# HUMAN-WILDLIFE COEXISTENCE: UNDERSTANDING ATTITUDES TOWARDS WILDLIFE IN URBAN ENVIRONMENTS

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## Dedication

To my wife, Jessica, for being willing to go with me on this great adventure of education!

## Abstract

Existing attempts to elucidate one's level of engagement with and attitude towards urban wildlife are primarily focused on a single species of flora or fauna and multiple species data are lacking. To achieve a more comprehensive understanding of perceptions of wildlife, I built and tested a measurement tool adopting both quantitative and qualitative methods: The Urban Wildlife Coexistence and Attitudes Scale (UWCAS). Two versions of the survey were administered to residents of the cities of Lethbridge, Calgary, and Red Deer (N= 1362). The results indicated that UWCAS (Version 2) is a psychometrically valid tool that elucidates the attitudes that residents hold toward wildlife. Overall, urban residents scored high on their willingness to coexist with and tolerate wild urban plants and animals. Further research could involve the collaboration with city planners and wildlife management groups to highlight species and habitats that could increase the health, happiness and well-being of residents.

**Acknowledgements**

I would like to thank the University of Lethbridge for use of their access to Qualtrics.com and for the input on ethics. I thank Java the Hut Coffee Shop for their extra prize donation. I thank the Barrett-Henzi Lab at the University of Lethbridge for their insight and critique and the many hours dedicated to helping me through this learning process. I acknowledge the hard work and efforts by the ecosystem management students at the Lethbridge College and psychology students from the University of Lethbridge as my volunteers. Special thanks to Ken Lehman from the City of Red Deer and Todd Nivens from the Kerry Wood Nature Center for their input on booth location and sign postage in the city of Red Deer. I thank Karen Anderson from Fish Creek Provincial park and the Friends of Fish Creek for their input and aid in booth set up and signage at Fish Creek Provincial Park. Anecdotally, doing research during a global pandemic was tough but showed me how willing people are to make sacrifices for a common cause. Whether it was wearing a mask to take a survey, or snapping a quick picture of the QR code and carrying on with their walk, I am grateful for the time people made to take a survey during a pandemic.

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# Chapter 1

> Our numbers multiply,
> we burn more energy,
> we consume more of our resources,
> we assail air and water and land with new and more persistent chemical combinations.
> In this crowded, mechanized world, environmental problems don't fit neatly within the lines on a map.
>
> --John Fraser, "Status of Environmental Education Issues in Canada"

Ritchie and Roser (2018) project that by 2050 the world population will rise to 9.8 billion with 3.1 billion in rural areas and 6.7 billion living in cities (~6.7/9.8 billion). Looking at Canada specifically, as of 2021, 81% (30,997,852) of Canadians already live in "urban" areas, which are defined by the nation as having a population greater than 1000 ("Canada Urban Population 1960-2021," 2021). With much of the population living in urban settings, urban ecosystems have been constructed to fit the needs of humans, affecting the biodiversity that once resided there (Gunnarsson et al., 2016; Ives et al., 2016). Where have all the wild things gone? Do people continue to see nature as something that exists outside the city or themselves? Are there spaces and species that are permitted to exist in the urban jungle and others that are not?

The effects of urbanization, as John Fraser put it, spill over into ecosystems (biological communities of interacting organisms and their physical environments) that are both near to and far from the point of urban growth. Over the past 100 years, ecosystem changes include: increased human activity during the day, the building of skyscrapers, and roads cutting off established movement paths for wildlife (or paths of connectivity). Some animals stop migrating to farther regions due to wetlands, warmer temperatures, and alternate food resources—from bird feeders to trash cans—in urban areas (Kobilinsky, 2020; Bonnet-Lebrun, Manica & Rodrigues,

2020). Urban habitat loss and fragmentation increase the need for bees (*Bombus* spp., *Halictus, Lasioglossum, Hylaeus, Megachile, Dasypoda, Panurgus, Andrena,* and *Colletes*) to travel farther due to a decrease in pollinating plants and can have a negative effect on species biodiversity (Ayers & Rehan, 2021; Hülsmann et al., 2015; Theodorou et al., 2020). Mule deer (*Odocoileus hemionus*) must cross dangerous roadways to travel between breeding and feeding grounds (Braaker et al., 2014; Fraser et al., 2019). Killifish (*Oviparous cyprionodontiform*), in the Elizabeth River in Virginia, that have a higher tolerance for toxic water have multiplied, while their less tolerance conspecifics have died (Konkel, 2016). Racoons (*Procyon*) and mice (*Mus musculus*) have adapted stronger immune systems to handle relatively dense living conditions, and pigeons (*Columba livia domestica*) roost high in skyscrapers thriving on the crumbs of citizens (Krimowa, 2012). Some wildlife has adapted to city life, but what about ecosystem biodiversity?

Rich biodiversity contributes to the physical health of people and of wildlife (Mills et al., 2019) and mental health of people (Bratman et al., 2015; Cloutier et al., 2014; Negami, 2018). By living close to a park, or visiting a park frequently, one's overall well-being can be increased (Brown et al., 2014; Larson et al., 2016b). Gunnarsson et al. (2016) found that actual, as opposed to perceived, biodiversity in the city contributes to positive aesthetic perceptions of greenspaces. In other words, more biodiversity makes places more appealing to go to which could lead to more active lifestyles and ultimately an increase in physical and mental health in cities (Bratman et al., 2015; Cloutier et al, 2014; Larson et al, 2016b). Gunnarsson et al. (2016) also suggested that "high" (*i.e.*, positive) environment-related attitude influenced perception of greenspaces. These environment-related attitudes could be influenced by several other factors such as one's willingness to tolerate problem encounters with wildlife (Charles& Linklater, 2015). Simply

having a high environmental attitude does not always mean you will want wildlife around you. One's experience with certain wildlife will shape attitudes and potentially behaviour towards wildlife (Eriksson et al., 2020; Charles & Linklater, 2015). Some have found that attitudes towards wildlife only slightly correlated with behaviour towards wildlife (Sheeran & Webb, 2016; Shumway et al., 2014), while others have found that negative attitudes lead to more violent reactions towards wildlife (Rupprecht, 2017). More violent reactions may be due to the origin (*i.e.* the experiences) of these negative attitudes. Imagined experiences, like one's perceived level of threat (Shumway et al., 2014), compared to an actual destructive event could account for these differences in research results. Further, the nature of the event itself has strong implications for one's level of tolerance and emotional response (Hudenko, 2012; König et al., 2020; Rupprecht, 2017, Shumway et al., 2014). Are attitudes shaped by smaller encounters? For example, if someone has a bird defecate on them while they are walking through the park, will they now like birds less? If they then like birds less, will they stop walking in the park? It is these smaller negative and positive experiences with nature that I wish to investigate to better understand how they might influence attitudes and behaviour.

Generally, human behaviour can change based on social situations, suggesting that people are less consistent than they think (Carley, 2014). Kowalski and Westen (2009) define consistency as a person responding to the same stimulus in the same manner over a period of time. They also define a person's attitude as an association between an act, object, and an evaluation of the act and/or object. Behaviours can consist of multiple dispositional and situational causes where one should be able to predict behaviour based upon one's attitude (Carley, 2014). As attitudes change, some claim that a change in behaviour then follows, making behaviour inconsistent from one situation to the next as the influence of the environment changes. For instance, one way that

attitude can shift from one situation to another is through persuasion, the deliberate attempt to change an attitude (Carley, 2014).

For this study, I define attitude as a learned and summary evaluation that influences thoughts and actions. I maintain that attitude is a very complex construct with cognitive (knowledge), affective (feeling) and behavioural components (Balram, & Dragicevic, 2005). Specifically, some have studied tolerance towards wildlife due to respondent's experience with and residential location in relation to wildlife. Past scales used to investigate attitude towards wildlife include, but are not limited to, the Dispositional Empathy with Nature Scale (DENS; Tam, 2013a) and the Nature Relatedness Scale (NR; Nisbit & Zelenski, 2013). Each scale relies on a unique insight about the human "connection" with wildlife. Such a connection to wildlife has been defined by some as *eco-connection* and others as *human-nature interaction* (Lomas, 2019; Soga & Gaston, 2020). Both terms have given similar dimensionality to the main term using differing lexis (Lomas, 2019; Soga & Gaston, 2020).

*Eco-connection* refers to three dimensions of a human's bond with nature, namely sacrality, bonding, and appreciation (Lomas, 2019). Sacrality refers to the phenomena of regarding nature as "other" and non-ordinary. In this way, nature becomes something that is set apart from oneself and thus unknown or forbidden. Bonding refers to the ways in which people connect with nature physically, experientially, cognitively, emotionally, philosophically, and spiritually with a focus on the manner and quality of the nature-human relationship. Appreciation refers to people actively engaging with and enjoying nature. This act of spending quality time in nature and attending to the details of the natural world diffuses through the previous two dimensions but can also remain distinct from them. Lomas (2019) discusses the need to study eco-connection to find new ways to conceptualize, articulate, rationalize, and discuss the nature-

human relationship. Such efforts can enlarge *wellbeing literacy*, which can be defined as "the vocabulary, knowledge and skills that may be intentionally used to maintain or improve the wellbeing of oneself or others" (Lomas, 2019). With the aforementioned urbanization of humans, wellbeing and wellbeing literacy in cities have been examined by many researchers (Larson et al., 2016b; Negami et al., 2018), and have been tied to park quality in urban centres (Larson et al., 2016b).

*Human-nature interactions* occur when a person is present in the same physical space as nature or directly perceives a stimulus from nature (Larson et al., 2016b; Soga & Gaston, 2020). As Soga and Gaston (2020) explain, this definition spans across five dimensions, namely, immediateness, consciousness, intentionality, degree of human mediation, and direction of outcomes. Immediateness is the degree of physical proximity between a person and nature. More immediate interactions occur when a person is physically present in nature (*e.g.*, walking in a park), whereas less immediate interactions do not require the person to be physically present (*e.g.*, having a view of nature through a window due to residential proximity). Consciousness is the extent to which a person is aware that an interaction with nature is occurring (*i.e.*, to what extent is one actively noticing and looking at the nature that surrounds them). Intentionality is the extent to which a person deliberately engages in a nature interaction (*e.g.*, visiting an urban greenspace or park). Degree of human mediation involves places or interactions that have been modified by anthropogenic activities. Less human-mediated interaction might include observing wildlife from a distance; more human-mediated interaction would include observing and identifying birds at a city park. Direction of outcomes can be considered from the human perspective and from the nature perspective. From the human perspective, positive outcomes would lead to health benefits and increased enjoyment of wildlife despite problem wildlife

encounters. I will return to these dimensions later in this thesis and incorporate them into my methods.

Urban wildlife coexistence could be categorized under either eco-connection (as both bonding and appreciation) or human-nature interactions (spanning all five dimensions). Some scales, like the DENS, focus on the feelings that an individual may have attached with nature and how representative those experiences are of oneself (Tam, 2013a; Nisbit & Zelenski, 2013). Other scales, like the NR6 and the Love and Care for Nature Scale, focus on one's feelings and the associated actions one may take to involve oneself with nature. In addition, there are scales that have studied individual tolerance to problem encounters with wildlife. Of these, some have involved problems as small as noise disturbances to as large as destruction of one's property (Charles & Linklater, 2015; Sifuna, 2010). Although these scales have been used extensively to understand some aspects of eco-connectivity, they have not covered Soga and Gaston (2020)'s five dimensions of human-nature interactions.

To avoid any confusion of terminology used regarding to the human dimensions of wildlife research, I refer to the specific area that I studied as *urban wildlife coexistence.* I define urban wildlife coexistence as the degree to which one actively engages with and is tolerant towards urban wildlife.

### 1.1 Expanding the Five Dimensions

Individual opportunity to interact with wildlife and visit urban greenspaces and parks can be the result of individual socioeconomic situations. Individuals living closer to parks may visit the parks more often, thus increasing their exposure to urban wildlife and habitat. These interactions may provide better mental health states and other benefits (Ribeiro et al., 2021). Conversely, individuals living further from greenspaces and parks may have poorer health

outcomes. Negami et al. (2018) found that city densification is linked to social isolation and poorer physical and mental health. Negami et al. (2018) also found that spaces with greenery and colourful, community-driven urban interventions were associated with higher levels of happiness, trust, and attraction to the sites. The author's participants, however, were largely visitors to the urban neighbourhood, not residents of the city. Negami et al. (2018) acknowledge this as a limitation and stated that their research did not speak to constant exposure to the areas.

Soga and Gaston (2020) note that when visiting urban greenspace, several differing human-nature interactions—such as viewing wildflowers, listening to bird song, being hassled by geese for food and actively feeding squirrels—can occur. I will explore some of these interactions by asking participants which animals they prefer in their neighbourhood and why. By doing so, I aimed to investigate the level of consciousness and intentionality individuals hold towards urban wildlife.

In addressing the spatial dynamics, researchers can speak to the three drivers (1) opportunity- availability, ease of access (*e.g.,* how often residents attend parks, or how willing residents are to walk to a greenspace); (2) distribution and behaviour of people (*e.g.,* where residents live), and (3) orientation with nature (*e.g.,* demographical questions to serve as a broad proxy for culture). I will be focusing on each one of these spatial dynamics to varying degrees throughout the thesis.

### 1.2 The Path Forward

I started by gathering questions from two previous surveys and created more questions to gain a greater understanding of resident tolerance and attitude towards urban wildlife. These questions were both quantitative and qualitative. The qualitative questions were added to expand the perceptions and preferences that residents had towards urban wildlife. I called the scale that I

assembled the Urban Wildlife Coexistence and Attitudes Scale (UWCAS). To validate the UWCAS, I started with a sample of university students and I looked at the simple structure of the data along with running a Kaiser-Meyer-Olkin (KMO) values and Bartlett's Test of Sphericity to produce a test for normality (*i.e.,* a normally distributed dataset). KMO values indicate whether a survey is a good fit to complete a factor analysis. According to Bandalos (2018) researchers should consider values of 0.80 meritorious whereas values of 0.70 should be treated as middling. I generated scree plots to indicate the number of eigenvalues. Any value greater than one on the eigen scale was considered a factor worth investigating. Following the scree plot procedure, I ran an exploratory factor analysis based on that scree plot output. Then I reviewed the simple structure of the analysis and reviewed questions that may have less-than-desirable loadings (<0.4). Loadings (or coefficients) represent the amount of variance in the variable that is explained by the factor (Bandalos, 2018). When variables load onto more than one factor, the variable loadings are referred to as cross-loading and further investigation was needed to understand to what extent the variable loads onto the primary (largest coefficient value) and secondary loadings (smaller coefficient values) (Bandalos, 2018).

By using factor analysis and the aforementioned methodology I validated a revised version of the DENS and called it Dispositional Empathy with Nature revised (DENSr) (Tam, 2013a). The original version of this scale contains items that focused on animate entities, and it was suggested to extend the DENS to inanimate entities (Tam, 2013a). According to Tam (2013a), empathy is regarded as a key component when trying to implement and understand conservation efforts. Empathy has both a cognitive and affective component, with the former as perspective-taking and the latter as sharing the emotional responses of another (Hogan, 1969; Batson, 1991). To this end, I will be extending that research and create a scale that is focused on

inanimate entities. I will also include the original DENS scale in my research for convergent validity. Convergent validity is present when all indicator items on a scale receive loadings that are higher than a minimum threshold (0.4) and are statistically significant ($p<0.05$) (Adam, 2021).

I used a mixed-methods approach to analyze the distribution of survey data. First, I ran a pilot study with students attending the University of Lethbridge and Albertan users of Facebook (n=330) to examine the effectiveness of frequency anchors vs agreement anchors for these types of scales. An example of a question using frequency anchors when measuring problem encounters with wildlife was measured with a question like "How often are your daily activities restricted by the presence of wildlife?". Similarly, tolerance is measured using a question like "How often are you annoyed by the animals on the road?". An example of a question using agreement anchors when measuring problem encounters with wildlife was measured with a question like "Wildlife in the city just cause problems". Tolerance is measured using a question like "I get frustrated with the wildlife in my backyard" (negatively scored). Brown (2004) explored the difference between frequency and agreement measures and found that that the correlation between the two constructs was weak. Brown's (2004) finding highlights that if the only thing that is changed on the scale is the anchor, then the scales are measuring quite different constructs and then the researchers are left to question what construct each tool is measuring. Brown (2004) argued that one's frequency of doing an activity is quite different from one's agreement with the activity or idea. I will explore if this notion is consistent when it comes to wildlife tolerance and connectivity. By comparing the UWCAS to other scales with similar characteristics via a multiple regression (*i.e.*, items that deal with how people feel about wildlife in the city as well as how they interact with wildlife), I was able to validate the scale for

discriminant validity (Bandalos, 2018). I have explored what items factor favourably to create a smaller scale for use with the general public. I also disseminated the survey using Facebook which increased the variance of loadings on the survey items.

Second, I took the revised agreement scale (Version 2) and gathered attitudes towards urban wildlife in the City of Lethbridge. I also evaluated efficacy of recruitment methods over a two-week period. Recruitment methods are the ways that researchers seek for and invite individuals to take part in their research. The two recruitment methods I used will be explained in further detail later (Chapter 4).

Third, I examined the efficacy of the recruitment method found in Chapter 4 as well as completed a cross-city comparison of attitudes and behaviours towards wildlife as captured by responses to the UWCAS Chapter 5).

The purpose of this thesis was four-fold:

1) To create a tool to describe the attitudes, perceptions, and behaviours of people have towards urban wildlife (Chapters 3 and 4);
2) To further refine psychometric properties of agreement and frequency response formats and related survey methodology (Chapters 3 and 5);
3) To test a tool for measuring tolerance and encounters between urban residents and local wildlife while making comparisons to types of location data (Chapter 5); and,
4) To determine if attitudes are shaped by cultural determinants such as age, race, city of residence, and education (Chapter 5)

## Chapter 2: Narrowing the Scope

### 2.1 Research Questions

1. What are people's attitudes towards coexisting with wildlife in an urban environment?
2. What are the main wildlife species that residents think live in their neighborhoods?
3. How do residents normally rank urban spaces in terms of where animals and plants should be allowed to live?

### 2.2 Background Literature

Upon examination of people's perceptions and attitudes of wildlife in their neighborhoods, Shumway et al. (2014) found that a spatial element was correlated with preferences for species and spaces of coexistence. Specifically, Shumway et al. (2014) found that attitudes toward koala conservation differed depending upon the urban density where the participants lived. Those who lived in suburban areas were less likely to have a positive attitude toward koala conservation and less likely to act for its betterment. Soga and Gaston (2020) would interpret this spatial component under the category of immediateness of an interaction. That is, the closer one lived in relation to an intact habitat and the species that naturally live there (*i.e.,* the less urban the area you live in), the more favourable the attitudes towards that species. Hariohay et al. (2018) highlighted the importance of understanding local attitudes as key to the future of wildlife conservation. In contrast to Shumway et al. (2014), Hariohay et al. (2018) found that the closer one lived to a protected area (PA) the more negative the attitude one held towards wildlife in the area. The negative attitude was due to the damage or threat that residents have from the wildlife towards their crops or livestock. What is to be predicted from these contrasting results? If people wish to build urbanscapes that promote conservation, then they

must also build them with the intent to enable positive interactions between human and non-human actors. Miller and Hobbs (2002) stressed the importance of conservation measures in the everyday lives of people so that biodiversity is communicated in a manner that will be positive and well received.

Rupprecht (2017) noted that our "urban selves" (in other words, people who live in urban environments) have "nature needs" and that there must be opportunities for urban residents to interact with their natural environment. Awareness and attitudes towards wildlife play a role in shaping human behaviour, but to what extent? Moreover, exchanges with nature can be altered when awareness is shaped by positive interactions (Hariohay et al., 2018; Mir et al., 2015). Similarly, negative attitudes due to destruction of property by wildlife can exacerbate human behaviour, sometimes leading toward the destruction of natural resources (Hariohay et al., 2018; Larson et al., 2016a; Sifuna, 2010). In urban and rural settings, Eriksson et al. (2015) found that direct encounters with wildlife in different places is correlated with an acceptance of those wildlife. Eriksson et al. (2015) argued that differences in municipalities, socio-demographics, wildlife experiences and psychological processes all place dimensions on the attitudes and acceptance people have towards geese. I explore these differences in demographics and location throughout Chapters 3 through 5. Since proximity and overall exposure to wildlife are important for acceptance, urban planners must be cautious when building parks and greenspaces as to avoid negative or problematic encounters. In trying to understand the best way to build modern urbanscapes that accommodate the movements of wildlife in cities while simultaneously accommodating human needs, one must first gain an understanding of the local attitudes towards wildlife.

## 2.3 Study Site

Lethbridge, Alberta, Canada formerly a "notorious whisky-trading post" (Fort Whoop-up) and a coal mining town, was incorporated as a town in 1890 and as a city in 1906 (MacLachlan, 2019). Until 1968, the city resided on the east side of the Oldman River and was divided by the Canadian Pacific Railway (CPR), with the north side of the rail containing the working-class district and the south side of the rail containing the middle-class merchants and professionals (MacLachlan, 2019). Since that time, the city has grown to span both sides of the Oldman River with a series of parks that run along the river valley. The population of Lethbridge is 101,799 and according to the City of Lethbridge website, there are 130 city parks within the city limits, which allow for a potentially wide range of human-wildlife interactions (Figure 2.1).

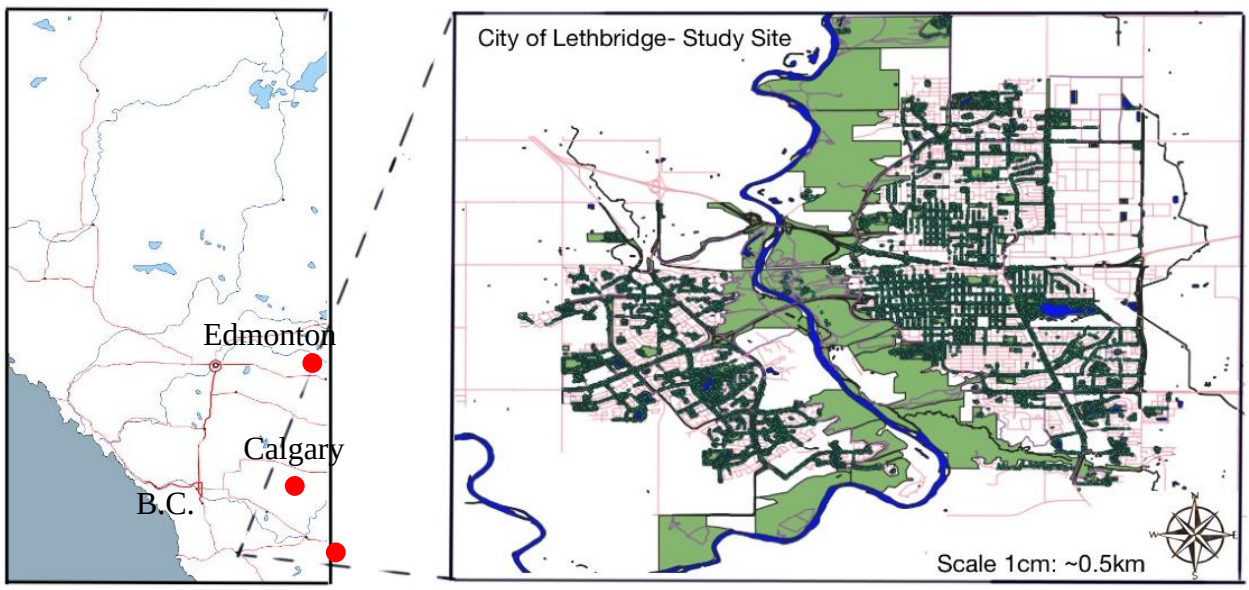


*Figure 2.1 Location of Study Site.* Light green polygons represent the coulees, and the dark green polygons represent the canopy cover.

