The generational continuity of land ownership on her property translated into more ecologically friendly land management and increased tolerance for native mesocarnivores. After spending one's entire life with these predators one can develop a personal relationship and deep understanding of their importance, despite potential conflicts such as those over livestock. However, the same cannot be said for non-native and domestic predators, as expanded upon below. As subdivision splits the land of the Huife watershed, more and more migrants without this long-term learned tolerance reside in these fragmented pieces, likely increasing negative interactions between humans and wildlife. Without lived experience, one may not understand or realize the beneficial aspects of the local wildlife, and instead may only have first-hand experiences of a negative manner, leading to lower tolerance of these animals.

### **Changing Dependencies on Land**

The changing demographics and land-use conversion, namely a decrease in agriculture and an increase in residential and tourism development, change dynamics between humans and local wildlife, altering the types of conflict formed. Relating to human-wildlife conflicts, the shift from agricultural to residential and tourism-based land use primarily means a lower presence of livestock. We have seen how mesocarnivores can decimate livestock populations which corresponds to a threatened livelihood. Without a financial reliance on raising livestock, it is possible that this hints at a possible reduction in human-wildlife conflicts as more migrants move to the area. An example of this is Isabel, who runs an eco-tourism destination with cabañas, who shifted away from livestock when minks decimated her poultry and did not suffer the same magnitude of economic loss as someone who relied on livestock for a livelihood. The conflicts with wildlife we observed in Kawellucó similarly did cause monetary losses to its inhabitants because as a residential development, there are no livestock being raised. Their tolerance for conflict before taking drastic measures was higher. A dichotomy between Jose's beliefs and interactions is how although he does express care for the balance of the ecosystem, he expresses a desire to kill the Harris's Hawk who killed his poultry. In this case, a shift away from agriculture could change the type of wildlife conflicts because resulting issues would not be economically threatening; increasing population density from land-use change, however, can nevertheless increase overall conflict. This is where intentional subdivisions like in Kawellucó could be helpful to mitigate the effects of increased population through the implemented measures such as lot-size requirements, porous fencing, and conservation areas.

As the demographics of the Huife Watershed continue to change, with more migrants with no generational place-based knowledge and a shift from agriculture to tourism and residences, the resulting human-wildlife conflicts differ. Conflicts will differ in their effects as

live-stock raising decreases, but larger populations will mean more impacts, and conflicts will be more difficult to remedy without inherited knowledge. The role of environmental education will become increasingly important.

### Native vs. Non-Native Predators

As we analyze our results, a distinction becomes apparent between native and non-native predators. Although not a direct result of subdivision, we noticed a common theme of contrasting tolerances between native and non-native predators. Despite differing demographics, property types, and land use as we have mentioned, all of our interviewees expressed significantly more disdain or intolerance towards the non-native mink and towards free-roaming domestic dogs. While it remains difficult to determine whether that is due to them causing the most damage to their livelihoods, or a disproportionate lack of tolerance due to them being thought of as invasive, it is apparent that there is a distinction to be made.

In our interviews, there seemed to be a shared tolerance for native mesocarnivores who, while sometimes preying on livestock or otherwise damaging farmers' livelihoods, are respected and recognized for their ecological importance. The same cannot be said, however, for domestic dogs, which are seen as a nuisance; these animals also prey on livestock but are more associated with poor neighbor relations than serving an ecological purpose. Similarly, despite demographic differences, there was a consensus among the majority of our interviewees that the invasive mink was a major problem. All interviewees who raise livestock disliked the mink, remarking that it has killed unnecessary numbers of their poultry, posed a threat to native birds and other small animals in the area, and was very difficult to get rid of. Interestingly, both the invasive mink and domestic dog were the only non-native mesocarnivores mentioned in the free lists and were also cited as the worst of the mentioned species.

This analysis could be an indication that, given time to learn about the area, people can come to coexist with native predators. At the same time, this coexistence may not be possible with invasive species. We hypothesize that along with the damage caused by an animal, knowing that a species is non-native could play into the tolerance an individual has for a species, indicating how the presence of knowledge (being a social characteristic we previously outlined) influences interactions. Most of the people we interviewed are ecologically aware, having accumulated ecological knowledge either through formal education or generational ties to the land, and this informs their ability to differentiate between native and non-native species. Possibly, to maintain social-ecological health, different approaches are needed to foster sustainable relationships between humans and native versus non-native predators.

## CONCLUSION

Increased subdivision has occurred concurrently with demographic shifts and land use change due to migration in the Araucanía region, specifically in the Huife Watershed. In this paper, we sought to answer the question of how social characteristics associated with increased land subdivision affect interactions between people and mesocarnivores in the Huife Watershed.

This exploration of human-wildlife interactions reveals relationships shaped by community structure, demographics, and the sharing of knowledge over generations and between community members. Through accomplishing our objectives we are able to understand how these concepts impact interactions between humans and wildlife. We investigated these social characteristics by interviewing multiple key actors in the Huife watershed. They informed us about their experiences from diverse perspectives which allowed us to analyze how demographic changes, community structure, land ownership continuity, and tolerance of native vs. non-native predators influence interactions with wildlife.