The School of Environmental Sciences (SES) at Lethbridge College found that Lethbridge is among the top three cities in Canada for wildlife movement through a city. Movement of wildlife is defined by the locations and habitats that wildlife travel within and through. These locations have been measured by sightings of animals in the areas and reported

by citizens as well as researchers. SES is investigating wildlife habitat connectivity via corridors in the city and hopes to better inform policies pertaining to habitat connectivity. Corridors include purposed greenspaces, public parks, habitat islands, boulevards, and open lawns. I am, therefore, working with SES and the City of Lethbridge to improve infrastructure and ecosystem management in the city. Our research is important because city living provides many opportunities for human-wildlife interaction, and negative human attitudes towards wildlife can often lead to the destruction of the natural environment (Larson et al., 2016a; Rupprecht, 2017).

In an effort to balance the needs of the people with those of wildlife, I created the UWCAS as a tool to study human perceptions and help sustain and perhaps improve biodiversity. I aim to share these data with the city to better inform management of human-wildlife spaces to facilitate positive interactions for all participants.

Specifically, I built the survey to act as a tool to study the attitudes of Lethbridge residents towards wildlife (Sifuna, 2010). The first study (Chapter 3) focused on developing a valid scale for measuring attitudes towards wildlife in this community. I compared the validity and strength of using frequentist anchors and agreement anchors. I then took the more psychometrically sound instrument and applied it to our research population in the various cities.

# Chapter 3: UWCAS Pilot Study

## 3.1 Introduction

For measurement tools (*i.e.*, surveys), items or questions are written with different styles of anchors. Anchors are the words used to phrase the response sets. Anchors can affect the way that people respond to questions that may otherwise be viewed as being similar (e.g., "I find it easy to stick to a study schedule" vs "I stick to a study schedule"). Brown (2004) explored the difference between frequency anchors (e.g., *never* to *always*) and agreement anchors (e.g., *strongly agree* to *strongly disagree*). Brown (2004) found that after running a chance-adjusted kappa (a measurement of agreement beyond chance) the average correlation was weak ($r$= 0.25)"; thus, the scales were measuring quite different constructs even though the questions were otherwise identical (Byrt et al., 1993). Conversely, his exploratory factor analysis (maximum likelihood estimation with oblimin rotation) indicated that each item loaded with its partner item on the same factor with similar loadings. Brown (2004) argued that one's frequency of an activity is quite different from one's agreement with the activity or idea. He went as far as to say that frequency anchors can be more problematic than agreement anchors when using self-report inventories for a multiplicity of reasons, but mainly because of memory effects.

Brown (2004) then recounted Schacter's (1999) report of the seven sins of memory: transience (forgetting things over time); absent-mindedness (inattention); blocking (sometimes not remembering); misattribution (association of somethings in our memory with the wrong thing); suggestibility (memory can be changed by outside influences); bias (memory is subject to unconscious influences connected to present beliefs); persistence (sometimes one cannot forget memories that one would like to forget). In addition to Schacter's seven sins of memory,

Baddeley et al. (2015) discussed the tendency for one to recall positive memories more than neutral or unpleasant memories and called it a *positivity bias*. While exploring human attitudes towards wildlife, I predicted that I would find a negatively skewed data set, meaning that people's attitudes would be more in favor of wildlife than against. Finding a positivity bias result would be consistent with other studies conducted attitudes towards wildlife in the city (Shumway et al., 2014). One's beliefs, however, are not always followed by supporting actions (Shumway et al., 2014). One may agree that wildlife conservation is something societies should make sacrifices for, yet not actively engage with wildlife by attending parks, providing bird feeders, naming wildlife, recycling or organize their rubbish (a sacrifice of time).

I predicted that positive memories would be more exaggerated than negative memories (Baddeley et al., 2015). The skewed perception of the participants would then present as an increased tolerance for those problem species and potentially an overall increased tolerance for wildlife in the city. Contrary to this hypothesis, Sifuna (2010) and Krimowa (2012) found that if individuals had experienced damage from wildlife then they would not only have a decreased tolerance for the wildlife, but also an increase in negative passions towards wildlife, ultimately leading to retaliatory attacks or culling methods (such as poisoning) against wildlife.

To understand these two contradictory explanations, I used a frequency measure to investigate how often participants recall the frustrations and problems they have with wildlife and compare it to their level of tolerance they have for the wildlife. Problem encounters were measured by questions like, "How often are your daily activities restricted by the presence of wildlife?" Tolerance was measured using questions like, "How often are you annoyed by the animals on the road?"

Along with the investigation of frequency measures, I created a separate tool trying to measure the same construct using agreement measures. My aim is to add to the literature that discusses agreement anchors being superior to frequency anchors when trying to understand attitudinal data (Brown, 2004).

I also revised a scale that elucidates the dispositional empathy participants have for nature. The original scale contains items that are living things (Tam, 2013b). My scale will contain only items that are non-living. This revised scale, along with the original, will be used to check construct validity on both scales I created as well as other established scales. I predict that:

1. If each of the scales measured fall onto a single factor it is because they are all measuring a single latent construct and have items that are consistent for that measurement.
2. If the UWCAS fall onto one factor, then the items point to the overall construct of tolerant coexistence with wildlife because the highest loadings will point to questions dealing with tolerance
3. If the DENS and DENSr factor onto the same construct they will also be positively correlated because they are measuring the same latent factor of having dispositional empathy with non-human entities.
4. If the agreement measures have better psychometric qualities (including central tendency, standard deviations, factor loadings, and internal consistency) than frequency measures when trying to understand the latent construct on Urban Coexistence and Attitudes it is because of errors that come with using frequency anchors.
5. If the DENSr positively correlates with UWCAS then those with the disposition to relate to nature will also be more willing to coexist with nature

6. If proximity to a park is positively correlate with responses to UWCAS and mediated by positive interactions, then those who live closer to greenspaces have more positive interactions with wildlife than those who live further away.

To test these predictions, I examined the distribution of the resulting factors using exploratory factor analysis.

**3.2 Methods**

I created two surveys for university students to use. Frequency (Version 1) vs Agreement (Version 2) and opened the survey to general Albertan Facebook users to use (Version 2.1; see Appendix A). University students were given one credit towards their final grade for participation in the survey. Participants were recruited from across Alberta with the use of Facebook. For the survey distributed across Alberta via Facebook, the previous Version 2 was used as well as a scale on support for provincial parks. Data collection occurred between March 2020-May 2020, with the results analyzed over the summer and early fall.

After combining the answers for Version 2 from the university students and the residents of Alberta, I conducted exploratory factor analysis (EFA) of all scales to determine if they produce one-factor outcomes using the psych, Quantpsych, dplyr, and REdaS packages in R (Version 1.1.456). Kaiser-Meyer-Olkin (KMO) values and Bartlett's Test of Sphericity were used to confirm that scree plots and factor analysis would be valuable to produce for each scale. KMO measure of factor adequacy indicates the proportion of variance in variables that might be caused by underlying factors. KMO values indicate whether a survey is a good fit to complete a factor analysis. Values that are 0.80s are meritorious and 0.70s middling.

The results of exploratory factor analysis of each of the surveys were compared using oblique rotation. The purpose of rotation is to make the factor solution more interpretable

(Bandalos, 2018). Bandalos (2018) explains that rotation can be accomplished in a couple of ways by stating:

> One *method** is to minimize the number of factors on which a variable loads. This is known as variable complexity. Another is to minimize the number of variables loading on each factor, known as minimizing factor complexity. (p.330)

There are two main types of rotation: orthogonal and oblique. Oblique rotations do not force factors to be correlated but allow for correlations to exist. If the factors are not related, then the resulting correlations are zero and would be identical to an orthogonal rotation. Orthogonal rotation does not allow for factors to be correlated (Bandalos, 2018).

Due to the exploration that each factor may have loadings on either or all factors, analysis was done under the framework of an exploratory factor analysis (EFA) using oblique rotation. Having developed some theoretical backing for my measurement tool but wanting to make sure that the most valid tool was available for subsequent phases of the project. The EFA analysis was conducted with an oblique rotation. I ran the model in three trials, each of varying factors dependent upon the scree plot output, for each of the measurement tools. I ran two-factor, three-factor and four-factor models for Version 1 and ran single-factor, two-factor, and three-factor models for Version 2. I investigated the weighted item loadings, removing of items that loaded lower than a 0.4 or poor communality (greater than 1.2). In Version 1, I removed questions 10, 11, 12-4, 12-5, 12-6, and 24; in Version 2, 13, 23, 24, 26, and 27. The general number of possible factors was evident by using eigenvalues in a scree plot.

A multiple regression on the measurement tools was used to examine the degree of correlation that existed between the different tools allowing me to see the distinctness of each tool and see if one tool was predictive of another. Specifically, I wanted to observe if the residential proximity to a park showed a significant effect on how people answered the questions

on the measurement tools. If types of encounters with wildlife were reflected by how close one lived to a park, these items would be correlated with higher scores on measures of tolerance towards wildlife, nature relatedness, and dispositional empathy with nature; however, this would be contrary to the previous research that indicates that having problems with wildlife will decrease one's tolerance towards thereof (Sifuna, 2010). Also, previous research has found that education affects one's tolerance toward wildlife (Campbell-Arvai, 2019; Rupprecht, 2019). Thus, I investigated the demographic correlations on the UWCAS via regression analysis ($\alpha$ <0.05).

**Ethics.** Ethics approval was achieved on February 12, 2020 by both the University of Lethbridge Ethics Board (HPRC Protocol: 2020-014) and the Lethbridge College Research Ethics Board (LC-20-23).

**Measures.** (See the Urban Wildlife Coexistence and Attitudes Scale [UWCAS] in Appendix A.) Version 1 of the UWCAS used frequency anchors and contained 36 questions regarding how often one would interact with, think about, or have problems with wildlife (*e.g.*, "How often are you annoyed by animals on the road?"). These questions were analyzed individually via exploratory factor analysis and collectively as an average score across the items. Version 2 used agreement anchors and contained 39 questions with the instructions "Please answer on how much you either agree or disagree with each statement." Agreement was measured on a 5-point Likert Scale from Strongly Disagree to Strongly Agree with a neutral option (*e.g.*, "I get frustrated with the wildlife on the roads"). These questions were also analyzed individually via exploratory factor analysis and collectively as an average score across the items. To avoid response bias, the agreement scale (Version 2) items 11, 13, 14, 15, 17, 18, 19, 21, 22, and 25 were either reverse worded or reverse coded or both. For the frequency scale (Version 1)

items 9, 11, 12_3, 12_5, 12_6, 14, 15, 16, 17, 18, 20, 21, 22, and 25 were either reverse worded or reverse coded or both.

Both versions of the survey contained a measure on the Dispositional Empathy with Nature revised (DENSr). DENSr is like the DENS but focuses on the dispositional tendency to understand and share the perceived emotional experience of the *inanimate* natural world.

Furthermore, the Dispositional Empathy with Nature (DENS) "refers to the dispositional tendency to understand and share the emotional experience of the natural world" (Tam, 2013a). Finally, I used a scale on Nature Relatedness-Short form that measures how one relates with and desires to be in the natural world. Those participants who received the survey via Facebook used a tool that had 50 questions which included the UWCAS Scale 2, DENSr, and DENS.

**Participants and Sample Size.** To manage the surveys having equal number of participants, I needed to halt the reception of answers in one survey (Version 1) to allow the other (Version 2) time to catch up in the number of participants. Of the two versions distributed to university students, Version 1 (n=181) had more respondents than Version 2 (n=150). There were even fewer (n=100) responses from those recruited through Facebook (Version 2). I excluded surveys that were less than 90% complete, as making comparisons with surveys that were not nearly complete would introduce challenges for data analysis. After the exclusion criteria were met and response sets with missing data were removed, Version 1 had 152 responses and Version 2 had 168 responses.

To complete a multiple regression on the data, I first took the average (mean) of the scores across the items per individual. I then needed to standardize the scores so that they could be compared. The data was treated as continuous and thus could fall under the assumptions necessary for multiple linear regression. Then I found the total mean score for each one of the

surveys collected. These total mean scores were then correlated through multiple regression analysis and evaluated to what degree and significance they correlated with each other.

**Definitions.** Encounters were operationally defined as any interactions with plants and animals. Wildlife was defined as any non-domesticated animal that is found in the city and will included any plant life or greenspace that exists in the city outside of a resident's home (*e.g.*, a tree in someone's backyard).

The underlying latent construct for UWCAS was one's willingness to coexist with urban wildlife. UWCAS will be operationally defined as the cumulative experience that one has towards coexisting with wildlife. Each scale is broken into overall frustration and problem experiences with wildlife, overall happiness and enjoyment towards wildlife, and tolerance towards wildlife.

## 3.3 Results

**Descriptive Statistics.** Demographics are shown in Table 3.1 and sample distribution around the city in Figure 3.1.

Table 3.1
*Demographics of the Pilot Study (N = 320)*

| ***Question*** | ***Choice*** | ***Number*** | ***(%)*** |
|---|---|---|---|
| *AGE* | | | |
| | 18 - 24 | 259 | 80 |
| | 25 - 44 | 33 | 10 |
| | 45 - 74 | 26 | 8 |
| | 75+ | 1 | 0.003 |
| *EDUCATION* | | | |
| | Less than a secondary school diploma | 1 | 0.3 |
| | Secondary school diploma | 144 | 45 |
| | Some college but no degree | 120 | 38 |
| | Bachelors | 29 | 9.1 |
| | Associate | 19 | 6 |
| | Masters or higher | 7 | 2 |
| *INCOME* | | | |

| | | |
|---|---|---|
| <30,000 | 152 (48) | 48 |
| 30,000-60,000 | 47(15) | 15 |
| 60,000-90,000 | 53(17) | 17 |
| 90,000-150,000 | 38(12) | 12 |
| 150,000+ | 30 (9) | 9 |

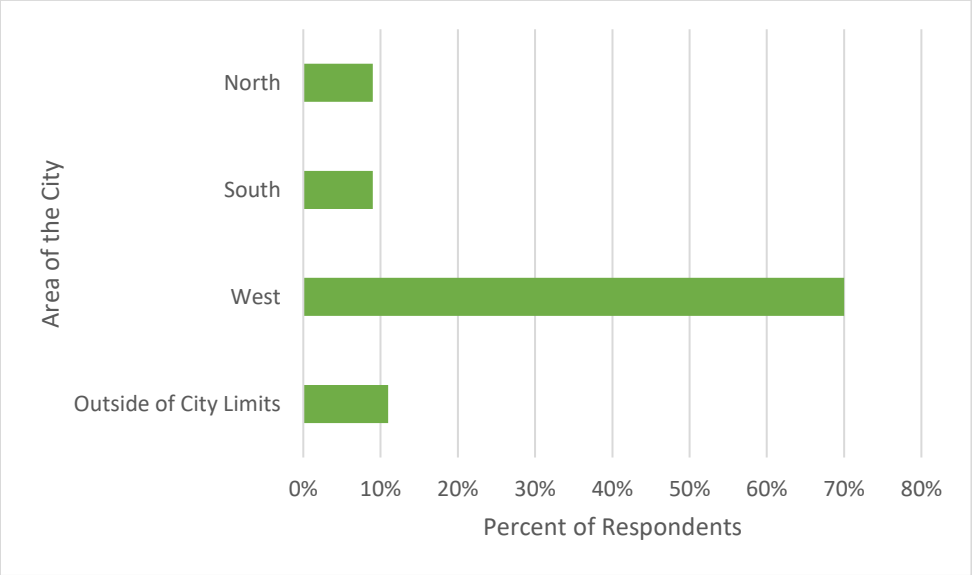


*Figure 3.1. Self-report residential occupancy of participants*: 70% (n=227) were from the west side of Lethbridge, followed by 11% (n=35) living outside of town, 9% (n=29) living on the north side, and 9% (n=29) living on the south side (N=320)

## Predictions and Results.

Table 3.2
*Summary of Predictions and Results*

| ***Predictions*** | ***Result*** |
|---|---|
| 1. *If each of the scales measured fall onto a single factor it is because they are all measuring a single latent construct and have items that are consistent for that measurement.* | Single factors were observed for the NR6, DENS and DENSr scales. Two factor models were found for both the UWCAS Version 1 and Version 2. (Figures 3.7 and 3.8) |
| 2. *If the UWCAS fall onto one factor, then the items point to the overall construct of tolerant coexistence with wildlife because the highest* | The UWCAS Version 1 items fell onto two factors pointing two a constructs of happiness from wildlife and problems with wildlife. (Figure 3.4)<br><br>The UWCAS Version 2 items fell onto two factors pointing two a constructs of coexistence with wildlife and proclivity to name wildlife (Figure 3.5) |

| | |
|---|---|
| *loadings will point to questions dealing with tolerance* | |
| 3. *If the DENS and DENSr factor onto the same construct they will also be positively correlated because they are measuring the same latent factor of having dispositional empathy with non-human entities.* | DENS and DENSr did not factor onto the same construct. (Figure 3.7). |
| 4. *If the agreement measures have better psychometric qualities (including central tendency, standard deviations, factor loadings, and internal consistency) than frequency measures when trying to understand the latent construct on Urban Coexistence and Attitudes it is because of errors that come with using frequency anchors.* | Psychometric qualities for both measurement tools were similar with Agreement measures (Version 2) had having slightly higher means, and a higher alpha than frequency anchors (Table 3.3; $\alpha$= 0.88 and $\alpha$=0.7, respectively). Both tools had two factor models best represent the data (Figure 3.2-3.5). |
| 5. *If the DENSr positively correlates with UWCAS then those with the disposition to relate to nature will also be more willing to coexist with nature* | The DENSr is not positively correlated with the UWCAS (Table 3.6-3.7). |
| 6. *If proximity to a park is positively correlate with responses to UWCAS and mediated by positive interactions, then those who live closer to greenspaces have more positive interactions with wildlife than those who live further away.* | Residential proximity is not correlated with responses to the UWCAS (Table 3.6-3.7). |

*Interitem **c**orrelations.* Upon investigating the interitem correlations I found that many of the items were correlated between 0.0 and 0.75 for the Frequency scale (Version 1) and between 0.0 and 0.64 for the Agreement scale (Version 2).

*Exploratory **f**actor **a**nalyses.* Results for the exploratory factor analysis commenced by obtaining the Kaiser-Meyer-Olkin (KMO) values and Cronbach's Alpha (Table 3.3). The Version 1- Frequency Anchors- scree plot indicated three factors with eigenvalues greater than 1 (Figure 3.2). Version 2 scree plot show that items fall onto two factors. (Figure 3.3).

Table 3.3
*KMO Values for Measurement Tools*

| ***Test Version*** | ***MSA value for KMO test*** | ***Cronbach's Alpha*** |
|---|---|---|
| *Version 1* | 0.76 | 0.7 |
| *Version 2* | 0.85 | 0.88 |

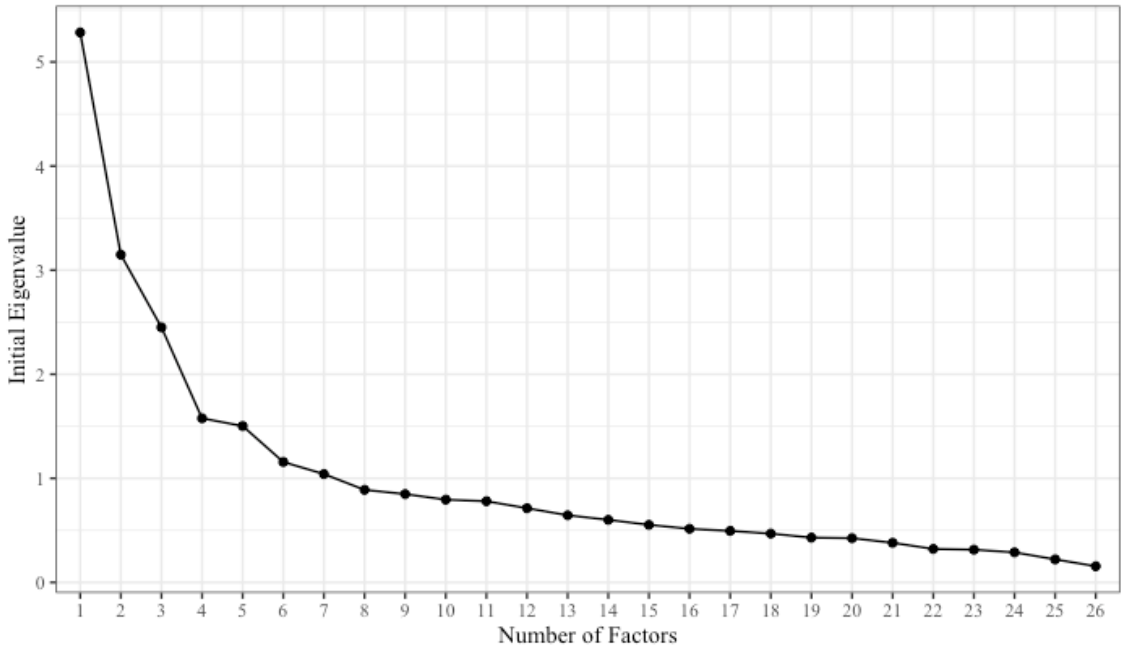


*Figure 3.2 Scree plot for Version 1- Frequency Anchors* based on the unreduced correlation matrix. The number of eigenvalues that exceed one were considered as potential factors. There are six potential factors.

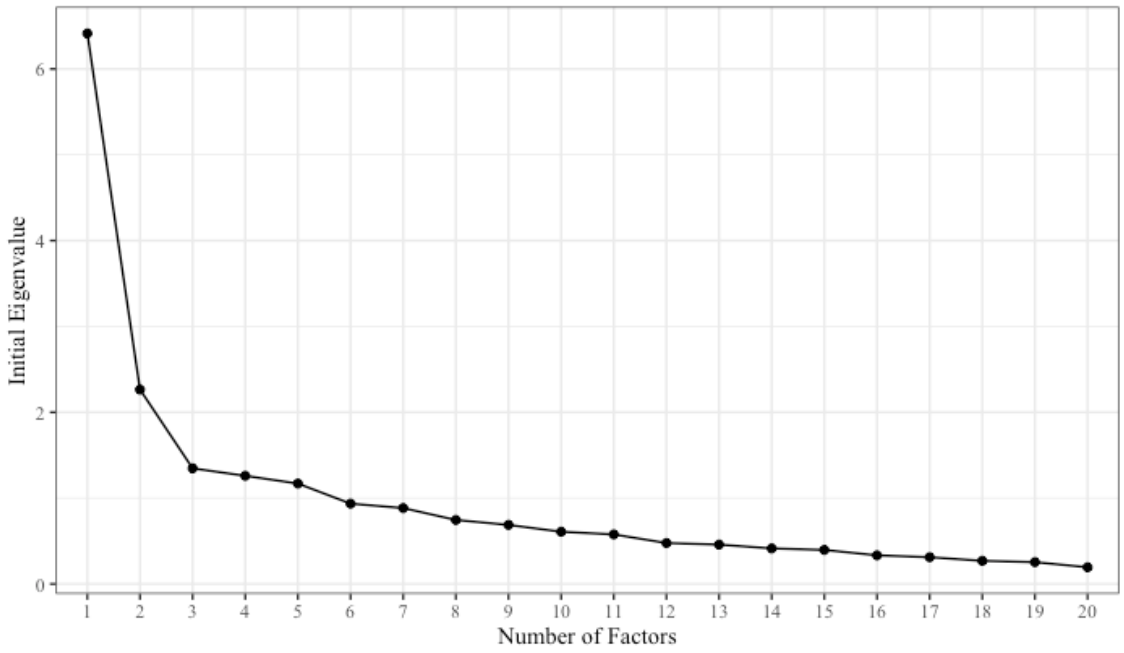


*Figure 3.3 Scree plot for Version 2--Agreement Anchors* based on the unreduced correlation matrix. The number of eigenvalues that exceed one were considered potential factors. There are five potential factors.

Item loadings were examined through the scree plot evaluation and factor analysis where Version 1 items from the scree plot had two factors with eigenvalues that were greater than one. I then ran a two-factor model and found two strong factors that did not correlated with each other (Figures 3.4 and 3.5).

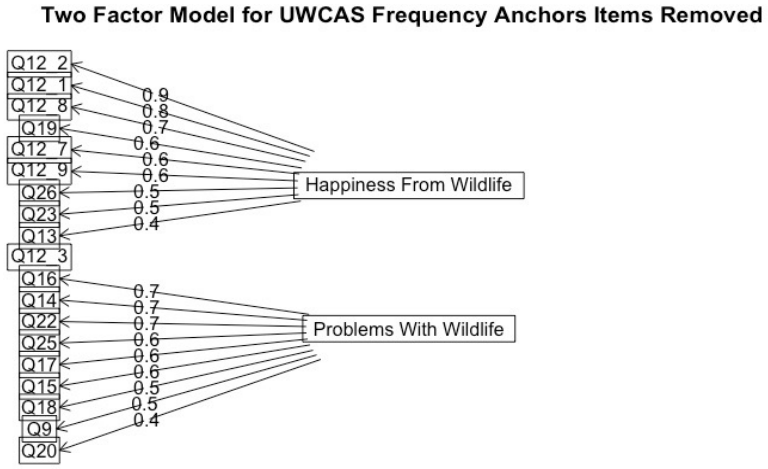


*Figure 3.4 Two Factor Model for UWCAS Frequency Anchors Items Removed*. Items with lower than 0.4 were removed and two factors emerged (n=152). A loading of 0.4 is small while a loading of 0.9 is strong. The underlying trait that describes the first set of loadings is best represented by Happiness derived from Wildlife while the second group has items discussing problems with wildlife. Arrow direction points from latent variable (or factor) to questions (or items) on the measurement tool

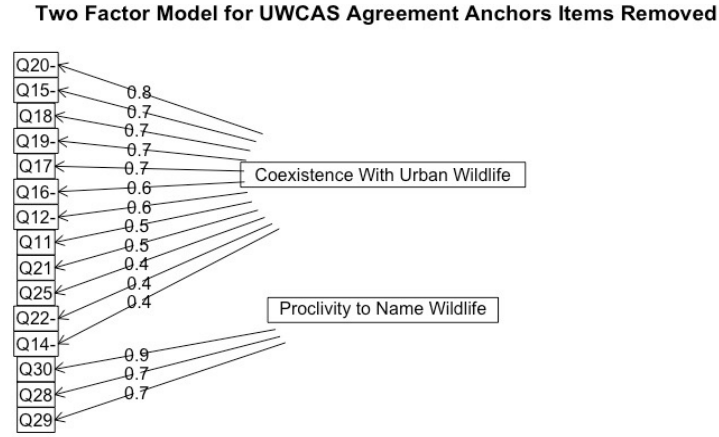


*Figure 3.5 Two Factor Model for UWCAS Agreement Anchors*. Items with lower than 0.4 were removed and two factors emerged (n=214). A loading of 0.4 is small while a loading of 0.9 is strong. The underlying trait that describes the first set of loadings is best represented by one's willingness to coexist with urban wildlife. The second group has items relating to one's proclivity to name wildlife. Arrow direction points from latent variable (or factor) to questions (or items) on the measurement tool

I combined both versions of the UWCAS to see if they would factor onto a single or multiple factors. The best fit was a four-factor model (Figure 3.6) with 33% of the factor items being explained by the UWCAS, 18% of the items being explained by the construct of Happiness

from Wildlife, 23% of the items being explained by the construct of Problems with Wildlife, and 16% of the items being explained by the construct of one's Proclivity to Name Wildlife (Table 3.4). Happiness from wildlife was negatively correlated with problems with wildlife (-0.27) and Coexistence with Urban Wildlife was positively correlated with Proclivity to Name Wildlife (0.24). After I conducted an EFA on DENS and DENSr to determine if they collectively fall onto one factor or if there is a two-factor outcome (one for animate entities and one for inanimate entities), the results are shown in Figure 3.7. A factor analysis was also completed on the NR6 (Figure 3.8).

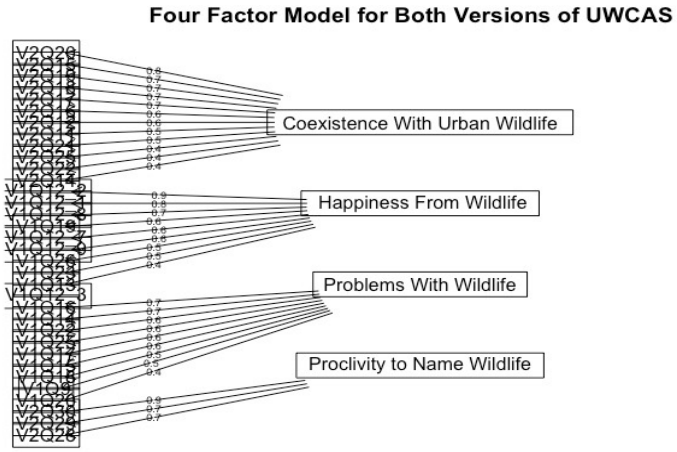


*Figure 3.6 Four-factor model when combining both versions of the UWCAS (n=214).* Item loadings range from small 0.4 to large 0.9 with four main factors being represented by the data. Arrow direction points from latent variable (or factor) to questions (or items) on the measurement tool

Table 3.4
*Factor Analysis using maximum likelihood with 4 factor model*

| | COEXISTENCE WITH URBAN WILDLIFE | HAPPINESS FROM WILDLIFE | PROBLEMS WITH WILDLIFE | PROCLIVITY TO NAME WILDLIFE |
|---|---|---|---|---|
| *SS LOADINGS* | 4.37 | 3.67 | 3.13 | 2.09 |
| *PROPORTION VAR* | 0.13 | 0.11 | 0.09 | 0.06 |
| *CUMULATIVE VAR* | 0.13 | 0.24 | 0.33 | 0.39 |
| *PROPORTION EXPLAINED* | 0.33 | 0.28 | 0.24 | 0.16 |
| *CUMULATIVE PROPORTION* | 0.33 | 0.61 | 0.84 | 1.00 |
| *CORRELATION OF (REGRESSION) SCORES WITH FACTORS* | 0.94 | 0.95 | 0.92 | 0.94 |

| | | | | |
|---|---|---|---|---|
| *MULTIPLE R SQUARE OF SCORES WITH FACTORS* | 0.89 | 0.90 | 0.85 | 0.88 |
| *MINIMUM CORRELATION OF POSSIBLE FACTOR SCORES* | 0.77 | 0.79 | 0.69 | 0.77 |

Note: Mean item complexity was 1.2. degrees of freedom for the model are 431with a RMSEA index of 0.069 CI [0.062, 0.076]

Table 3.5
*Between Factor Correlations with Version 1 and Version 2*

| | COEXISTENCE WITH URBAN WILDLIFE | HAPPINESS FROM WILDLIFE | PROBLEMS WITH WILDLIFE | PROCLIVITY TO NAME WILDLIFE |
|---|---|---|---|---|
| *COEXISTENCE WITH URBAN WILDLIFE* | 1.00 | - | - | - |
| *HAPPINESS FROM WILDLIFE* | -0.05 | 1.00 | - | - |
| *PROBLEMS WITH WILDLIFE* | 0.06 | -0.27 | 1.00 | - |
| *PROCLIVITY TO NAME WILDLIFE* | 0.24 | -0.04 | 0.00 | 1.00 |
| *COEXISTENCE WITH URBAN WILDLIFE* | 1.00 | -0.05 | 0.06 | 0.24 |

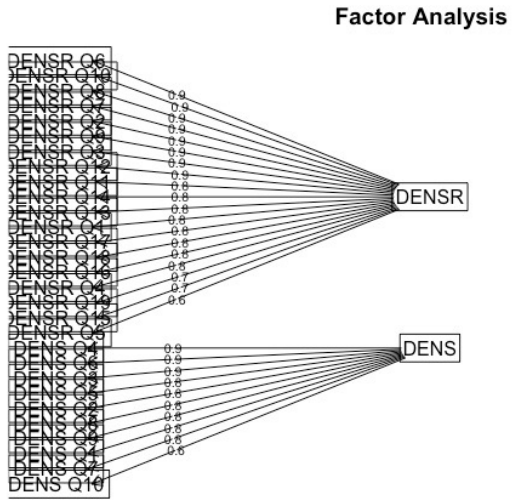


*Figure 3.7 Factor Analysis of the two measures DENS and DENSr* Item loadings greater than 0.4 are kept and are range from small (0.4) to large (0.9). Two strong non-correlated factors are represented. Arrow direction points from latent variable (or factor) to questions (or items) on the measurement tool (n=320).

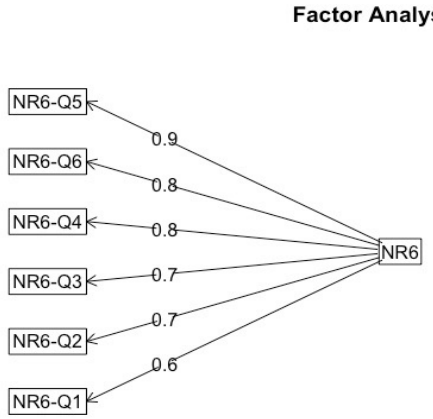


*Figure 3.8 Factor analysis of Nature Relatedness Short Form* Item loadings are represented by the latent factor of one's relatability to nature. Item loadings range from moderate (0.6) to strong (0.9). Arrow direction points from latent variable (or factor) to questions (or items) on the measurement tool (n=320).

***Multiple Linear Regression Analysis.*** For Version 1, using frequency anchors, the multiple linear regression tested if the means responses to DENS, DENSR, NR6, and Proximity to Park significantly predicted responses to the UWCAS. The fitted regression model was UWCAS Version 1 = 2.769 + (0.086*DECA) + (0.017*DENS) – (0.00495*DENSR2) – (0.072*NR6) + (0.005*Proximity). The overall regression model was statistically significant ($R^2$ = 0.12, F[4.013, 146], p<0.01). Although the model was statistically significant, none of the predictor variables contained strong correlations with the UWCAS. For example, the DENS did not significantly predict UWCAS (β = 0.017, p= 0.58). Similar results were found for all other predictor variables (Table 3.6).

Table 3.6
*Regression Output for UWCAS Version 1- Frequency Anchors (n=152)*

| | ***Estimate*** | ***Std. Error*** | ***t value*** | ***Pr(>\|t\|)*** |
|---|---|---|---|---|
| *Coefficients: (Intercept)* | 2.769 | 0.211 | 13.116 | < 2e-16 *** |
| *DECA* | 0.086 | 0.037 | 2.314 | 0.02* |
| *DENS* | 0.017 | 0.032 | 0.55 | 0.583 |
| *DENSR2* | -0.005 | 0.02 | -0.251 | 0.802 |
| *NR6* | -0.072 | 0.038 | -1.894 | 0.06 . |
| *Proximity* | 0.005 | 0.022 | 0.24 | 0.81 |

Note: Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

For Version 2, multiple linear regression was used to test if the DENS, DENSR, NR6 or Proximity to a park would significantly predict responses to the UWCAS. The fitted regression model was UWCAS Version 2= 3.483 + (0.088*DECA) – (0.145*DENS) + (0.239*DENSR2) + (0.057*NR6) – (0.008*Proximity). The overall regression was statistically significant ($R^2$ = 0.154, $F_{(5,162)}$ = 5.487 p <0.001). It was found that responses to the DENSR significantly predicted responses to the UWCAS (β = 0.13, p<0.001). All other predictor variables did not significantly predict responses to the UWCAS (Table 3.7).

Table 3.7
*Regression Output for UWCAS Version 2- Agreement Anchors* (n=152)

| | ***Estimate*** | ***Std. Error*** | ***t value*** | ***Pr(>\|t\|)*** |
|---|---|---|---|---|
| *Coefficients: (Intercept)* | 2.769 | 0.211 | 13.116 | < 2e-16 *** |
| *DECA* | 0.086 | 0.037 | 2.314 | 0.02* |
| *DENS* | 0.017 | 0.032 | 0.55 | 0.583 |
| *DENSR2* | -0.005 | 0.02 | -0.251 | 0.802 |
| *NR6* | -0.072 | 0.038 | -1.894 | 0.06 . |
| *Proximity* | 0.005 | 0.022 | 0.24 | 0.81 |

Note: Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1; 152 observations deleted due to missing data

## 3.4 Discussion

With a sample of 320 participants mostly from a demographically and geographically homogenous group (*i.e.,* Caucasian university students under 24 years old living on the west side of Lethbridge within one block of a park), analysis of the questions investigating causal effects between answers to the UWCAS, and those three demographic indicators, has shown no significant effect. The lack of effect is due to the lack of variance in any one of those indicators, and thus further studies are needed to gain a more demographically diverse sample.

**Interitem Correlations.** "In conducting non-cognitive scales, it is important that item content be homogenous in the sense that items measure the same construct" (Bandalos, 2018). Upon investigating the interitem correlations I found that most of the items were correlated

somewhat homogeneously. Those items that scored less than 0.2 with multiple variables were removed and a more homogenous scales was built.

**Exploratory Factor Analyses.** After combining the answers for Version 2 from the university students and the residents of Alberta, I conducted exploratory factor analysis (EFA) of all scales to determine if they produce one-factor outcomes using the psych, Quantpsych, dplyr, and REdaS packages in R (Version 1.1.456). KMO measure of factor adequacy indicates the proportion of variance in variables that might be caused by underlying factors. KMO values indicate whether a survey is a good fit to complete a factor analysis. Values that are 0.80s are meritorious and 0.70s middling. Due to the value being close to 1 and above 0.7, this indicates that factor analysis may be useful. Reliability analysis, which is also a measure of internal consistency, indicated that the items on Version 2 achieved acceptable reliability (Tavakol & Dennick, 2011) with a Cronbach's alpha of 0.88. However, reliability analysis of Version 1 did not achieve as strong of internal consistency with a Cronbach's alpha of 0.7. Some interpret an alpha of 0.7 as not achieving sufficient internal consistency (Tavakol & Dennick, 2011). Internal consistency is measure based on the correlations between the different items on the same scale but if this is not achieved then the items are not measuring the same general construct. As a result, Version 1 was not chosen to be used for subsequent data collection. The lack of internal consistency may have also been a result of too many constructs being represented by one measurement tool. With frequency measures, the questions regarding happiness and the questions regarding problems load onto two separate constructs. When comparing the models and investigating individual items, I weighted item loadings, removing of items that loaded lower than a 0.4 or poor communality (greater than 1.2). In Version 1, I removed questions 10, 11, 12-4, 12-5, 12-6, and 24; in Version 2, 13, 23, 24, 26, and 27. After problem items were

identified and removed the internal consistency increased to an acceptable level (Cronbach α = .825).

Due to exploratory nature of the project, item loadings were examined after performing multiple rounds of factor analysis testing different factor models and comparing those models with item content. It is standard practice to use the eigenvalues as a default when choosing factors. Solely relying on them without interpretation can be problematic (Bandalos, 2018). Problems can arise when items that produce a separate factor use similar wording or have a similar skew of responses. The skewness of an item indicates the degree to which the item's distribution deviates from symmetry and can create a "false" factor that can be misleading. To avoid being misled, I ran two-factor, three-factor and four-factor models for Version 1 and ran single-factor, two-factor, and three-factor models for Version 2. I then compared the results.

When investigating the results of factor analysis, the initial factor analysis of three of the measurement tools produced single-factor outputs for the DENS, DENSr, and NR6 using maximum likelihood (ML) estimation and oblique rotation. Oblique rotation allows for correlations between factors to be observed and is preferred when trying to investigate the number of factors that will be associated with a measurement tool in an exploratory manner (Baglin, 2014). ML estimation methods require the use of covariance, as well as the data to be continuous (or treated as such) and is common when using exploratory factor analysis (Lee et al., 2012). Exploratory factor analysis applications are scale invariant which means that one can analyze either the covariance or correlation matrix (Bandalos, 2018). Some argue these assumptions are violated with ordinal and categorical data because the analysis would result in underestimation of the relationship between the variables (Baglin, 2014; Bandalos, 2018). However, if the Likert-scale data has greater than five response categories these violations are

minimal (Bandalos, 2018). Further, it has been convention to use ML for weighting items even with ordinal data, as the underlying construct is assumed to be continuous even though the data is not (Lee et al., 2012).

By having the loadings of each item fall upon a single factor, I have demonstrated that the DENS, DENSr, and NR6 maintain construct validity (Bandalos, 2018). Using factor analysis to measure construct validity bases how the relationship of the test items mirrors those expected from theory via the internal structure of the measurement tool (Bandalos, 2018). The NR6 items range from 0.6 to 0.9, which indicates that all six items have strong factor loadings and demonstrates simple structure with high communalities. Factor loadings measure the amount of variance in a variable that is shared with the factors (Bandalos, 2018). Loadings above 0.4 are accepted with loadings between 0.6 and 0.9 being favorable, a loading of 1 is the maximum value of any single factor loading (Figures 3.6 and 3.7). Contrary to hypothesis 1, I found that for UWCAS-Version 1, with non-convergent items removed, item loadings fell onto two factors, and for UWCAS-Version 2, with non-convergent items removed, items loadings also fall onto two factors (Figures 3.4 and 3.5). The reasons for these factors will be discussed under prediction #2.

Upon further investigation of the item loadings and communalities, as well as looking at the item structure, I found that for Version 1, the items loaded onto potential constructs of "Happiness from Wildlife" and "Problem Encounters with Wildlife". For Version 2, the item loadings fell onto one's tolerance for wildlife or one's behaviour towards wildlife. Thus, the hypothesis that these scales would fall onto a single factor was not supported. Also, when combined, Version1 and Version 2 produce four latent factors with similar items loading upon similar constructs as before. When trying to reduce the number of factors, I looked at the

possibility of three constructs, namely: tolerance of wildlife, frequency of problems, and proclivity to name wildlife.

I predicted that if one's tolerance for wildlife was high, then their frequency rating of happiness would also be high. This would be consistent with similar research done by others (Buckley, 2020; Cloutier et al., 2014; Larson et al., 2016b; Negami et al., 2018). For this reason, I thought that the happiness items would correlate strongly with the tolerance items. What I found was four strong factors which supports the theory that the frequency at which one behaves differs from the attitude one holds towards that behaviour (Shumway et al., 2014). There were seven items that loaded onto a single factor that were separate from the three other items. Upon review of the items, most of them (n=5) all asked, "how often are happy when you see…." The other two items asked, "how often do you try to name the wildlife in your neighborhood" and "how often are you daily activities enhanced by the presence of wildlife".

I suggest that the presence of wildlife in one's backyard, at the local greenspace, or in a national park may enhance your daily activities, or perhaps by having wildlife in your backyard, you are happier, and happiness is reflected in an overall enhancement of daily activities. More work needs to be done to understand the correlation between these two variables and to identify the underlying construct. If it is happiness that is the construct, then I would suggest trying to investigate the connection between the presence of wildlife in one's backyard and its causal relationship of increased happiness and enhanced daily activities. This is supported by Buckley (2020) who found that individuals reported that park visits lead to greater happiness (65%), and that this was significantly greater ($p<0.001$) for those who held the view that "when I'm happy I take part in outdoor nature tourism and recreation" (14%).

One criticism of this result could be cognitive loading (Kahneman, 2011). Cognitive loading refers to the amount of effort exerted when doing a particular task. It may be that the participants had a collectively easier time attributing their happiness to park attendance rather than attributing their park attendance to happiness. One often goes to a park to "destress," thus affirming the former assertion (Buckley, 2020). Even if participants did affirm that explanation with cognitive loading, does that make the relationship any less valid? Perhaps only to the extent that when people view their experience in parks, the memories are flooded with positivity, the very thing that urban planners and ecosystem managers would want in the joint pursuit of building more urban greenspaces and increasing happiness in the city. Cameron et al. (2020) found that if participants thought a site was booming with wildlife (*i.e.,* rich in biodiversity) then they reported more positive emotions. If positive emotions that result from building more biodiverse greenspaces and parks in the city, and urbanization is on the rise, then more greenspaces and parks should be made available to all who dwell in the city at a distance that is easily accessible (more on this later).

The DENS analysis revealed that the items on the survey point to one's dispositional empathy for nature, rather than dispositional empathy for non-human entities. Dispositional empathy reflects one's tendency to understand and share the emotional experience of the natural world (Tam, 2013a). While disposition reflects both negative and positive emotions and previous dispositional empathy research focused only on animate nature. As suggested by Tam (2013a), I wanted to see if this construct would exist with inanimate entities (*i.e.*, nature such as water, air, and earth). With the result of the factor analysis of the combined tools, (DENS and DENSr), two distinct factors (animate and inanimate) have emerged, contrary to my hypothesis. Here, I have validated the construct of dispositional empathy with nature and have some evidence for the

validity of dispositional empathy with inanimate nature. However, I do not have evidence to support my hypothesis that the DENS and DENSr would fall upon the same factor thus illustrating that the empathy one has for animate nature is different from the empathy one has for inanimate nature. One explanation is that we as humans we do not empathize in the same way with entities we view as living compared to entities we view as non-living. Another explanation is that although we may empathize in the same way, the degree to which one is willing to take part in the feelings of animate entities differs from inanimate entities.

One criticism of the DENSr would question whether the scale is truly measuring one's empathy towards inanimate nature, or if it is measuring the inclination one may have to be compassionate towards nature. It may be that participants are displaying more compassion for nature rather than empathy; however, as Tam (2013) also pointed out, the items on the scale focus on whether the respondent shares the suffering of the waterways, airways, and earth which is a key feature of the affective component of empathy rather than compassion.

Regression analysis was used to understand how an individual's tolerance towards wildlife in the city is related to the way one empathizes with non-living parts of nature. Although the regression models were statistically significant, there were not significant predictor variables. When the data from all 320 participants were analyzed, 168 cases were removed. This was due to the different versions of UWCAS. The linear relationship between the UWCAS- Version 2 and the DENSr was that, for one unit increase on the UWCAS, one would increase 0.12 points on the DENSr (CI=0.0697-0.18, $t= 4.563$, $p<0.01$). Although the effect is significant, it not very meaningful because of how small it was. It could be the case that with a sample size of 168 that the result is exaggerated that was may exist in the population. This will need to be investigated for further clarity with a larger and more diverse sample size.

I found that the psychometric qualities of both frequency and agreement anchors were similar. In fact, all of the means for agreement anchors were negatively skewed whereas only four of the items with frequency anchors were negatively skewed. When trying to compare the measurement tools to determine which is better than the other for understanding urban wildlife coexistence, the answer will only be found in the definition of the construct. My aim was to understand people's overall tolerance towards wildlife; thus I used the agreement anchors because agreement anchors target the heart of respondent's tolerance by not only asking questions of tolerance but also questions of problems, enjoyment, and frustration. Indeed, it is only slightly more comprehensive than the frequency tool, but it did allow me to gain a sense of how tolerant one is toward wildlife in the city and limits the added confound of memory effects that comes with the use of frequency anchors (Brown, 2004). If researchers are trying to understand how the frequency of one's positive and negative interactions with wildlife affects their tolerance, I recommend a combination of items from the measurement tools to better reflect participant's overall experience with urban wildlife.

Using a multiple regression, where the dependent variable was UWCAS, I found that attitude measures on the UWCAS were not significantly correlated with proximity to a park or greenspace for either version of the survey. The statistical result may be attributed to most respondents being students attending the University of Lethbridge and living on or near campus; thus, this question of proximity did not have adequate variance.

### 3.5 Implications

The UWCAS-Version 2 (agreement anchors) was found to be a psychometrically sound tool that focused more on tolerance than the UWCAS-Version 1. Due to the greater focus on

tolerance towards wildlife it was used in subsequent research projects. Chapters 4, 5, and 6, used the modified scale to illuminate the perceptions and attitudes of city-dwelling people towards wildlife. Although I found no spatial correlation between UWCAS and proximity to park or resident location in the city, the lack of correlation may have been due to the lack of variance in responses to those questions. Further work using a more diverse population is needed to better assess the relationship between one's proximity to a park and tolerance towards wildlife. Similarly, further work in recruiting participants from various locations in the city will increase the variance and allow for evaluation of the correlation between respondent resident location and tolerance towards wildlife.