We discovered that community connectedness and enforcement of regulations accompanied by social pressure play a role in determining human-wildlife interactions. In Kawellucó, their community association has attempted to reduce human-wildlife conflicts and have been successful in sharing knowledge and steps towards maintaining biodiversity (but at this point we are unable to determine the overall efficacy of these efforts). The lack of regulations in place regarding the management of domestic dogs in Kawellucó has led to increased conflicts; in some cases, social pressures have persuaded people to better control their pets through mechanisms such as shaming. Contrastingly, in Ana and José's more rural communities, the absence of zoning laws and dictation of land use resulted in increased subdivision and a lack of community structure. We make the distinction between Ana and José's communities and those of Liken and Kawellucó because the latter are more developed, have a greater presence of tourists or non-locals, and the zoning laws are deed-based.

Additionally, we found that the influx of wealthier migrants seeking rural living associated with land subdivision often results in individuals unfamiliar with local wildlife making up greater proportions of communities. These migrants then experience a learning curve in which they educate themselves on native biodiversity and, sometimes, learn from their mistakes when they have negative interactions. This lack of experience can lead to unintended negative consequences, emphasizing the need for educational initiatives for communities. The continuity of land ownership through generations emerges as a significant factor in fostering tolerance and inherited ecological knowledge. Our research suggests that human-wildlife conflicts can be mitigated through both intentional planning during subdivision enforced through policies and social pressures, as we found in the case of Kawellucó, as well as opportunities for environmental education.

We analyzed that the continuing movement away from agricultural land use recharacterizes conflicts in newly developed tourist and residential areas because livestock predation does not threaten livelihoods. Our corresponding actors' responses, therefore, showed different levels of tolerance towards the animals.

Finally, we found a theme between tolerance towards native and non-native predators. It became apparent that residents had a negative attitude towards the invasive mink and free-roaming domestic dogs. These animals had detrimental impacts on residents' livelihoods as they killed livestock and trampled vegetable gardens. Although it was unclear if the views towards these native and non-native mesocarnivores are because of their impacts or because of

existing ecological knowledge, a consensus was shown among our interviewees, regardless of their demographic differences. We also observed that those with generational knowledge tend to be willing to make changes to the way they manage their livestock as opposed to changing how they interact with predators.

The key takeaways from our paper that we seek to highlight include:

- Trends in land subdivision change and recharacterize human-wildlife conflicts.
- Community connectedness can facilitate sustainable relationships between humans and wild mesocarnivores by allowing for the communication of ecological knowledge and social pressures to promote coexistence.
- Tolerance for wildlife can be accumulated over time and inherited over generations; therefore, land ownership continuity is key for promoting human-wildlife coexistence.
- A species' endemic status is likely to affect peoples' tolerance for it. If a species is endemic, it is more likely to be tolerated than a non-endemic species, even if both cause negative interactions with humans.

Creating a healthy co-existence between ourselves and vital, biodiverse ecosystems is an essential part of a sustainable future. We hope our research can better characterize the connections between land subdivisions and human-wildlife conflicts.

## LIMITS OF OUR STUDY

Due to our strict time and resource constraints, our study was limited in scope and depth. First, we were only able to conduct five interviews and survey three properties. As a result, our study areas were not fully representative of the process of subdivision in the Huife Watershed. Additionally, there was bias in our selection of interviewees because our selection process was not random. Each actor interviewed had a preexisting relationship with researchers studying environmental topics, and four of our five interviewees are actively involved in conservation projects, leading to potential bias in our results.

Because of the limits of our study, we are reserved in our presentation of findings. Rather than presenting concrete conclusions, our results come in the form of common themes and proposals for further avenues of research.

## NEXT STEPS AND FUTURE RESEARCH

As an additional project and continuation of our research, we have created an educational website for current and future Kawellucó residents on behalf of the Biodiversity Committee. We focused on creating a positive and interesting hub for new camera trap photos and helpful information. By interspersing information on how to help various native fauna with the new camera trap footage that is very enticing and exciting to residents (at Joshua's suggestion), we hope this will encourage residents to continue making an active effort to facilitate positive

interactions with the species present on their land. We will continue to discuss and alter this website with different members of the Kawellucó community as a gesture of thanks for their willing participation in our project. A topic of future research could examine how effectively our website changes attitudes and behaviors of Kawellucó residents using camera trap data and further interviews.

Additionally, we discovered an interesting connection between the substantially negative perception our actors showed toward the mink and its role as a non-native predator. Future research could further parse out the role of the mink's non-native origin in current attitudes and tolerances for the animal. Finally, as suggested by multiple interviewees, future research could also be performed to investigate new methods for community education on the ecological importance of these predators as an effective and vital method to achieve human-wildlife coexistence.

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