### 3.6 Limitations

A limitation of my comparative study was using anchor statements that did not use the same phrasing or number of anchors. The difference in phrasing and number of anchors may explain the difference in loading strengths and direction; further, it introduced another confound to the study when trying to do a direct comparison of frequency to agreement anchors. However, both versions of the survey did turn out to be useful tools for trying to understand how residents think, feel, and behave towards urban wildlife. Even though the surveys could not be directly compared as others have (Brown, 2004), a comparison of means was still useful for providing justification to use agreement anchors when compared to frequency anchors if the question at hand involves a mixture of attitude and behaviour. Perhaps, a more effective survey would involve frequency measures when ascertaining park and greenspaces use around the city. In concert, these questions may provide a thorough understanding of how tolerance, park use, and proximity to park are related.

Another limitation of the study was low variance in the two spatial measures of the survey—proximity to a park and place of residence in the city. The low variance was due to many of the participants being university students. Future studies (Chapter 4 and 5) will expand to invite participants from different areas of the city.

The use of EFA estimation is typically based on analysis of Pearson product-moment (PPM) correlation matrices and a violation the related assumptions can result in bias of EFA parameters (Bandalos, 2018). The assumptions under PPM are that the variables are continuous and linear. The nature of the *individual* Likert questions presented in this chapter may be ordinal rather than continuous and so the assumptions of PPM would be violated. The result would mean that the EFA outputs would be underestimated because PPM correlations cannot completely capture the ordinal relationship, either due to nonlinearity or their regression on a continuous factor (Bandalos, 2018). Although EFA is a conventional choice among researchers using Likert scales (Baglin, 2014), it is recommended by many researchers to use polychoric correlation for EFA when examining ordinal variables (Baglin, 2014; Garrido et al., 2013). Polychoric correlations are an extension of the tetrachoric correlation which is a technique for estimating the correlation between two bivariate, normally distributed, continuous variables measured using an ordinal scale (Baglin, 2014). It is also recommended that, if the assumptions are being violated when examining ordinal data, that item response theory (IRT) be used for non-continuous data (Baglin, 2014; Bandalos, 2018; Lee et al., 2012; Lee et al., 1990; Maydeu-Olivares et al., 2011).

Another critique is the reliance on scree plots to determine the number of factors. As scree plots were used in trying to extract the number of factors, these types of plots have been shown to overestimate the number of dimensions in the data (Baglin, 2014). I found this to be true with my data using frequency items. Those that were negatively worded factored separately

and thus the eigenvalues overestimated the number of dimensions in the data. This did not occur in the agreement anchors. These adjustments in analysis will be used for comparison in future chapters to evaluate the degree of discrepancy across data collection samples.

# Chapter 4: UWCAS Refined Scale, Different Demographic

## 4.1 Introduction

This chapter aims to explore two problems. First is to examine the effectiveness of different choice architecture used to encourage people to take part in survey data collection processes. Second is the evaluation of Likert scale data assumptions. This includes an evaluation of the same correlations from the previous chapter and the assumptions about the data, as discussed in the limitations section of the previous chapter.

**Choice Architecture.** Choice architecture is the design of different ways in which choices are presented to people (Thaler, Sunstein, & Balz, 2013). People make many choices every day and most often think themselves are the author of those choices. However, it is often the context that drives individual choice, and the consequences of those choices are often not entirely in the individual's control (Bode et al., 2014; Johnson et al., 2012). It is then important to understand how the results of a set choice structure will manifest itself in a real-world setting.

One way to encourage people to alter their choice structure, or to take part in a behaviour that is not typical to their routine, is through nudges. Nudges have been used in almost every kind of human interaction to encourage one behaviour over another (Thaler, Sunstein, & Balz, 2013). Nudges include incrementally closer perpendicular lines on the road, which encourage drivers to slow down before they get to a sharp corner (Thaler & Sunstein, 2008), or a pair of eyes on the wall of an examination room, which increases honesty in a coffee shop or reduce littering (Ernest-Jones et al., 2011; Bateson et al., 2013). By definition, a nudge is any aspect of the choice architecture that alters people's behaviour in a predictable way, a key point being that the aspect must not forbid any option or significantly change their economic incentives (Thaler

& Sunstein, 2008). Nudges in survey design include the phrasing of anchors for questions and the number of options to choose from (*e.g.*, 1 to 5 versus -5 to 5 on a Likert scale) (Brown, 2004). Positively or negatively packed survey choices on a Likert scale have been found to increase the variance in a dataset that would otherwise be found to have low variance (Brown, 2004). This increased variance can provide meaningful understanding of the extent to which an individual is willing to support an idea, driving those who do not agree with the positively packed scales to stand out. Removing a neutral item creates a forced choice situation where all those who may in fact feel neutral to the topic will need to submit to an option (Bandalos, 2018). This forced choice is a move away from nudge but still falls under choice architecture. By creating a situation where a choice needs to be made, researchers can encourage deeper consideration of a topic than perhaps previously achieved by the individual.

Moving away from nudge theory and into incentivizing people to make choices under the framework of choice architecture: When an individual is offered the opportunity to take a survey, what is the likelihood that they will take the survey out of their own volition with a passive pamphlet at their door when compared to an alternate setting like an invitational booth in a park? In the studies of Asch et al. (1951), Milgram et al. (1963), Darley and Batson (1973), Darley and Latané (1968), and Shumway et al. (2014), people's knowledge, intention, beliefs, and attitudes are not reflected in their behaviour. But what about individuals who attend urban greenspaces and parks? Will a similar disconnect between attitudes and behaviour be found with individuals who are actively using park areas?

**Likert Scale Assumptions.** I have previously explained the dilemma in choosing which assumptions to follow (*i.e.*, maximum likelihood (ML) or polychoric correlations (OLS)) and add that researchers such as Barendse et al. (2015) believe that the use of ML lacks theoretical

justification for discrete datasets (*i.e.,* Likert scales). A Likert scale that has five or more ordered categories are treated as both discrete and continuous data (Bandalos, 2018; Mircioiu & Atkinson, 2017; Stochl et al., 2014). However, when comparing the models and associated statistical analysis some have theorized that the bias violation, which is to have a continual normally distributed dataset, is minimal (Bandalos, 2018; Mircioiu & Atkinson, 2017). I explored the differences between ML and OLS assumptions with a post hoc evaluation of the exploratory factor analysis to see if there were any significant changes in the simple structure of the data and choice of which items to keep or discard. I also looked at the item characteristics to investigate any changes that may have occurred due to a change in assumptions about the data.

In this chapter, I examined the same factor loadings and correlations as in the previous study. I aimed to obtain a more geographically diverse sample of Lethbridge residents using two methods of data collection: (1) door-to-door canvasing and (2) interactive invitations via an incentive booth to collect data. Both methods used monetary incentives to motivate participation.

My overarching research question was the same as in the pilot study: to understand the perceptions, attitudes, and behaviour of the residents of Lethbridge have towards wildlife. I also wanted to test if the closer one lived to a local greenspace and park increased their connection to urban wildlife (*i.e.,* UWCAS items). I predict that:

1. If the difference in recruiter presence (choice architecture) is important, then Method 2 will recruit more participants than Method 1 when comparing hours worked.
2. If each area of the city is canvased similarly, then the west side of the city will have the highest rate of responses.
3. If people score higher on the UWCAS then they will be younger, more educated, and more religious than those who score lower.

4. If people are given the choice between a low-value immediate item or a high-value, for their participation in the survey then more people will choose the low-value immediate option.
5. If UWCAS items factor onto one latent construct it will be the same factor as previously observed in the pilot.
6. If people who score high on the UWCAS then they will be able to name more plants and animals when compared with those who score lower.
7. If residents who live on the west side of the coulee have a higher response rate, then they will also score higher on the UWCAS than residents who live on the east side of the coulee.

## 4.2 Methods

**Ethics.** Ethics approval was secured from the University of Lethbridge (2020-014) and the Lethbridge College (LC-20-24) for the summer of 2020 (Method 1). For the spring of 2021 (Method 2), ethics approved by the University of Lethbridge (2020-014) and Lethbridge College (LC-20-25).

### Data Collection.

*Method 1.* Using an online survey provided by the University of Lethbridge Qualtrics system, researchers collected data in the summer of 2020 from the residents of Lethbridge by canvasing door to door and dropping off flyers that extended an invitation to participate in the survey. Due to Covid-19, I had to adjust safety measures to adhere to social distancing guidelines and masks and sanitation measures were observed. I expected close to a 10-15% participation rate hoping for a moderate result from the methods chosen and aimed for 300 total participants;

with approximately 50 from each of the six areas of the city (Campbell et al., 2018). Areas of the city were defined as: North West (north of Whoop-up Drive and west of the coulee) South West (south of Whoop-up Drive and west of the coulee), North Central (north of Highway 3 and between the coulee and Mayor Magrath Drive/ 26th St. N.), South Central (south of Highway 3 and between the coulee and Mayor Magrath Drive/ 26th St. S.), North East (north of Highway 3 and east of 26th St. N./ Mayor Magrath Drive), South East (south of Highway 3 and east of Mayor Magrath Drive), and Outside of City Limits. It was brought to my attention after the survey began that Mayor Magrath Drive is 23rd St. North. I did not change it for that survey because I combined the six areas into three for data analysis, which made the distinction of the road irrelevant (Figures 4.1 and 4.2).

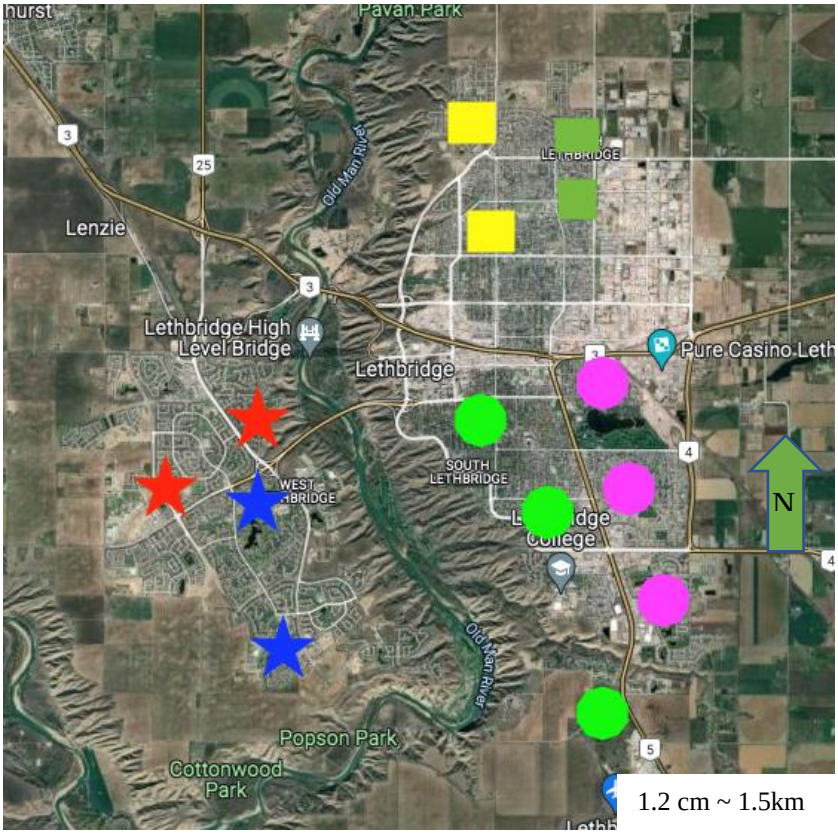


*Figure 4.1. Study area map in the City of Lethbridge.* The study area was categorized into six areas, and each area is represented by a different colour and boundaries marked by a polygon. Westside north is red. Westside south is blue. Northside west area is dark green. Northside east area is yellow. Southside west area is light green. Southside east area is purple

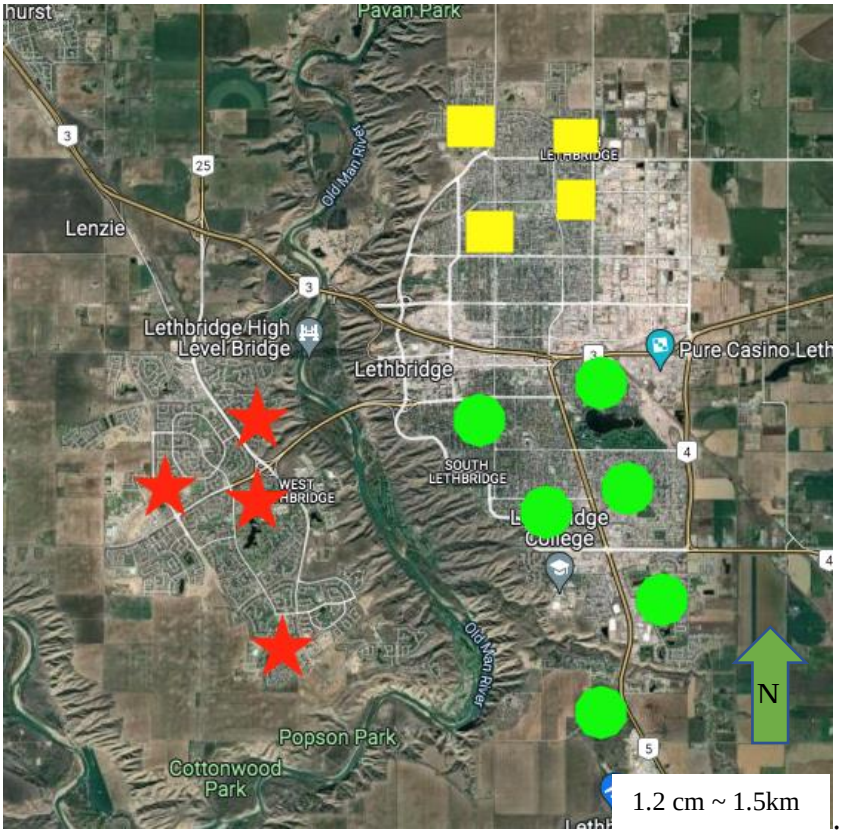


*Figure 4.2. Area map of the City of Lethbridge.* Study site grouped into three areas; each area marked with a specific colour. Westside is red. Northside is yellow. Southside is green.

Some areas of the city were canvased on foot (Figure 4.3). These areas were solicited twice, one week apart. Within each of the six regions (Figure 4.1), apartment complexes were chosen according to location and number of residents. For apartment deliveries, I used Canada Post (~1500 flyers). Door-to-door deliveries (~1500 flyers) were made between Tuesday and Thursday of each week. These days were chosen after consulting with Canada Post on the best and worst days to deliver flyers. Radio and online print ads were used as additional recruitment measures. In total, the survey was distributed to about ~3,000 households. Data were collected via the online survey on the Qualtrics website and secure database. All files were backed up onto the University of Lethbridge and Lethbridge College servers.

The measurement tools used were a shortened and revised version of the UWCAS (scores on the UWCAS were a calculated average minimum score of 0 and a maximum score of 5), along with the Nature Relatedness short form (NR6) by for validity testing (Nisbet & Zelenski, 2013).

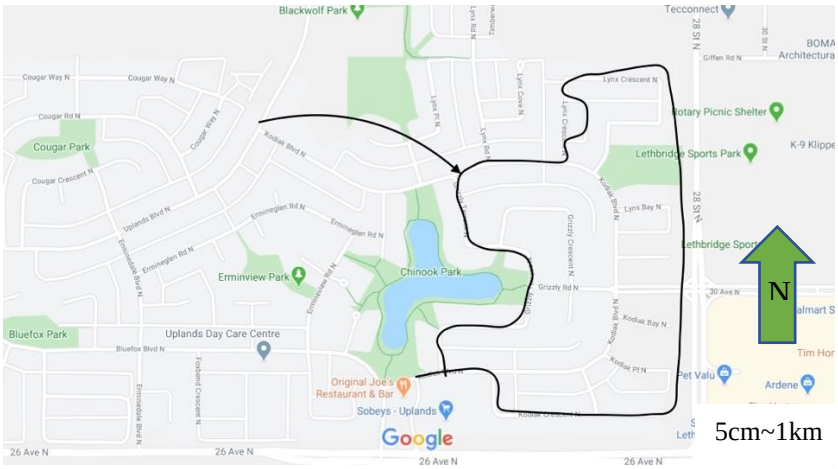


*Figure 4.3. Delivery route for flyers* (about 100 flyers delivered) to every odd numbered house within the area, (outlined in black).

*Method 2.* During March 2021, student volunteers (n=18) from the University of Lethbridge, Department of Psychology, and students from the Lethbridge College, Department of Biological Sciences set up a "Wild Wheel of Fortune" booth in three different parks in the city, namely: Nicholas Sheran, Henderson Park, and Indian Battle Park (Figure 4.4). The booths were set up from 1200 to 1700 from Monday to Saturday, March 8-27. Those who were attending the park on those days were invited by students to take the survey related to their attitudes towards urban wildlife (Appendix F). If they accepted, and after the survey was complete, the participants had an option to spin the "Wild Wheel of Fortune." Before spinning, they could choose to spin for a low-value immediate reward (*green*: granola bar; *blue*: $5 gift card to a local diner or coffee shop; *yellow*: a pack of gum) or a prize of high value, neither immediate nor assured (*yellow*: $50 gift card; *green*: $100 gift card; *blue*: being their choice of

draw. There was a maximum of 150 entries per card. Only participants who completed the survey had a chance to spin the wheel because data from the option chosen by the participant who spins the wheel were to be collected and analyzed.


*Figure 4.4 Photo of the data collection booth*: Method 2 at Nicholas Sheran Park.

*Covid-19 Adjustments.* With Covid-19 lockdown procedures being uncertain at the time of ethics approval, I wanted to ensure that the research would be able to continue despite any restrictions that were in place. Restrictions were proposed to be lifted on January 21, 2021, so I planned not to complete data collection until late March/early April of 2021: to accommodate the vaccine rollout (which was not fully available to all until the summer of 2021) and to give time for people to adjust to any new or lifted restrictions. I planned to proceed with sanitation procedures in place--that is, sanitization of tablets (if participants choose this option) and the " Wild Wheel of Fortune" (which was spun after every participant). Research assistants used hand sanitizer before and after each participant, and masks were available to be worn by participants, if needed. As a precaution, the research assistants were required to wear masks at the booth while

volunteering, but it was not mandated that every participant wear a mask because participants were able to join the survey by scanning a QR code with their personal device. This touchless option made participation open to any passerby and allowed for people without masks to participate without getting close to the research assistants. Before taking the survey, some participants were asked if they had been out of the country in the last 14 days or if they had any feelings of illness. If they answered yes, they were not permitted in the study. These questions were limited to those who were coming in close contact with the research assistants. All research assistants (student volunteers) had to take the appropriate ethics training beforehand (TCPS2core training) and were involved in hazard assessment protocol before participating in research in public places.

*Data Analysis.* Survey data were analyzed using Rstudio version 1.1.456. Bartlett's Test of Sphericity, which tests if the items are an identity matrix and if those items are unrelatable, indicates that factor analysis would be useful for the data because the data are normally distributed. In concert with that test, I used a Kaiser-Meyer-Olkin measure of factor adequacy which indicates the proportion of variance in my variables that might be caused by underlying factors. A value above 0.7 indicates that factor analysis may be useful. Exploratory factor analysis (EFA) was used for examining the components of the survey for construct validity and internal consistency. A comparison of maximum likelihood to ordinal least squares assumptions was conducted. Multiple regression was used to evaluate the correlations between variables. A multiple regression on the measurement tools was used to examine the degree of correlation that existed between the different tools allowing me to see the distinctness of each tool and see if one tool was predictive of another ($p<0.05$).

## 4.3 Results

**General Demographics.** Most respondents identified as white (85%) and female (59%). Spring data were then combined with the data collected from the summer previous for comparison (n=488) (Table 4.1). Incomplete response sets (<90% complete) were removed. Some questions were analyzed independently of others and thus had a different sample size. Of those who completed the survey, the majority (86%) of the individuals reported going to a park at least once per week and with 35% reporting that they had visited a park almost every day (n=441). Fifty six percent (251) indicated that they strongly agree with the statement of being willing to walk more than five blocks to a favoured park. Twenty-three percent (101) said that they usually agree and 15% (66) indicated that they moderately agree with being willing to walk more than five blocks. Six percent either strongly disagreed (3) or usually disagreed (21) with the statement of being willing to walk more than five blocks. When asked if they were in favor of having more parks in their neighbourhood, 48% strongly agreed (214), 22% usually agreed (97) and 23% moderately agreed (25) with 6% usually disagreeing (25) and less than 1% strongly disagreeing (3). Descriptive statistics for item responses to the NR6 and other general questions are found in the appendix in Tables 4.10 and 4.11 respectively.

Table 4.1.
*Demographic Characteristics of Respondents*

| ***Question*** | ***Choice*** | ***Number (%)*** |
|---|---|---|
| *GENDER* | | |
| *(n=484)** | Male | 190 (39.26) |
| | Female | 286 (59.09) |
| | Other | 8 (1.65) |
| *AGE* | | |
| *(n=488)** | 18 - 24 | 103(21.2) |
| | 25 - 34 | 90 (18.44) |
| | 35 - 44 | 87 (17.83) |
| | 45 - 54 | 61 (12.5) |
| | 55 - 64 | 74 (15.16) |

| | | |
|---|---|---|
| | 65 - 74 | 66 (13.52) |
| | 75 - 84 | 7 (1.43) |
| *RACE* | | |
| *(n=503)** | Black or African American | 9 (1.79) |
| | Indigenous (including Metis, Inuit, First Nations) | 25 (4.97) |
| | Asian | 14(2.78) |
| | East Indian | 3 (0.6) |
| | Latino | 10 (1.99) |
| | White or Caucasian | 430 (85.49) |
| | Other | 12 (2.39) |
| *RELIGION (n=474)** | | |
| | Christian | 248(52) |
| | Other | 143(30) |
| | Atheist | 76(16) |
| | Buddhist | 5(1) |
| | Muslim | 2(0.4) |

*n value differs because participants were able to select more than one race to which they identify or opt out of answering these questions.

## Predictions and Results.

Table 4.2
*Summary of Predictions and Results for Chapter 4*

| ***Predictions*** | ***Result*** |
|---|---|
| 1. *If the difference in recruiter presence (choice architecture) is important, then Method 2 will recruit more participants than Method 1 when comparing hours worked.* | Method 1 recruited 113 participants or 1.51 participants per hour worked. Method 2 recruited 417 or 2.32 participants per hour worked. |
| 2. *If each area of the city is canvased similarly, then the west side of the city will have the highest rate of responses.* | Respondents from the west side of Lethbridge held much of the response rate with the south side residents having the second highest rate and the north side having the lowest rate of city residents. |
| 3. *If people score higher on the UWCAS then they will be younger, more educated, and religious than those who score lower.* | Only religion was significantly correlated with the UWCAS (Table 4.6). |
| 4. *If people are given the choice between a low-value immediate item or a high-value, for their participation in the survey then more people will choose the low-value immediate option.* | When given the choice, respondents chose the low value immediate item 38%, high value 32%, 10% opted out of a prize and 20% didn't answer the question. |
| 5. *If UWCAS items factor onto one latent construct it will be the same factor as previously observed in the pilot.* | Factor analysis shows that the same factoral structure was observed as was found in the pilot study (Table 4.4) |

| | | |
|---|---|---|
| 6. | *If people who score high on the UWCAS then they will be able to name more plants and animals when compared with those who score lower.* | For every point increase on the average score of naming wildlife, individuals would have an increase of 1.52 on the UWCAS (Table 4.7-4.8). |
| 7. | *If residents who live on the west side of the coulee have a higher response rate, then they will also score higher on the UWCAS than residents who live on the east side of the coulee.* | Residents score on the UWCAS who were from the west side of Lethbridge scored lower than residents on the north side but like those from the south side (Table 4.9). |

*Recruitment Method.* To understand what method of recruiter engagement achieves a greater participation rate I compared two methods of recruitment. I found that Method 1 of handing out 3000 flyers to mailboxes had a response rate of 3% in two weeks (n=113). Method 2 of recruitment, which consisted of inviting park goers to take part in a survey for a prize, brought 417 participants to the study in a three-week timespan. When I evaluated the time spent recruiting in total hours, Method 2 proved to be more effective, and less expensive, than Method 1. For total hours worked, Method 1 required 75 hours of canvasing over two weeks with a result of 113 (n=107 for complete surveys) participants who engaged with the survey. This is a rate of 1.51 participants per hour. For Method 2, 180 hours were worked over three weeks with 417 individuals taking the survey. This is a rate of 2.32 participants per hour.

In trying to understand if areas of the city were equally represented, I found that the most represented area of the city (*i.e.,* the area with the highest response rates) was the west side of Lethbridge (Figure 4.5). The result of asking participants which prize option they wanted resulted in small immediate prizes being chosen more often (38%) than larger lottery prizes (32%). Ten percent of participants opted out of getting a prize and 20% didn't answer the question.

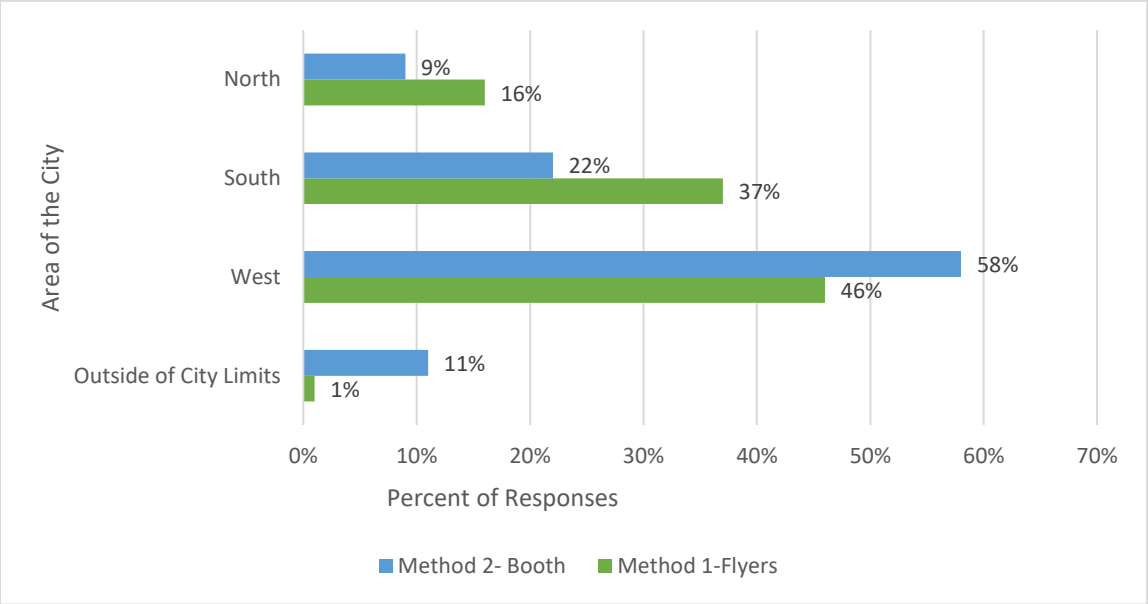


*Figure 4.5. Respondents' location of residence in the city.*

*Measurement Tool Psychometrics.* The factorability of the thirteen UWCAS items was examined using several criteria. Item descriptions are found in Tables 4.3. With scores on the Bartlett's Test of Sphericity, ($X^2_{(153)} = 722.14$, $p<0.001$), and the Kaiser-Meyer-Olkin, measure of factor adequacy had an overall MSA of 0.83 with only two items scoring lower than 0.5, factor analysis chosen as an adequate psychometric for evaluation of the items of the UWCAS. I used a scree plot to view the eigenvalues of factors and found evidence for a single-factor model (Figure 4.6). By use of exploratory factor analysis (EFA), following the assumptions of maximum likelihood, I found that 12 items had a single factor loading of 0.3 or greater with loadings of 0.6 or greater on nine of the items. These 12 items all pointed to a single latent variable. The individual item communalities ranged from 1.0 to 1.2. To understand the difference between the loadings of maximum likelihood (ML) to the loadings of ordinal least squares (MR), I compared the item loadings. The loadings using MR ranged from 0.4 to 0.8 (Table 4.4). With only one exception, each item on the UWCAS had stronger factor loadings and decreased uniqueness using the assumptions of ordinal least squares (MR) when compared to the

assumptions of maximum likelihood (Table 4.4). Ordinal least squares assumptions also increased the proportion of the variance (.48) that the underlying construct (urban wildlife tolerance and behaviour) predicts variation in the questions (Table 4.5).

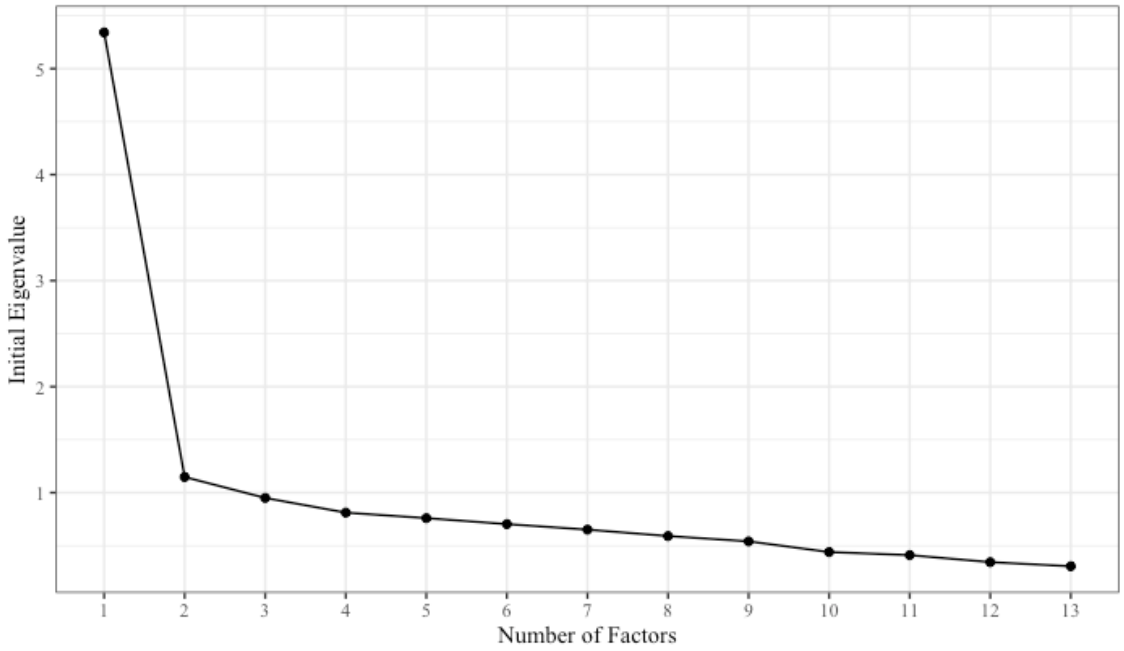


*Figure 4.6. Scree plot for UWAS Items.* Indicating the number of factors and their corresponding eigenvalues (n=489).

Table 4.3
*Descriptive Statistics for Items on the UWCAS and Behaviour Tools*

| Item Label | Item Details | n | mean | sd | median | min | max | range | skew | kurtosis |
|---|---|---|---|---|---|---|---|---|---|---|
| UWCAS | | | | | | | | | | |
| UWCAS1 | I get frustrated with the wildlife in my backyard | 443 | 4.31 | 1 | 5 | 1 | 5 | 4 | -1.64 | 2.3 |
| UWCAS2 | I enjoy the wildlife and wild plants in my backyard | 444 | 4.13 | 1.11 | 5 | 1 | 5 | 4 | -1.23 | 0.68 |
| UWCAS3 | I get frustrated with the wildlife on the roads | 443 | 3.8 | 1.19 | 4 | 1 | 5 | 4 | -0.65 | -0.66 |
| UWCAS4 | I enjoy see wildlife and wild plants throughout the city | 445 | 4.59 | 0.8 | 5 | 1 | 5 | 4 | -2.39 | 6.09 |
| UWCAS5 | Wildlife and wild plants in the city just cause problems | 445 | 4.27 | 0.92 | 5 | 1 | 5 | 4 | -1.27 | 1.18 |
| UWCAS6 | Wildlife and wild plants should be kept out of the city | 445 | 4.44 | 0.95 | 5 | 1 | 5 | 4 | -1.82 | 2.65 |
| UWCAS7 | The wildlife in my backyard are unwanted | 445 | 4.04 | 1.06 | 4 | 1 | 5 | 4 | -1.02 | 0.34 |
| UWCAS8 | The wildlife in the city is beneficial | 445 | 4.15 | 0.96 | 4 | 1 | 5 | 4 | -1.1 | 0.83 |
| UWCAS9 | The wildlife in the city parks are enjoyable | 443 | 4.58 | 0.73 | 5 | 1 | 5 | 4 | -1.96 | 4.26 |
| UWCAS10 | I avoid areas of the city where there is a lot of wildlife | 442 | 4.57 | 0.88 | 5 | 1 | 5 | 4 | -2.54 | 6.51 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| UWCAS11 | I tolerate most levels of property damage by wildlife** | 441 | 3.59 | 1.06 | 4 | 1 | 5 | 4 | -0.54 | -0.21 |
| UWCAS12 | I usually walk down the street without looking around me (example: reading a book or looking at my cell phone) | 443 | 4.37 | 0.98 | 5 | 1 | 5 | 4 | -1.83 | 3.03 |
| UWCAS13 | To protect urban wildlife and plants we have to accept restrictions in our lifestyle | 441 | 3.77 | 1.06 | 4 | 1 | 5 | 4 | -0.65 | -0.09 |
| MOREP1 | I think that the City of Lethbridge needs to have more parks and greenspaces in the city. | 442 | 4.12 | 1 | 4 | 1 | 5 | 4 | -0.74 | -0.53 |
| BEHAV1 | I am willing to walk or bike more than 5 blocks to get to a preferred park or greenspace. | 442 | 4.3 | 0.94 | 5 | 1 | 5 | 4 | -1.18 | 0.51 |
| BEHAV2 | I can name at least 5 wild plants in my neighborhood* | 439 | 3.01 | 1.39 | 3 | 1 | 5 | 4 | 0.03 | -1.21 |
| BEHAV3 | I can name at least 5 wild animals in my neighborhood* | 444 | 4.12 | 1.09 | 4 | 1 | 5 | 4 | -1.17 | 0.6 |
| BEHAV4 | I can name at least 5 wild birds in my neighborhood. * | 444 | 3.66 | 1.34 | 4 | 1 | 5 | 4 | -0.59 | -0.91 |
| BEHAV5 | On average, I go to a local park or greenspace at least: | 441 | 4.78 | 1.2 | 5 | 1 | 6 | 5 | -0.87 | 0.27 |
| PROXIMITY | How close do you live to a local greenspace or park? | 445 | 2.44 | 1.75 | 2 | 1 | 6 | 5 | 0.95 | -0.51 |
| RCHOICE | Why did you choose to live in your current residence? | 335 | 1.79 | 0.83 | 2 | 1 | 3 | 2 | 0.41 | -1.42 |
| MOREP2 | Would you like to see more parks and greenspace in your neighborhood? | 338 | 1.35 | 0.76 | 1 | 1 | 3 | 2 | 1.71 | 0.92 |
| BEHAV6 | Normally, how often do you interact with wildlife? | 340 | 2.01 | 0.94 | 2 | 1 | 5 | 4 | 1.09 | 1.45 |
| SPECIES2 | Pick one of these species you mentioned; how abundant are these species? | 327 | 3.34 | 0.83 | 4 | 1 | 4 | 3 | -1.02 | 0.1 |
| SPECIES3 | Since the pandemic started, would you say you see more wildlife in the city? | 336 | 1.41 | 0.49 | 1 | 1 | 2 | 1 | 0.36 | -1.87 |

Table 4.4

*Comparison of Maximum Likelihood (ML) and Ordinal Least Squares (MR) Results for a Single Factor Model*

| *Item* | ***ML1*** *Item Loadings* | ***MR1*** *Item Loadings* | ***ML1-u2*** *Communalities* | ***MR1-u2*** *Communalities* |
|---|---|---|---|---|
| *I get frustrated with the wildlife in my backyard* | 0.60 | 0.66 | 0.64 | 0.56 |
| *I enjoy the wildlife and wild plants in my backyard* | 0.70 | 0.74 | 0.52 | 0.35 |
| *I get frustrated with the wildlife on the roads* | 0.51 | 0.59 | 0.74 | 0.67 |
| *I enjoy seeing wildlife and wild plants throughout the city* | 0.61 | 0.76 | 0.63 | 0.35 |
| *Wildlife and wild plants in the city just cause problems* | 0.74 | 0.8 | 0.46 | 0.37 |
| *Wildlife and wild plants should be kept out of the city* | 0.62 | 0.75 | 0.61 | 0.45 |
| *The wildlife and wild plants in my backyard are unwanted* | 0.76 | 0.8 | 0.42 | 0.32 |
| *The wildlife and wild plants in the city are beneficial* | 0.74 | 0.8 | 0.45 | 0.41 |

| | | | | |
|---|---|---|---|---|
| *The wildlife and wild plants in the city parks are enjoyable* | 0.68 | 0.79 | 0.54 | 0.40 |
| *I avoid areas of the city where there is a lot of wildlife and wild plants* | 0.48 | 0.70 | 0.77 | 0.52 |
| *I tolerate most levels of property damage by wildlife and wild plants* | 0.57 | 0.63 | 0.68 | 0.62 |
| *I usually walk down the street without looking around me (example: reading a book, or looking at my cell phone)* | -0.03 | -0.03 | 0.99 | 0.99 |
| *To protect urban wildlife and plants we have to accept restrictions in our lifestyle* | 0.34 | 0.39 | 0.89 | 0.84 |
| *I think that the City of Lethbridge needs to have more parks and greenspaces in the city.* | 0.33 | 0.38 | 0.89 | 0.84 |

Note: n=393 The yellow highlights represent any change in the item loadings or change in communalities Communalities indicate whether an item falls on more than one latent variable and in our case those items with a communality over 1.0 had a loading of less than 0.2. Low communalities and loadings less than 0.4 on the single-factor indicates that a single-factor model is the best fit.

Table 4.5

*Summary Stats for Factor Analysis using OLS Method Compared to ML*

| | *Maximum Likelihood (ML)* | *Minimum residual (Ordinal Least Squares)* |
|---|---|---|
| *SS loadings* | 4.73 | 6.23 |
| *Proportion Var* | 0.34 | 0.48 |
| *Tucker Lewis Index of factoring reliability* | 0.897 | 0.853 |
| *RMSEA index* | 0.07 and the 90 % confidence intervals are 0.061 0.079 | 0.116 and the 90 % confidence intervals are 0.106- 0.126 |
| *BIC* | -215.76 | 57.63 |
| *Fit based upon off diagonal values* | 0.98 | 0.99* this is not used for OLS evaluation |
| *Correlation of (regression) scores with factors* | 0.95 | 0.97 |
| *Multiple R square of scores with factors* | 0.90 | 0.93 |
| *Minimum correlation of possible factor scores* | 0.79 | 0.87 |

Note: n=393

Multiple linear regression was used to test if the Age, Education, Area of the City and Religion would significantly predict responses to the UWCAS. The fitted regression model was UWCAS= 3.90 + (0.019*Area.of.City) + (0.042*Education) - (0.020*Age) + (0.045*Religion). The overall regression was statistically significant ($R^2 = 0.030$, $F_{(4, 388)} = 3.09$, $p < 0.05$). It was

found that religion predicted responses to the UWCAS ($\beta = 0.047$, $p<0.01$). All other predictor variables did not predict responses to the UWCAS (Table 4.6).

Table 4.6
*Multiple Regression Analysis of UWCAS*

| *Coefficients* | ***Estimate*** | ***Std. Error*** | ***t value*** | ***Pr(>\|t\|)*** |
|---|---|---|---|---|
| *(Intercept)* | 3.904 | 0.131 | 29.722 | < 2e-16 *** |
| *Area of the City* | 0.019 | 0.016 | 1.174 | 0.241 |
| *Education* | 0.042 | 0.022 | 1.893 | 0.059 . |
| *Age* | -0.020 | 0.0195 | -1.028 | 0.304 |
| *Religion* | 0.045 | 0.018 | 2.494 | 0.013* |

Significant codes: '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1

The fitted regression model was Behaviour of naming plants + Behaviour of naming animals + Behaviour of naming birds = 4.45 + (1.52*UWCAS score). The overall regression was ($R^2$= 0.085, $F_{(1,427)} = 36.69$, $p <0.01$). Table 4.7 shows the addition of controlling for awareness while walking. The fitted regression model was Behaviour of naming plants + Behaviour of naming animals + Behaviour of naming birds= 5.01 +(1.87*UWCAS) + (0.53*Awareness). The overall regression was ($R^2$= 0.138, $F_{(2,425)} = 34.1$, $p < 0.01$). A test of statistical power using the Wilcoxon test was run (Table 4.8).

Table 4.7
*Multiple Regression of Behaviour Variables*

| | ***Estimate*** | ***Std. Error*** | ***t value*** | ***Pr(>\|t\|)*** |
|---|---|---|---|---|
| *Coefficients: (Intercept)* | 5.0079 | 1.2416 | 4.033 | 6.52e-05 ** |
| *UWCAS* | 1.8663 | 0.02587 | 7.216 | 2.49e-12 ** |
| *Awareness* | 0.525 | 0163 | 3.222 | 0.00137* |

Significant codes: '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1

Table 4.8
*Wilcoxon-Mann Whitney Test of Behaviour Variables*

| ***Variable*** | ***Wilks*** | ***Approximate F statistic*** | ***P value*** |
|---|---|---|---|
| *UWCAS* | 0.9 | 15.67 | <0.01 |
| *Awareness* | 0.97 | 4.55 | <0.01 |

Results show that residents on the west side of the coulee scored lower on the UWCAS than those on the east side (Tables 4.9).

Table 4.9
*Pairwise Comparison Using T Test with Pooled SD*

| | ***North*** | ***Outside*** | ***South*** |
|---|---|---|---|
| *Outside* | 0.244 | - | - |
| *South* | 1 | 1 | - |
| *West* | 0.037* | 1 | 0.282 |

*P value adjusted method: Bonferroni. Table shows the p-values of the compared means on the UWCAS per area of the city*
**p value <0.05*

## 4.4 Discussion

I studied the effectiveness of different recruitment strategies for obtaining the most participants per hour worked. I then explored the choice architecture of incentives for participants who took the survey and their reward response type for taking the survey (*i.e.*, did participants favor one type of reward over another). Lastly, I aimed to understand the relationship between average responses on the UWCAS that I created and several other variables. The other variables included the spatial relationship (*i.e.*, proximity to a park and residential location per area of the city), the behavioural relationship (*i.e.*, those who score high on the UWCAS will name more plants and animals), and demographic correlations.

**Recruitment Strategies.** When examining which method of recruitment was more effective, I will need to expand on what it means to be effective. If my examination of effectiveness is solely based on the number of participants that take the survey per hours worked then Method 2 emerged as a superior method of data collection in the city of Lethbridge and was applied to other cities (Chapter 5). The superiority of Method 2 may be due to the majority of the individuals going to a park at least once per week, which is where I found the participants. This would fit with the prediction that a change in choice architecture would provide an increase in recruited participants. However, collecting data on opinions of urban wildlife by those who are actively seeking to be surrounded by urban wildlife, by attending a park, may have biased my sample. Indeed, the west side of the city had the highest response rate when compared to the other areas of the city with most survey responses being from that side of the city (Figure 4.5). One reason for the sampling bias in Method 2 was that I sampled three major parks in the city, none of which were exclusive to the north side of Lethbridge (Figure 4.9). Although park

location may be a good explanation for a lack of participation from the north side, this does not explain the overrepresentation of participants from the west side.

If effectiveness is to be evaluated for obtaining the most representative sample, then Method 1 was more effective. However, in Method 1, I spent additional hours on the north side of the city to compensate for the low participation rates that I had obtained while collecting the data using Method 1.

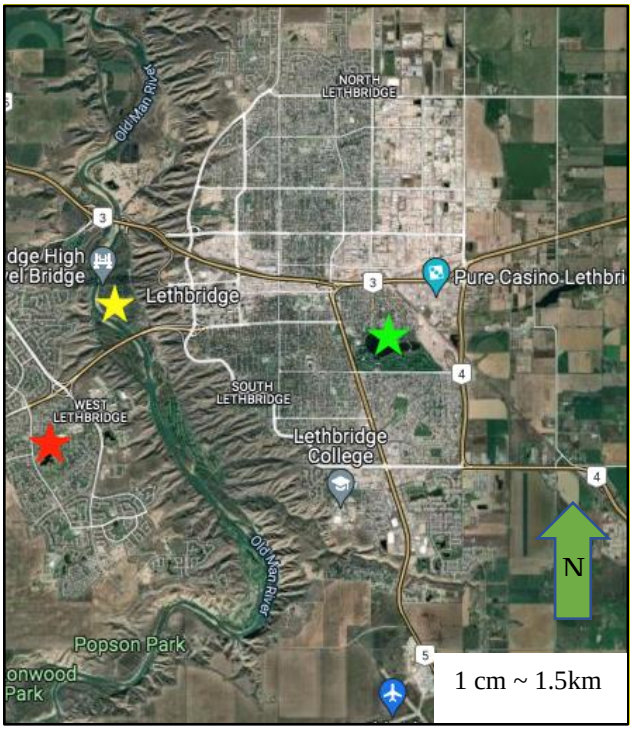


*Figure 4.9 Map of the City of Lethbridge with park locations marked*. Red is Nicholas Sheran Park. Yellow is Indian Battle Park. Green is Henderson Park. None of the parks was farther than a 15-minute drive from any residential area of the city (given optimal road conditions).

Why are the participation rates so low from the residents on the north side of Lethbridge? The residents on the north side of Lethbridge have traditionally been the working class and have a lower socioeconomic status (SES) than the rest of the city. A lower SES could be indicative of a reason for refusal. That is, those with a lower SES may not have time or make time for getting outdoors, taking walks, have poorer access to large parks, or taking a survey on their opinions on wildlife (Jennings et al., 2017). In fact, in a review of reasons people refuse to take a survey,

Menold & Züll (2010) found that a general denial of taking a survey was most common followed by not interested and no time. They also note a continuing trend in multiple populations that there are decreasing participation rates for many types of surveys (Menold & Zill, 2010). Not having time due to low SES may be a reasonable cause for such a low response rate from the north side in both data collection methods but this will need to be further explored.

For Method 2, park location may have influenced the lack of participants from the north side. More time could be spent on the north side of the city to obtain participants; however, it may result in a low sample size unless a more extreme cost is incurred by the researchers or a different method of data collection is used, like telephone surveys.

Of those who attend the park, over one third reported that they visited a park almost every day (n=441). With such a large portion of the sample population reporting a frequency greater than or equal to once per week, I found that most people desired to have more parks and greenspaces built in the city. These parks could add paths of connectivity for wildlife throughout the city and provide places where more human-wildlife interactions could occur. Having more parks and pathways of connectivity would offer all those who are willing to walk to a desired park the infrastructure to do so. As most participants agreed that they were willing to walk more than five blocks to a desired park, it may not be necessary to provide a park every other city block. Instead, urban planners could build parks in five-block increments. By building parks in five-block increments overall outside activity of those living in those neighbourhoods could be positively affected, subsequently increasing the well-being of those residents (Larson et al., 2016b). Greenspaces of connectivity from park to park could provide pathways that would help people and wildlife move from one park space to another more fluidly by encouraging movement away from conflict zones: like roadways.

Motivating residents of a city to partake in a survey can be challenging. With an average rate of 3% participation for the mail-in survey, I was left to find creative ways to incentivize participation. I wanted to investigate the results of differing choice architecture to discover if there would be a difference between the options of choosing a larger lottery prize and a smaller immediate prize when inviting those over 18 years old to participate in the survey. I found there was no significant difference in the choice between a low-value item or a high-value item to incentivize participants to take the survey at a booth. By using the booth and the wheel, I was able to attract a much larger audience and was able to nudge people to take the survey by giving them immediate enjoyment "spinning the wheel", whilst also giving them an immediate or (potentially) distal reward. The study was also completed during a pandemic, which may highlight the necessity of human interaction and social networks (Umberson & Montez, 2010). By providing a safe place to engage with others, we, (the research assistants and myself) heard a variety of stories and shared space with many in the community. Indeed, where we located the booth became a hub for social interaction – an invitation to engage with others at a time when most social engagement was outlawed.

UWCAS Psychometrics and Correlations were under the assumptions of maximum likelihood, strong evidence for a single factor model was found (Figure 4.6). In this data analysis, I removed the items that loaded onto one's proclivity to name wildlife which will be analyzed separately. The 12 items pointed to a latent variable that I call "Coexisting with Urban Wildlife" or "Coexistence Rating" while question 12 was a control variable (Table 4.3).

I conducted a *posthoc* evaluation comparing the use of maximum likelihood (ML) to ordinal least squares (OLS) for factor analysis to better understand the dimensionality of the

UWCAS. Dimensionality is defined as the minimum number of latent variables needed to describe all statistical dependencies in the data. When considering the loadings of each item, I found some moderate differences in the loadings but not a significant difference in the outcome (Tables 4.4 and Table 4.5). When compared, there were loading differences up to 0.19 for some items, which takes an item (question) from being somewhat correlated (0.62) to very correlated (0.81). Although there were some moderate increases in loadings, the overall structure of the survey did not change, likely because any single item needing to be dropped or retained due to the item's loading and uniqueness was not below the threshold. It should be noted that according to Hogarty et al. (2005) my sample size was sufficient to account for discrepancy in communalities and thus not a confound in my findings.

Even though ML has been disputed as not appropriate for analysis of ordinal scale items, using the ML may be appropriate in EFA when using frequency anchors. Frequency scale items are more likely to be treated and viewed as continuous because if one is asked how often an event takes place, that event could be placed on a continuous timeline. For my scale, the agreement scale items did not end up having the same dimensionality as the frequency anchors. I surmise that from one participant to the next the spacing between strongly disagree and disagree may not be equal to the spacing between agree and strongly agree. These items, therefore, need to be treated as ordinal. Conversely, how often one goes to a park or has an encounter with nature could be treated as continuous (integer) data. Future studies could investigate the dimensionality of the frequency anchors in more detail and provide recommendations for data analysis of such items.

Age, education, or area of the city had no effect on the response sets to the UWCAS. Religion significantly predicted responses on the UWCAS; however, that correlation maybe due

to a discrepancy in the variance (*i.e.*, the number of participants choosing a particular response over the others). Most participants were Christian (52%). Religion could play a role in tolerance of urban wildlife but this has not been found in any previous research. Others have created a model that would incorporate one's norms, values, institutions, and other internal model variables that could account for the difference in religious dogma (Kansky et al., 2016). Özgüner (2011) found cultural differences in the use of park space which highlights the necessity to continue to gather demographical and cultural information so that researchers can better understand the relationships between culture and the environment.

Interestingly, requesting demographic information was also one of the more contested items in the survey. One participant was upset that I would ask a question on religion and suggested that, if the data came out to say that one religion over another was more in favour of urban wildlife, that they wouldn't believe it. A positive, although contested, dialogue about the importance of demographic indicators, which should not be used as a tool of racism, sexism, or any other divisive means, but as a tool of education and understanding. Thus, demographics can help researchers understand where there may be divisions among people and then be able to work with those divisions. For example, if it was found that religion played a significant role in the tolerance one had towards urban wildlife, then researchers could investigate the tenets of that religion and, through ethnographic research, elucidate the tenets of that religion that might create a mindset to be more tolerant of urban wildlife.

I found that residential distance from a greenspace did not predict one's report of how often they encountered wildlife. Residential proximity effects may be competing with the frequency of the participants visiting parks in the city, and so any effect would have been mitigated by participants putting themselves in locations where wildlife exist.

Individuals who scored high on the UWCAS were more likely to agree to the statement that they can name five or more plants, animals, or bird species when compared to those who scored low on the UWCAS. Adding the variable of awareness increased strength of the model (Table 4.7-4.8). If urban planners and wildlife managers are trying to predict whether residents are involving themselves in more than one way with wildlife and wild spaces, the UWCAS is a good predictive tool to elucidate residents' attitudes and behaviours. Understanding resident behaviour can lead to better planning outcomes and can enlighten wildlife managers on which animals are being observed the most. The UWCAS can also inform planners which animals are most favoured areas of the city. With this added knowledge, planning corridors for wildlife can be made beneficial for both wildlife and residents.

Results show that residents on the west side of the coulee scored lower on the UWCAS than those on the east side, but the result was not statistically significant, nor is the difference large. There was a significant difference between the residents from the west and those of the north sides; however, this should be interpreted with some caution. The actual difference in means was 0.26 with the north side ($\mu$= 4.38) having an aggregate score higher than the west side ($\mu$= 4.12). All areas of the city had mean scores of 4.0 or higher, indicating that all those who took the survey were indeed very tolerant towards wildlife in the city. The result of a high average may be due to a sampling bias. I did recruit residents who were attending urban parks and so I expected a higher average on the survey, knowing that these individuals were actively seeking spaces that involved wildlife and plants. For the smaller sample population obtained from Method 1, however, the data were just as skewed, meaning that the average for those participants throughout the city still scored over 4.0. Recall that the scale options were from 1-5;

thus, most participants, whether they were recruited from the booth or from the flyer, were very tolerant towards urban wildlife.

### 4.5 Implications

I aimed to test whether UWCAS is a robust scale for measuring the attitudes of humans towards wildlife in a city setting. I found that UWCAS can be used to understand residents' tolerance and attitudes towards wildlife in the city, and that these attitudes are correlated with residents' proclivity to name wildlife. With the studies from Chapter 3 and Chapter 4 complete, and having performed psychometric validation on the scale that I created, I met with researchers at the Lethbridge College and the University of Lethbridge to consult on which items might be valuable for future studies. I added a few more survey items to gain a greater sense of resident interactions with wildlife (Appendix C). Minor changes were also made through the addition of a few more demographic questions. Finally, further research was conducted in the cities of Calgary and Red Deer (Chapter 5), and a comparative analysis was conducted between cities.

When trying to recruit participants for a survey, I found the best method was to set up a booth and recruit with a small immediate reward or a large lottery prize reward. I assert that either option will be beneficial, but both are not fully necessary, though this will need to be investigated with more research. When trying to recruit participants, recruiters will have to work harder to obtain resident opinions from the north and south sides of the city of Lethbridge when compared with the west side of the city. As environmental literacy has been noted by others to aid in the participation in conservation and wildlife management efforts, more effort needs to be focused on the north and south sides of Lethbridge. Perhaps this research could involve place attachment in all areas of the city to elucidate if a sense of place and place attachment are associated with reasons for refusal to take a survey.

Urban design of parks and greenspace with the features would greatly benefit the place attachment of residents in the city (Negami et al., 2018). Place attachment (*i.e.,* individual experience and affective bonds), sense of place (*i.e.,* overarching relationship between people and spatial settings), empathy, and perspective taking have been found to significantly affect at least some pro-environmental intentions (*e.g.,* volunteering and litter clean-up), and some assert that emotional attachment plays a role in protecting the natural environment (Jorgensen & Stedman, 2001; Jorgensen & Stedman, 2006; Von Wirth et al., 2016; Walker & Chapman, 2003). Pro-environmental behaviours could act as a positive feedback loop where the more an individual helps environmentally sustainable causes, the more they gain a sense of place and increase their place attachment to nature in urban settings. If individuals increase their sense of place and place attachment then urban residents could see an increase their happiness, well-being, and overall health (Larson et al., 2016b; Negami et al., 2018).

Place-making can include activities like setting up a booth or a massive chair or holding a "photoshoot" in locations that would otherwise be devoid of such activities (Montgomery, 2013). I argue that it is of increasing importance that place-making becomes a priority of city planners for their cities and towns. There needs to be a location where the exchange of ideas and social norms (or counter norms) can take place. It does not take much to incentivize participation in such places, if residents can make meaningful connection to the "places of nature" in and around their neighbourhoods. If cityscapes are planned around habitat building for urban wildlife then researchers may find an increase in the amount people are willing to spend on wildlife conservation (Walker & Chapman, 2003). Having places of outdoor engagement and place-making settings is vital to the health and well-being of a community (Larson et al., 2016b; Umberson & Montez, 2010).

Future research could also investigate response sets to the UWCAS in different cities and evaluate if there is a difference between the residents of these cities and their willingness to coexist with urban wildlife.

### 4.6 Limitations

Running parametric tests on Likert scale data is widely contested (Mircioiu, & Atkinson, 2017). The Likert scales used in this study were positive bias meaning that there were more positively worded anchors than negatively worded anchors. Anchoring Likert scales in this manner is accepted when trying to obtain a greater variance in the dataset if it is known that the responses have a high likelihood of being skewed (Brown, 2014). The assumption of the data being continuous, however, cannot be assumed because the spacing between variables like "usually disagree" and "moderately agree" might not be viewed by the respondents as equal to the distance between "moderately agree" and "usually agree". It is advised that when using positively packed Likert scales that an ordinal regression or Bayesian analysis be used (Dienes & Mclatchie, 2017; Douven, 2017; Muthukumarana & Swartz, 2014).

## Chapter 5- Cross Population Studies

### 5.1 Introduction

To accurately generalize findings obtained from survey data, cross cultural/regional research should be conducted after a measurement tool is validated. In a cross-cultural study comparing citizens of Sapporo Japan to Brisbane Australia, Rupprecht (2017) found that there was a difference between residents of Sapporo compared to Brisbane in preference for where residents thought animals and plants should live in the city. These differences were expressed with caution due to a low sample size in each city, but the assertion was made that due to cultural differences, these populations had different wildlife values and thus differing tolerance and preference for wildlife in the city (Rupprecht, 2017). Rupprecht (2017) also discussed urbanization as a driver in local species richness and how, if urban designers focus on how urban space is contested between humans and animals', solutions for conflict areas can be achieved. Some animals draw positive attention (*e.g.*, songbirds, *Passeriformes,* and butterflies, *Lepidoptera*) while others draw negative attention (*e.g.*, skunks, *Mephitis mephitis,* and coyotes, *Canis latrans*).

Comparative urban studies can be useful when trying to understand regional differences and similarities in wildlife conservation (Magle et al., 2019). For traditional comparative urban studies, these differences or similarities between urban areas may also be found in subcultures of a particular region and the delineation of results between areas is often bound to geography (Ward, 2010). Conversely, *relational comparative urban studies* view cities as open and constituted in and through relations that span beyond territorialized place (Ward, 2010). To expand beyond a single-city approach and investigate comparative studies using a relational

comparative lens, I aim to elucidate the perceptions and attitudes of residents across multiple cities in Alberta. Geographically, the cities of Lethbridge, Red Deer, and Calgary Alberta, are bisected by river valleys. Lethbridge and Red Deer also have population demographics that are similar yet the population density in Red Deer is greater than that of Lethbridge (Table 5.1).

Table 5.1
*Comparison of City's' Demographics Selected for the Study*

| | City of Lethbridge | City of Red Deer | City of Calgary |
|---|---|---|---|
| Founded* | 1906 | 1913 | 1894 |
| Population** | 101,799 | 104,392 | 1,611,475 |
| Area** | 122.09 $km^2$ | 104.75 $km^2$ | 848 $km^2$ |
| Pop. Density** | 759.5 residents/$km^2$ | 958.8 residents/$km^2$ | 1329 residents/$km^2$ |
| Average Household Income** | $95,030 | $99,110 | $105,060 |
| Climate* | Semi-arid | Humid continental/ Semi-arid | Semi-monsoonal (eastern part of the city)/ Subarctic (western part of the city) |
| Greenspace/natural areas*** | 2827 ha of parkland<br>28.3 ha/1000 people<br>23% of the city is parkland | 1,949 ha of parkland<br>18.7 ha/1000 people<br>18% of the city is parkland | 8,121 ha of parkland<br>6.4 ha/1000 people<br>10% of the city is parkland |
| River Valley and location in the city | Oldman River Valley-West Central | Red Deer River Valley-Central | Bow River Valley - Central |

*The Canadian encyclopedia
**reporting median family income from regionaldashboard.alberta.ca/region
***ccpr.parkpeple.ca/2019/cities/

When looking at what industries the populations work in as the major contributors to employment across the cities, the wholesale retail and trade industry is highest for both Calgary and Red Deer, while the Healthcare and Social assistance industry is the highest for Lethbridge (Table 5.2).

Table 5.2
*Employment by Industry in Each of the Cities in the Study*

| Industry | City of Lethbridge | City of Red Deer | City of Calgary |
|---|---|---|---|
| Wholesale Retail & Trade | 14% | 24%*Sales and Service | 14.1% |
| Healthcare and Social Assistance | 21% | 8%*Health | 13.9% |
| Professional, Scientific and Technical Services | 5% | 5% * Natural and applied sciences and related occupations | 11.7% |
| Construction | 8% | 17%*Trades, transport, and equipment operators | 9.1% |
| Manufacturing | 9% | 5% *Manufacturing and utilities | 5.6% |
| Educational Services | 8% | 10%*Education, law and social, community and government | 8.9% |
| Unemployment Rate | 6.6% | 7.1% | 7.6% |

Note: The Lethbridge and Calgary data had similar designations for occupations where Red Deer had slightly different categories

My primary research question was to understand the perceptions, attitudes, and behaviour of the residents of Calgary, Red Deer, and Lethbridge towards wildlife (*i.e.*, UWCAS items). I wanted to understand what species were most prominent in the minds of residents in each of the cities. I also wanted to describe where people believe wildlife should live. Finally, I wanted to see how the cities differ in their nature relatedness (NR6). I predicted that:

1. Residents of the cities of Calgary, Red Deer, and Lethbridge will have similar response rates (proportion of people that take the survey) during a two-week period;

2. Residents of the cities of Calgary, Red Deer, and Lethbridge will score similarly on the UWCAS;

3. The cities will score similarly on the NR6;

4. The wildlife species mentioned between the cities will be similar.

## 5.2 Methods

Consultation for all cities from the park management groups was conducted before park sites were chosen. The consultation process consisted of asking which parks would have the most foot traffic during the hours of data collection. Friends of Fish Creek were consulted for Fish Creek Park and the City of Calgary Parks website was reviewed and employees were asked for foot traffic for all other city parks. Fish Creek Provincial Park beside the information center located west of the Friends of Fish Creek was chosen to be the site of data collection.

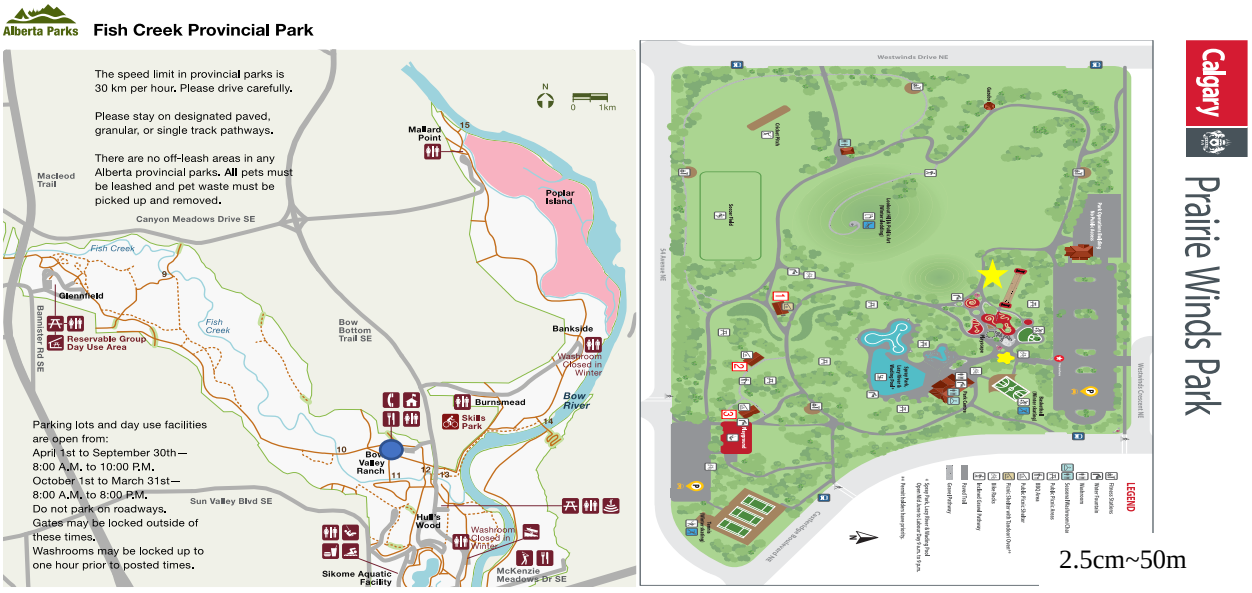


*Figure 5.2 Location of the invitational booth*. Fish Creek Park South Calgary (left blue dot) and the booth at Prairie Winds Park North Calgary (right yellow star).

By consulting the city of Red Deer Ecological Sciences Operations Department and Facebook data counts, I was able to optimize the location of booths in the city of Red Deer. Bower Ponds, Three Mile Bend and the Kerry Wood Nature Centre were the best locations to set up the booth.

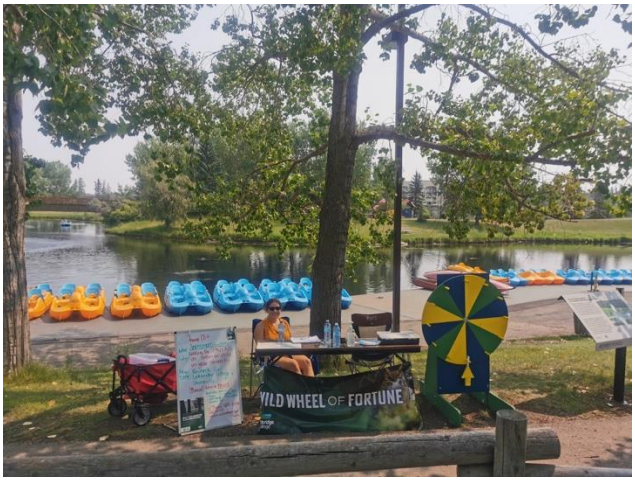


*Figure 5.3- Research assistant at Bower Ponds.*

I analyzed the data using RStudio (V. 1.3.1093), Excel (V. 16.43), and NVIVO (V. 1.5) to perform descriptive and inferential statistical tests following procedures adopted by Rupprecht (2019). Bonferroni-corrected Mann-Whitney tests were used as a non-parametric statistical test of power and to correct for multiple comparisons and a Kruskal-Wallis Test was used to account for non-normally distributed data.

Respondent preference of which animals and/or plants they wanted in their neighborhood were tabulated in NVIVO, and words that were similar were combined (*e.g.,* deer and dere). Similar to Rupprecht (2019), respondents frequently named both individual species (*e.g.,* chickadees, deer) and species groups (*e.g.,* mammals and birds). Individual species were not consolidated into species groups. Qualitative comments to explain a particular choice of wildlife or plant were incorporated into the discussion. Preference scores were calculated for wildlife or plants mentioned more than four times in total by adding up positive mentions (+1) and negative mentions (-1). Highly contested animals were defined as those with a difference of more than ten points between preference score and total mentioned. Each space where residents thought animals or plants should be able to live was counted as one point and scores on the UWCAS

were a calculated average (minimum score 0, maximum score 5). I also performed a pairwise t test to investigate if there was a significant difference between the mean scores on the UWCAS between those living in Lethbridge and those living outside of Lethbridge. Lastly, I performed Kruskal Wallis test to examine the mean differences between the residents of Lethbridge, Calgary, and Red Deer.

To avoid a response bias in the data, participants would have needed to answer both questions to have their answers counted towards preferred and not preferred animals (or plants). Those who answered that they would welcome or prefer all animals and had no animals they did not prefer were not counted in the dataset because I did not include a category for "all animals". Animal preference was tabulated and scored by combining the Calgary and Red Deer samples (n=286) and comparing them to the Lethbridge sample (n=321).

**Ethics.** Ethics approval was granted on June 9, 2021 by Lethbridge College Research Ethics Board (LC-10) and June 18, 2021 by the University of Lethbridge Ethics Board (HPRC Protocol: 2021-065).

**Measures.** (Urban Wildlife Coexistence and Attitudes Scale [UWCAS] in Appendix A.) The scale used agreement anchors and contained 39 questions with the instructions "Please answer on how much you either agree or disagree with each statement." Agreement was measured on a 5-point Likert Scale from Strongly Disagree to Strongly Agree with a neutral option (e.g., "I get frustrated with the wildlife on the roads"). I used a scale on Nature Relatedness-Short form that measures how one relates with and desires to be in the natural world (Appendix A). Using NVIVO I searched under the word frequency criteria for the most common animals or plants that were mentioned. I then searched under the word frequency criteria for the most common adjectives to describe the animals or plants that were mentioned.

Participants used text fields to input information on which animals they preferred and were prompted by being asked “Which animals do you prefer *(or not prefer)* to have in your neighbourhood and why?” For participants to have their answers counted towards preferred and not preferred plants or animals, they needed to answer both questions. This way, those who answered only preferred questions or not preferred questions would not bias the data to any one side over the other. Those who answered that they would welcome or prefer all plants and had none that they did not prefer were not counted in the dataset because I did not include a category for “all plants”. The adjectives describing why will be found in the discussion section.

**Data Cleaning.** Some participants selected more than one option for the frequency with which they attended a park. Those who selected 1,2 were scored 1 (n=0). Those who selected 2, 3 were scored as 2 (n=4). Those who selected 3,4 were scored 3 (n=3). Those who selected 4,5 were scored 4 (n=4). Those who selected 5,6 were scored 5 (n=1). Those who scored any other combination were scored NA(n=2).

### 5.3 Results

**General Demographics.** In Lethbridge, Calgary, and Red Deer respondents identified as white (84.2%) (n=519) (Table 5.3). Incomplete response sets (those that were less than 90% complete) were removed (n=251). Some questions were analyzed independent of the others and thus will have a different sample size. Participants from the cities of Lethbridge, Calgary, and Red Deer were asked to what extent to they agree with the statement, “I am willing to walk or bike more than 5 blocks to a preferred park or greenspace”. Fifty six percent of respondents strongly agreed that they would be willing to walk or bike more than 5 blocks, with 38% usually or moderately agreeing to walk or bike that distance and 5.5% disagreed to walking or biking that distance.

Table 5.3
*Demographic Characteristics of Respondents*

| ***Question*** | ***Choice*** | ***Number*** | ***(%)*** |
|---|---|---|---|
| *AGE* *n=519* | | | |
| | 18 - 24 | 103 | 19.8 |
| | 25-34 | 102 | 19.7 |
| | 35-44 | 116 | 22.4 |
| | 45-54 | 70 | 13.5 |
| | 55 - 64 | 69 | 13.3 |
| | 65+ | 59 | 11.3 |
| *RACE* *n=519* | | | |
| | Black or African American | 13 | 2.5 |
| | Indigenous (including Metis, Inuit, First Nations) | 0 | 0 |
| | Asian | 26 | 5 |
| | East Indian | 9 | 1.7 |
| | Latino | 8 | 1.3 |
| | White or Caucasian | 437 | 84.2 |
| | Other | 12 | 2.3 |
| | Multirace | 14 | 2.7 |
| *EDUCATION* *n=519* | | | |
| | Less than a secondary school diploma | 11 | 2.1 |
| | Secondary school diploma | 66 | 12.7 |
| | Some college but no degree | 120 | 23.1 |
| | Bachelors | 166 | 32 |
| | Associate | 81 | 15.6 |
| | Masters or higher | 75 | 14.4 |
| *INCOME n=519* | | | |
| | <30,000 | 118 | 22.7 |
| | 30,000-60,000 | 106 | 20.4 |
| | 60,000-90,000 | 111 | 21.4 |
| | 90,000-150,000 | 113 | 21.8 |
| | 150,000+ | 71 | 13.7 |
| *CITY* *n=519* | | | |
| | Calgary | 132 | 25.4 |
| | Red Deer | 57 | 11 |
| | Lethbridge | 270 | 52 |
| | Other | 60 | 11.6 |

## Predictions and Results.

Table 5.4
*Summary of Predictions and Results for Chapter 5*

| ***Predictions*** | ***Result*** |
|---|---|
| 1. *Residents of the cities of Calgary, Red Deer, and Lethbridge will have similar response rates (proportion of people that take the survey) during a two-week period* | Residents of Calgary (n=132) and Red Deer (n= 57) had lower response rates compared to Lethbridge (n=270) over a two-week period. |
| 2. *If residents of the cities of Calgary, Red Deer, and Lethbridge will score similarly on the UWCAS* | There was not significant difference in mean scores on the UWCAS between Calgary, Red Deer and Lethbridge. |
| 3. *Respondents from each city will score similarity on the NR6* | There was not significant difference in mean scores on the NR6 between Calgary, Red Deer and Lethbridge. |
| 4. *Where one lives in Alberta will not significantly affect their qualitative responses to what species they prefer nor where they think wildlife should live.* | Most of most preferred species mentioned from all three cities were deer and roses (Figures 5.5-5.10). These responses were similar between cities.<br><br>Most least preferred species mentioned were similar between Red Deer and Lethbridge but different from Calgary respondents (Figures 5.5-5.10).<br><br>Calgary and Red Deer respondent's top choice of where wild animals or plants should live was similar whereas Lethbridge respondent's top choice differed (Figure 5.3-5.4) |

**Response Rates.** In Lethbridge, there were 321 participants in a two-week data collection time frame spanning March 8-21, 2021 (first two weeks). In contrast, in Calgary there were 204 participants in a two-week data collection period (July 20-August 1, 2021). Red Deer data collection obtained 86 participants in a two-week period (August 03-15, 2021). When comparing the residents score on the UWCAS between cities, a Kruskal-Wallis rank sum test returned a chi-squared of 7.06 ($p = 0.07$). When comparing the residents score on the NR6 between cities, a Kruskal-Wallis rank sum test returned a chi-squared of 1.99 ($p = 0.57$). That is, there was no significant difference in scores between cities on both the UWCAS and the NR6. Race was a significant predictor of attitude towards wildlife ($p < 0.05$). Race was not a significant predictor of respondents' relatedness to nature ($p = 0.37$).

**Where Should Plants (or Animals) Live.** When analyzing the questions of where residents think wild animals or plants should live, Calgary and Red Deer residents favoured wildlife in Informal Urban Greenspaces (IGS) (76% and 70% respectively) and City Parks (76% and 66% respectively). Figures 5.4 (animals) and 5.5 (plants) show respondents' overall preference to have, or not to have, wildlife or plants in their certain neighbourhoods.

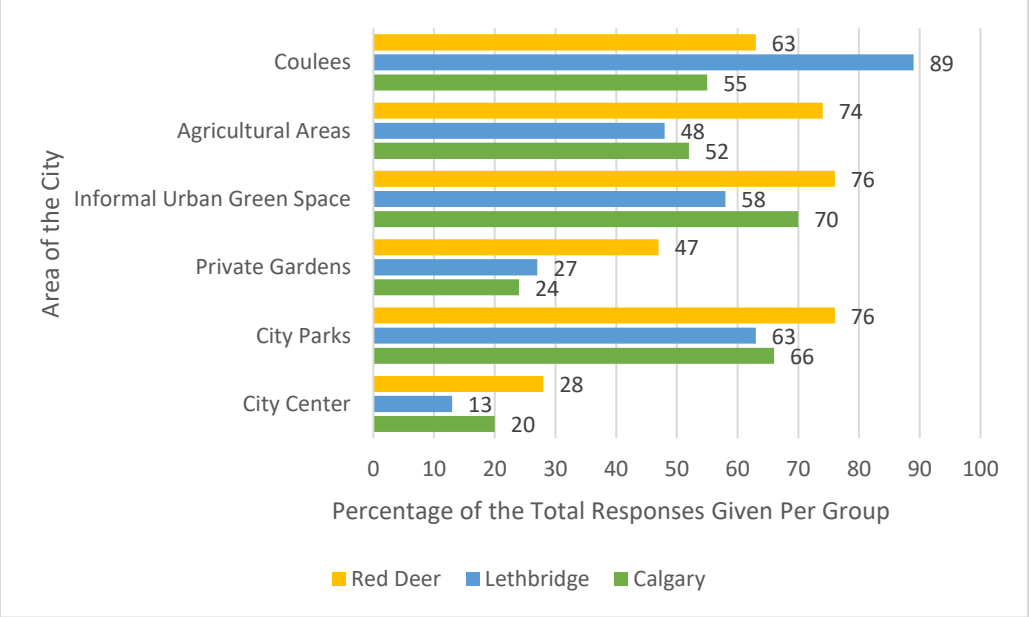


*Figure 5.4 Respondents' perception of where animals should live.*

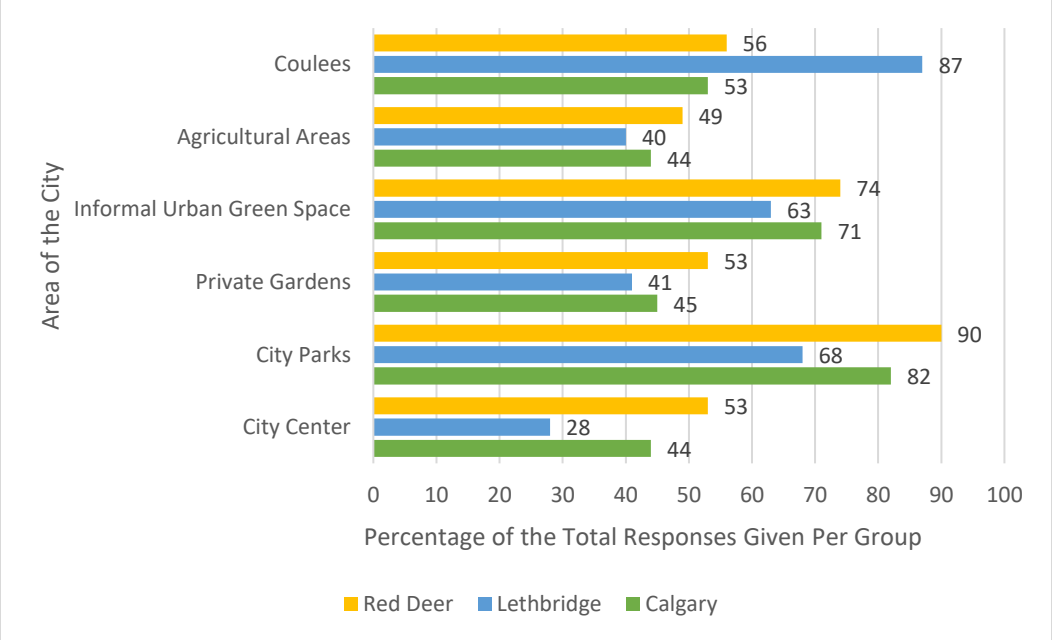

*Figure 5.5 Respondents' perceived places of belonging for plants*

**Which Animals (or Plants) Are Preferred.** Animal preference was tabulated and scored for each city and then by compared. Red Deer results (Figure 5.6), Lethbridge results (Figure 5.7), and Calgary results (Figure 5.8) were compared. Results for plant preference in Red Deer (Figure 5.9), Lethbridge (Figure 5.10), and Calgary (Figure 5.11) were also compared.

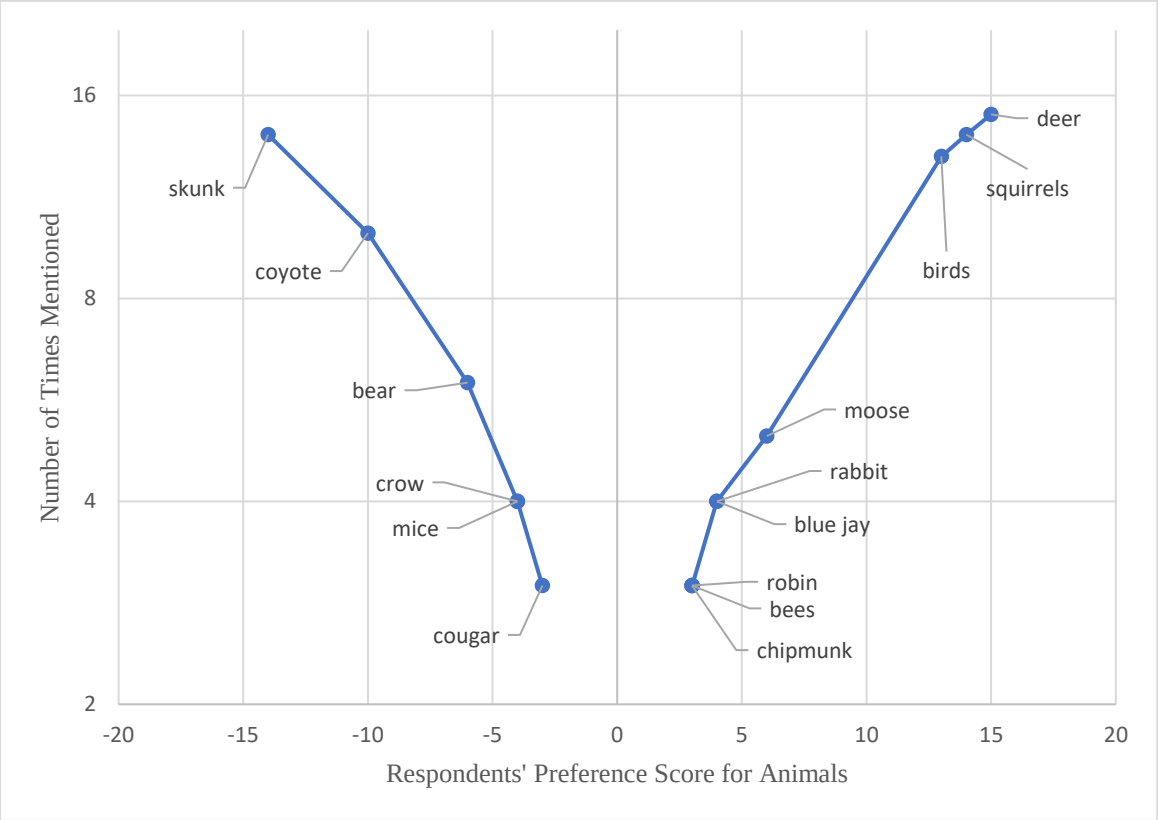


*Figure 5.6 Preferred, Not Preferred Animals of Red Deer Residents*
Residence preference for and against wildlife in their neighbourhood. Red Deer (n=40) -20 to 0 are not preferred. 0-20 are preferred.

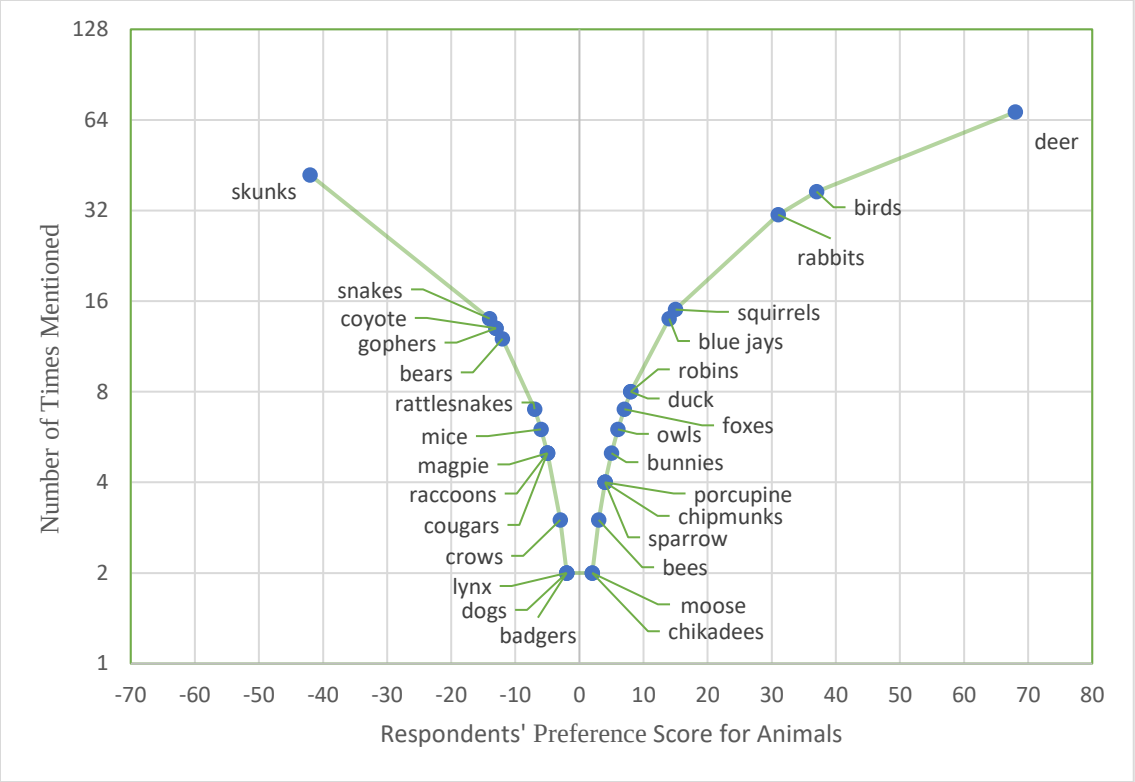


*Figure 5.7 Preferred, Not Preferred Animals of Lethbridge Residents*. Preference for and against wildlife in their neighbourhood. Lethbridge (n=160) -70 to 0 are not preferred. 0-80 are preferred.

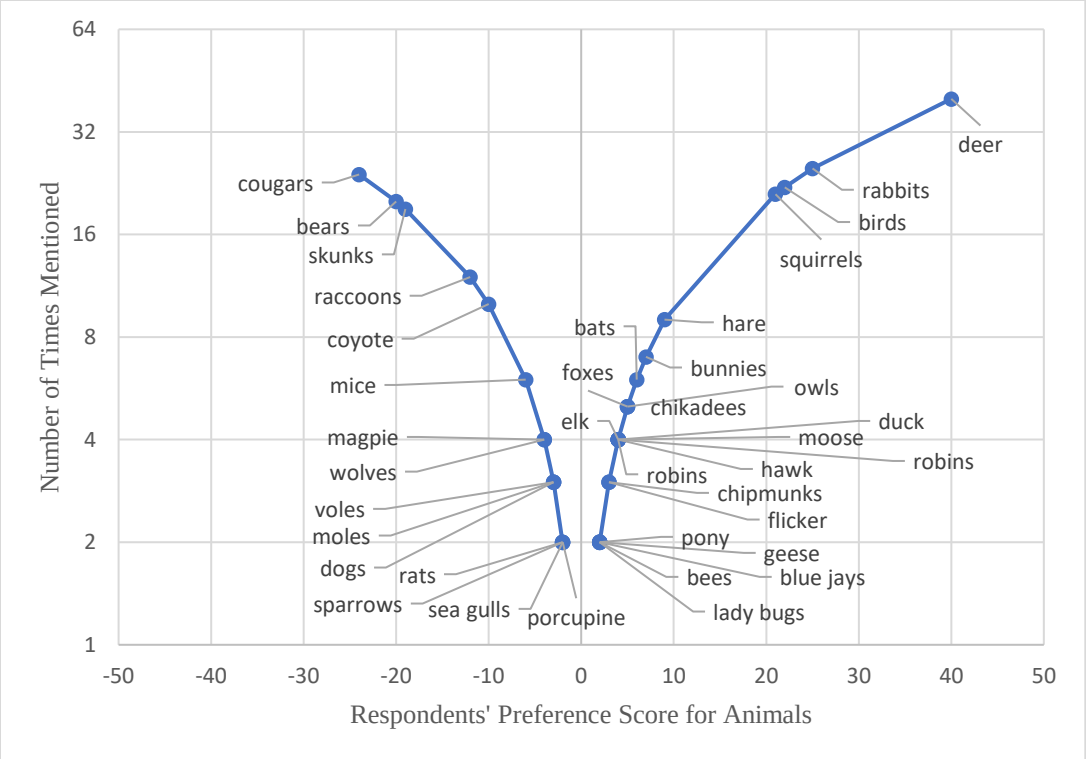


*Figure 5.8 Preferred, Not Preferred Animals of Calgary Residents. Preference for and against wildlife in their neighbourhood. Calgary (n=105) -50 to 0 are not preferred. 0-50 are preferred.*

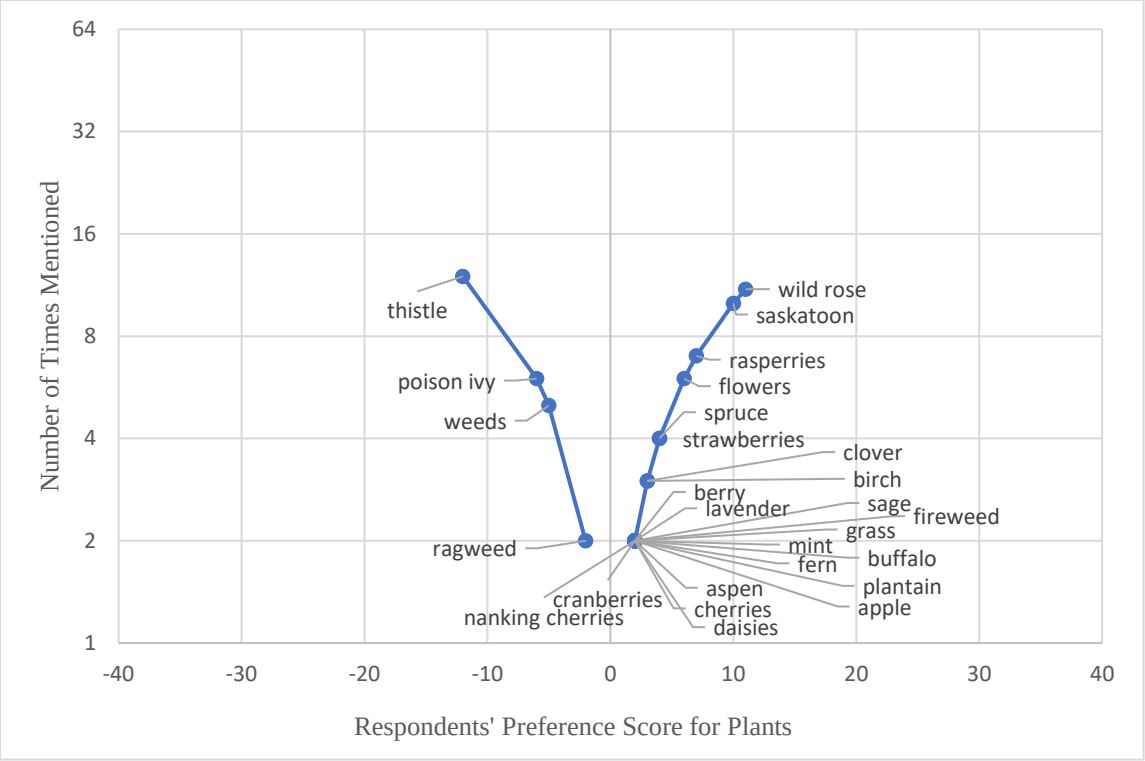


*Figure 5.9 Preferred, Not Preferred Plants for Red Deer Residents*
Residence preference for and against wild plants in their neighbourhood. Red Deer (n=40) -15 to 0 are not preferred. 0-15 are preferred.

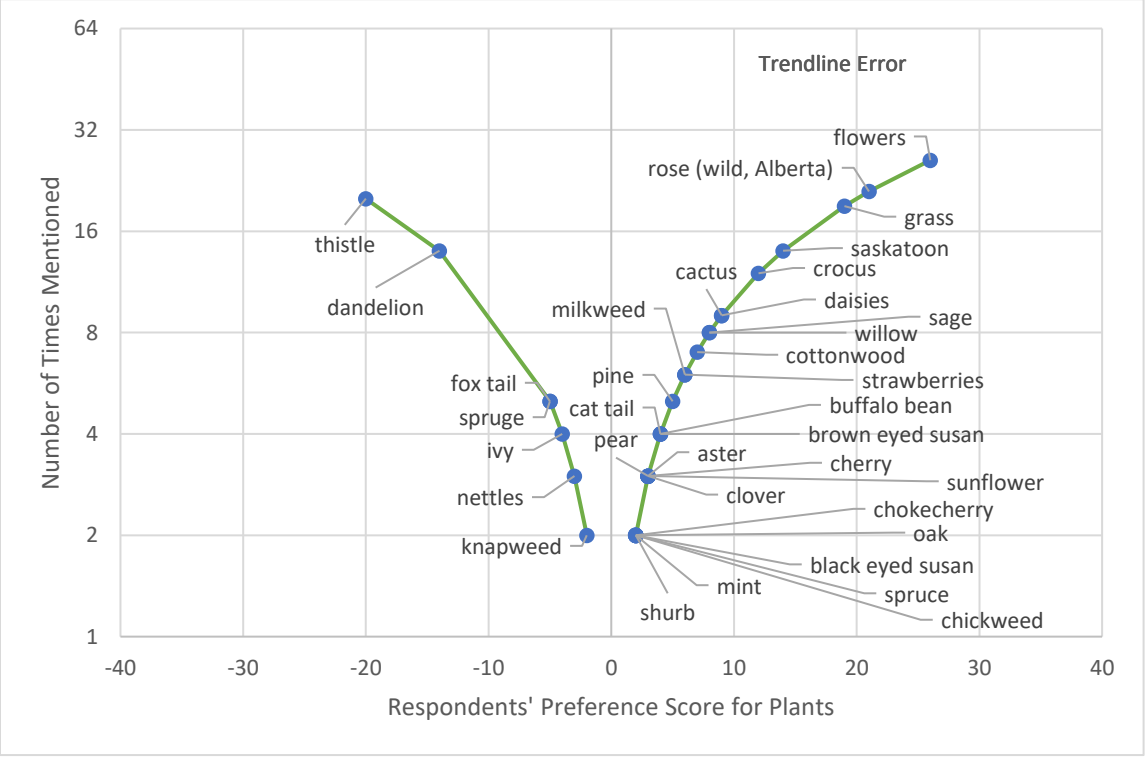


*Figure 5.10 Preferred, Not Preferred Plants for Lethbridge Residence.* Preference for and against wild plants in their neighborhood. Lethbridge (n=160) -40 to 0 are not preferred. 0-40 are preferred.

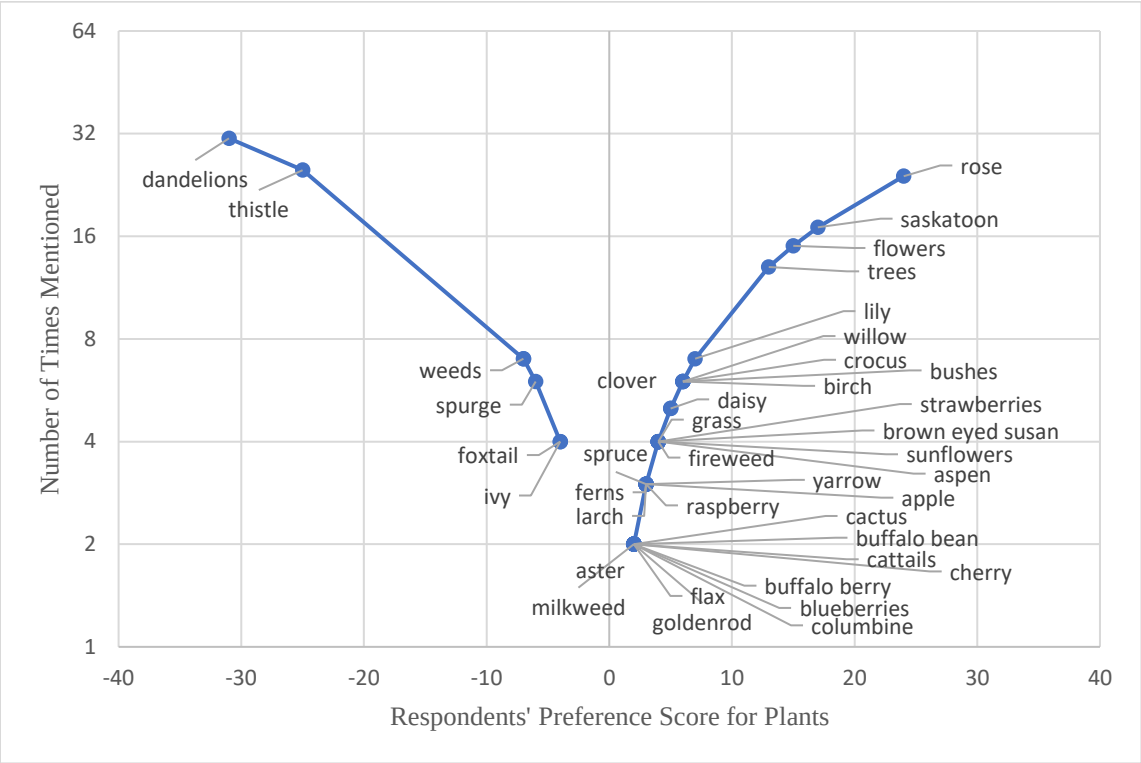


*Figure 5.11 Preferred, Not Preferred Plants for Calgary Residents*
Residence preference for and against wild plants in their neighbourhood. Calgary (n=105) -40 to 0 are not preferred. 0-40 are preferred.

## 5.4 Discussion

I compared the two-week success between the cities and found that over a two-week period more residents in Lethbridge took the survey with the recruitment method of an invitational booth than in Calgary or Red Deer. My findings point to an issue with the generalizability of methods when investigating different populations and trying to draw conclusions between them. Although the demographics of Lethbridge, Calgary, and Red Deer are similar, and the geography of each of these cities has a bisecting river valley which creates a large wildlife corridor, there is a difference between the number of participants who chose to take part in the survey over a two-week period. A confound to this conclusion may be the park locations chosen in each city. Each city had a park chosen that was in the river valley. Each river

valley park was canvased using the booth for one week. Along with park location, this seasonal variation may be a salient reason for the difference in numbers.

Canvasing in Lethbridge, as noted above, took place in the spring and in the other two cities in the summer. In fact, when the research assistants (RAs) were in Red Deer the city was experiencing a heat wave. For this reason, a park officer indicated that the RAs would not see many people and reported most would be staying indoors to avoid the heat or head to Sylvan Lake. Further studies could isolate a particular three-week period in the spring, as that has shown to have the most success for recruiting over 300 participants during a shortened time frame in Lethbridge, and complete data collection in multiple cities during the same three-week time frame. This would control for the confound of seasonal variation of park attendance in different cities.

As predicted, there was no significant difference between residents of Lethbridge, Calgary, and Red Deer on the UWCAS. Further, how residents in Lethbridge, Calgary and Red Deer relate to nature (NR6) was not significantly different. This lack of difference may be due to the demographic similarities across these cities. However, across demographic characteristics of education, race, age, and income had no significant correlation with attitude. While there was no difference between urban centers in Alberta there may be other subcultural differences within Alberta. Subcultural determinants of race and religion may predict an increase tolerance towards urban wildlife and should be explored further by making sure that sampling measure reach out to and obtain sufficient representation of the population of Alberta.

Participants view skunks as the most unwanted animal, and coyote was the third most unwanted animal (Figures 5.5, 5.6 and 5.7). When asked for the reasons, the most mentioned

answer was that the skunks are stinky or have a *horrid* "smell" (Figure 5.12). It was also mentioned that skunks "argue with dogs" and are dangerous.

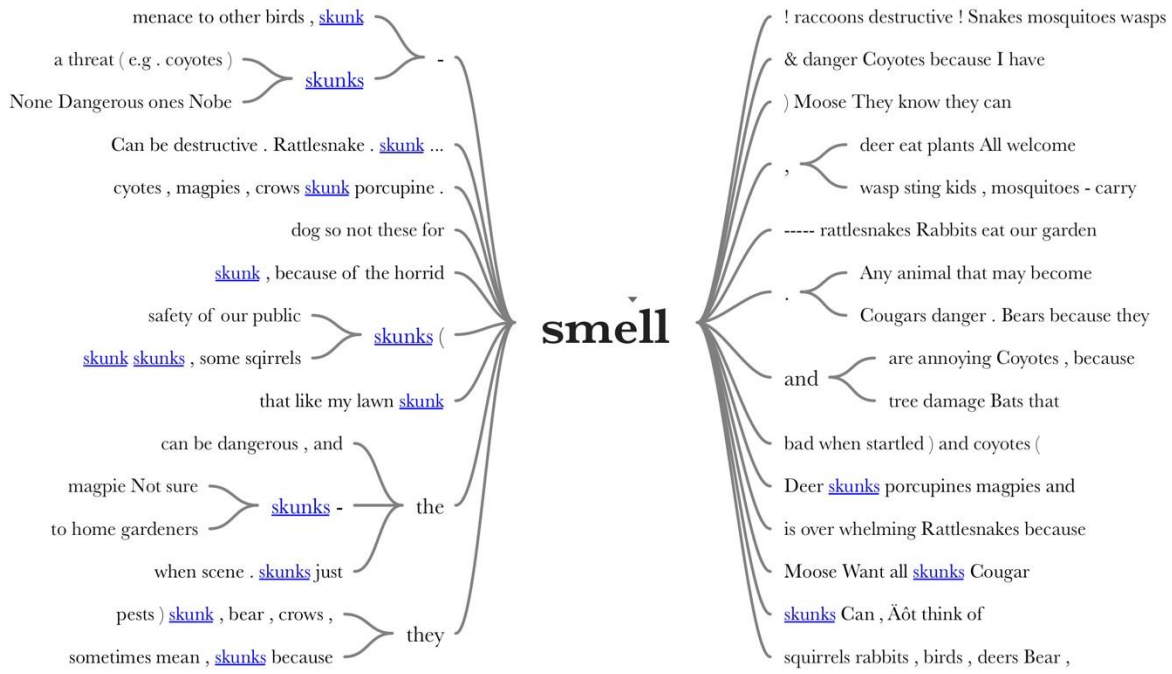


*Figure 5.12 Word Tree for Frequency of "Smell" and Skunk via word search using NVIVO.*

When looking at coyotes, the most mentioned reason was due to danger (or a word synonymous with the animal being a threat or aggressive). Danger was the most common reason for people to not favour any animal (57 mentions) which is consistent with what Rupprecht (2019) discussed. The qualifying adjectives that people choose to use often describe how much or little they contest for urban space and the perceived threat of those animals (Rupprecht, 2019). Second to "danger", after accounting for "smell", adjectives that described "damage" or "destruction" of property and place were used to explain the reasons that people did not want certain wildlife in their neighbourhood. Hariohay et al. (2018) asserted that those who experience more damage from wild animals hold more negative attitudes towards wildlife. The damage sustained by those living in the city may not be as financially significant when compared to crop

or livestock loss and may explain why only a small percentage of participants from the Calgary and Red Deer survey (16.6%) and Lethbridge (15.5%) reported that they disagree with the statement: “I tolerate most levels of property damage by wildlife and wild plants”. Thus, attitudes of coexistence with wildlife are not solely dependent on damage sustained from wildlife. Recency of damage may have played a role in how respondents answered this question; this could be examined with further research.

All groups favoured deer (*Odocoileus* spp.) in their neighbourhood over other animals (Figures 5.5, 5.6 and 5.7). Birds (*Aves*) were the second most mentioned followed by squirrels (*Sciuridae*) and rabbits (*Leporidae*) for Calgary and rabbits and squirrels for Lethbridge. The most common adjective used to describe why respondents prefer deer was to “watch” them followed by “like”, “love” and “cute”. As deer and other desired animals contest for urban space, the focus of tolerance seems to be that these animals bring levels of enjoyment. Residents claimed that most of these animals are unwanted, yet the overall response was in favour of them. When a respondent reported deer, birds, rabbits, or squirrels as unwanted, the most common reason was because of damage to or destruction of property (17 mentions).

When investigating which plants are most dominant in the mind of residents, I found that thistles (*Carduoideae*) and dandelions (*Taraxacum officinale*) was abhorred by both sample groups (Figure 5.8). The most common reasons for being against these plants in the neighbourhood was because they are seen as weeds or invasive. Flowers (unspecified) were the most preferred in Lethbridge followed by the rose (*Rosaceae*). For those outside of Lethbridge the most preferred plant was rose followed by saskatoon (*Amelanchier alnifolia*). The top five reasons describing preference for these plants included “for the bees”,  beautiful, pretty, native, and food for either wildlife or humans (Figures 5.9-5.11).

For both plants and animals, the overall result of total mentions was positive. That is, there were more preferred plants and preferred animals mentioned than not preferred plants or animals. This result may have been primed with a positively packed agreement scale preceding the questions of "which wildlife (*or plants*) do you prefer or not prefer to have in your neighbourhood?". However, the result reflects Charles and Linklater (2015)'s assertion that people generally hold positive views towards nature and their wildlife in their surroundings.

When examining the reasons for or against coexisting with wildlife in one's neighborhood, a few themes arise. Most people dislike animals because of the damage or danger that they pose to their property or themselves. In contrast, most people prefer wildlife that offers them a sense of enjoyment through observation. For plant life, species that are invasive are not wanted, while species that are beautiful and provide utility for ecosystem development (*e.g.*, food for bees) are preferred.

How then can urban planners build cities in a manner that promote the enjoyment, beauty and utility of wildlife and plants while protecting against the damage, danger, and invasion? An understanding of where people believe wildlife and plants should live can provide specific areas of focus to answer this question. For Lethbridge residents, coulees maintained the highest result for where wildlife and plants should live. For residents outside of Lethbridge, and particularly in Red Deer and Calgary, there was some confusion on what a coulee was/is which may have been the reason for the low response rate for that category from this group. The next most favorable areas for where wildlife should live are both Informal Greenspaces (IGS) and City Parks. If urban planners aim to reduce fear among residents in cities, then providing spaces for residents to watch more wildlife mingle may reduce this fear. In IGS, habitat can be specifically designed for skunks, other rodents, and coyotes to draw those species away from contested locations like

backyards and direct them into areas that can be monitored. Signage and information via QR codes on signs could be placed along trails with information on how to respond if a park patron encounters a coyote or skunk ("Coexisting with Coyotes," n.d.). Increased education via signs may then provide a change of response for residents who formerly opposed skunks but now can view them in a setting that does not directly damage their property. Like the coyote coexistence work being done in Vancouver, B.C., informing residents about the typical behaviour of the species and other helpful tips when encountering these animals can make coexistence much safer and enjoyable ("Coyote Breeding Season," 2022).

But how can problems with plants be mitigated? Urban areas have high levels of invasive plants for many reasons (Reichard, 2010). With an increase in habitat by building more city parks and IGS, invasive plants would be able to be monitored because the flora would be appropriately selected for the region. Further, signage and information via QR codes on signs could be places along trails with information on how residents can help the to fight the spread of invasive plants. By increasing the native plant biodiversity in the city through flower rich IGS and city parks, the negative effects of urbanization on foraging bumble bees (*Bombus spp.*) could be mitigated (Hülsmann et al., 2015).

Jennings et al. (2017) discussed the importance of understanding how far people are willing to travel to get to greenspaces. One of the questions on my survey investigated this topic. Participants from the cities of Lethbridge, Calgary, and Red Deer were asked to what extent to they agree with the statement, "I am willing to walk or bike more than 5 blocks to a preferred park or greenspace". I did not investigate the respondents chosen walking limit but wanted to see if there would be any difference with needing to walk roughly half a kilometer (a typical 5 block distance) to a park. Most people agreed that they would be willing to walk or bike more than 5

blocks. That is a lot of walkers and bikers in the cities. Only 5.5% disagreed to walking or biking that distance and it would be interesting to find out their reasoning. A conclusion that can be drawn is that at least 5.5% people prefer a different mode of transportation to get to a park that is further than 5 blocks away. As city planners look to areas where greenspace is limited, there is a need to try and build parks so that residents are at most 5 blocks to the nearest park. The participants of the study mostly took part in the survey while attending a park, which means that they were already attending a park for some purpose while the question was asking them about their willingness to travel to their preferred park. Perhaps mobility is an issue for the 5.5%; thus, they would rather drive or use public transit to a preferred park to enjoy the space more than going to a poorly managed park close to their residence. These questions should be investigated further by adding a few questions onto the survey that would elucidate how people get to and from urban parks and IGS.

## Chapter 6 Attitudes and Behavior Towards Wildlife-Going Forward

My aim has been to create a tool that can accurately capture the attitudes, tolerance, and behaviour urban residents have towards wildlife. I will conclude my thesis by summarizing each stage of data collection and analysis. First, I will elaborate on the psychometrics in each survey type (N=1362). Following, I will discuss how I administered the measurement tool to the residents of the city of Lethbridge and expand on the completed data collection in two additional cities in Alberta. Lastly, I will discuss the larger implications of green infrastructure on health and how researchers can influence prosocial behaviour towards urban wildlife.

I started by examining two modified tools for investigating attitudes, tolerance, and behaviour towards urban wildlife, by creating the Urban Wildlife Coexistence and Attitude Scale (UWCAS). Both measurement tools combined questions from Rupprecht (2017), Purdy and Decker (1989), and questions that I created with my research team. One tool used frequency anchors (Version1) and the others used agreement anchors (Version 2). In doing so, I investigated psychometric differences of agreement and frequency anchors via exploratory factor analysis using the assumptions of maximum likelihood. I found, like Brown (2004), that the loadings of agreement items fall upon a different latent construct than frequency anchors. I also found that within both the agreement items and the frequency items more than one factor was present. The agreement items loaded onto one attitudinal and one behavioural factor. For frequency items, a three-factor structure was computed. Interpretation of the items represented by the three factors were able to be focused onto two factors due to the negative loadings from negatively worded questions creating a "false" factor. With completion of the factor analysis, I conclude that tolerance, attitudes, and behaviour towards wildlife could be characterized using the UWCAS with either frequency or agreement anchors. I argue that agreement anchors are

more effective at understanding the attitudinal aspect of the construct and that frequency anchors elucidate more accurately the behavioural aspect. Going forward both types of anchors should be used in concert to gain a greater understanding of how residents respond to urban wildlife. One limitation of both anchor sets may have been the inclusion of a neutral option. By removing a neutral option, researchers can create a forced choice scenario and can increase the variance of the survey responses (Brown, 2004). When I compared the item means from the Version 2 of the survey that used a neutral option (3= "Neither agree nor disagree") with the item means from Version 2 of the survey that had no neutral option (3= "Moderately agree *or disagree*") I found that the overall mean for those who did not have a neutral option ($\mu$=4.1) was greater than those who did have a neutral option ($\mu$=3.71). The only difference in these two surveys was the item anchors. I assert that by removing a neutral option and having anchors that are skewed one way the items on the survey do obtain a "forced choice" scenario but may lead to other problems with the data like ceiling effects (Chyung et al., 2020). A ceiling effects are the condition where most of the data are close to the upper limit (Chyung et al., 2020). Ceiling effects can occur due to the measurement tool's sensitivity that leads to a lack of variance (Chyung et al., 2020). Some claim that positively packed surveys can reduce ceiling effects as found by Vita et al. (2013), and Lakin and Chaudhuri (2016) but I found that positively packed surveys need to be used with caution as they may not always reduce ceiling effects (Lam & Klockars, 1982; Masino & Lam, 2014). I also found that in all versions of the UWCAS the distribution of answers was negatively skewed. That is, most people answered that they had a higher tolerance and generally positive attitude towards urban wildlife. The frequency responses used a six-point scale and the agreement used a five-point scale. According to Chyung et al. (2020) there should have been less of a ceiling effect with the frequency data than the agreement data however, the mean for the

frequency data was slightly larger than the agreement data using a five-point scale with a neutral response and slightly less than the agreement data using a five-point scale with no neutral response ($\mu$=3.99, sd =0.46).

I found that exploratory factor analysis (EFA) using ordinal least squares estimation was an effective tool to understand Likert scale data (ordinal data) and parse the items into the elements, or factors, that the questions are representing. I then used the UWCAS to measure the attitudes, behaviour, and tolerance respondents have towards urban wildlife. The behaviour of naming wildlife was studied using both frequency of naming wildlife and ability to name wildlife. This behaviour would be classified by Soga and Gaston as intentionality. Immediateness was measured by asking how frequent participants go to a park. Neither intentionality nor immediateness were predictive of answers on the UWCAS. Regarding intentionality, I suggest that one may enjoy and be tolerant towards nature, but that does not mean that they are going to take part in naming the wildlife around them. Frequency of park visits were correlated with one's relatedness to nature (NR6). That is, the more one relates to nature the more likely they are to visit a park. I found that respondents are also more likely to want more parks in urban centers if they relate more with and are more tolerant towards nature but only if the question is answered in a Likert-scale style. In the survey, I had asked two questions, one binomial and the other on a Likert scale. The binomial responses from all surveys show that most people (<80%) want to have more parks in urban settings and average tolerance, as measured by the UWCAS, did not correlate with those answers. Using a Likert scale, however, did shift the correlation significantly. From studying residents who live in Alberta, I found that most individuals who live both within and without urban areas want more urban parks. Because most people want more urban parks, city planners and urban designers can work

closely with wildlife management teams to create biodiverse urban parks. I found that the areas that people believe wildlife should live within cities are the Informal Green Spaces (IGS) and City Parks. Existing literature suggests that if urban development is to be focused on creating "happy cities" then there needs to be an increase in the amount of greenspace and wildlife within the city (Folmer et al., 2019; Montgomery, 2013; Rupprecht, 2017). Other cities should continue to examine the level of tolerance that residence have towards wildlife and these attitudes future research could understand the relationship between level of tolerance as found by the UWCAS and wildlife value orientations as described by Manfredo et al. (2020).

The Urban Wildlife Coexistence and Attitudes Scale is an accurate tool to elucidate the attitudes and tolerance that people have towards urban wildlife. By incorporating items used by Rupprecht (2017) and Purdy and Decker (1989), the psychometrics of the tool are consistent with those found by others and I have demonstrated both divergent and convergent validity. Indeed, the tool does measure what it intends to measure and can be used in future studies to try and understand the attitudes, tolerance, and behaviour people have towards urban wildlife.

Now, with an accurate tool that combines tolerance and behaviour measures, how can researchers invite people to take part in a survey? One way to try and invite people behaviours is through nudges or incentives (Johnson et al., 2012). I found that altering the choice architecture had a significant effect on the number of participants that took the survey. Data collection was completed in with two primary methods of invitation. Method 1 was via a flyer dropped off at the resident's mailbox. Method 2 was an invitation via a booth with research assistants asking park patrons to take the survey. These two methods were compared for effectiveness by comparing hours worked to number of respondents who took the survey. People were more likely to take a survey when they were invited with a booth compared to those who received two

paper invitations by mail. This is consistent with previous literature stating that (depending on survey type) respondents preferred “interview-administered” surveys over mail or web surveys (Smyth et al., 2014). Interview-administered surveys have been shown to reduce cognitive demands by providing support throughout the interview process (de Leeuw, 1992; Smyth et al., 2014). Using an invitational booth allowed me to mimic the setting of an interviewer-administered survey and by having the survey online the patrons could take their time and set their own pace which allowed for a better survey taking experience. The effectiveness, however, was limited to specific cities studied and what time of year the study is conducted. The residents of Lethbridge who took the survey by invitational booth did so in the early spring of 2021. The residents of Calgary and Red Deer took the survey in the late summer of 2021. Seasonal variation may have been a confound in the difference of the number of people who took the survey thus researchers who are wanting to obtain the highest participation rate may need to consider what time of year they are surveying populations. I found that late summer was not ideal as most individuals were avoiding the outdoors because it was too hot for multiple days in a row. Spring had a moderate temperature which enticed more individuals to be outdoors and willing to take a survey. Hours of the day and days of the week were controlled for and thus would not explain the difference in rate of participation per city.

Methods of survey invitation are important for researchers to reach their particular study group, but the way that wildlife encounters are represented in the news, other forms of media and research literature can shape the way that people interact with and view those wildlife (Casola et al., 2020). To date, urban ‘wildlife’ conservation efforts have been primarily focused on vertebrates while invertebrates and plants are either largely ignored as urban ‘wildlife’ or distinguished from urban wildlife (Egerer & Buchholz, 2021). For example, wildlife corridors,

wildlife-friendly gardens, and bird-or bat-monitoring programs through citizen science mainly focus on higher tropic species of wildlife (Egerer & Buchholz, 2021). Urban conservationists, ecologists, and urban planners that promote certain species create spaces to become regionally abundant of those species at the expense of less well-adapted species. This in turn may give rise to the focus of conservation being on vertebrates (McKinney, 2006). That is not to say that no studies have been completed on arthropods, plants or other species, just that they are underrepresented in the literature as urban wildlife and are more often referred to as urban biodiversity (Egerer & Buchholz, 2021).

In my research, I found that when I asked people what their attitude was towards urban wildlife *and* wild plants, some would make the statement that they 'do not have a problem with the plants at all but they do have a problem with some animals' and thus were unsure how to answer the question. More to the point Egerer and Buchholz (2021) made that the way the public perceives the term "urban wildlife", it is necessary for researchers to take the opportunity to build an inclusive framing of 'urban wildlife'. The goal of this type of framing would be to build a more holistic urban wildlife concept and to 'heighten society's appreciation of all urban wildlife' (Egerer & Buchholz, 2021). When I examined the frequency of particular plants that people preferred in their neighborhood, the reasons for wanting particular plants were more focused on reasons associated with the urban ecosystem (*i.e.,* for "food for the bees" or "habitat or food for animals"). By contrast, the reasons for wanting animals was for viewing pleasure (*i.e.,* people liked or loved watching the deer or squirrels) but made little mention of their association with the urban ecosystem.

In all samples of the survey, skunks were the most unwanted and deer the most wanted in peoples' neighborhoods. For the residents of the cities of Lethbridge, Calgary, and Red Deer this

may have been a result of priming. The contents on the flyer that was delivered to each home and the posters that were put up at and around the booth contained a statement that read “Songbirds making you smile? Skunks stinking up your porch?”. It seems unlikely that these answers were primed for because the populations that didn’t have the flyer or poster had the similar results. Having phrases on the flyers to attract attention need to be treated with caution but if the researchers have a specific species they want to investigate, then putting that species on a flyer could act as a nudge for people to take the survey. That nudge may bias the data however, in my experience, it did not.

Collaborations between researchers and city planners could focus on the ways that cities are built to provide nudges or incentives for people to participate prosocial behaviour such as recycling, participating in park clean up, and even taking a survey (Baruch-Mordo, 2009; Montgomery, 2013). Design strategies can aim to improve happiness and sustainability simultaneously (Cloutier et al., 2014). One method would be the use of signage in urban parks. Urban parks and greenspaces facilitate access to nature, increase environmental quality and increase the psychological well-being and physical health of patrons (DeGraaf et al., 2005). Increasing the quality and number of urban parks and greenspaces would provide residents with opportunity to pursue activities that increase their happiness by reducing rumination and activation in the brain region associated with rumination (Bratman et al., 2015). By increasing citizen conscientiousness through education, patrons of parks and greenspaces would be able to increase their attachment to that environment and then, as Bratman et al. (2015) discussed, transform negative psychological states to more positive one's by means of selecting favorite environments to occupy. An educational tool to increase the knowledge of citizens park management teams would be to have signs around the city with QR codes and pictures of species

to help orient citizens and visitors to the species that exist in those spaces. Although the knowledge-attitudes-behaviour models is too simplistic of an explanation to change pro-environmental behaviour, transformation of negative mental perceptions associated with wildlife through experience and education could have a significantly better outcome (Bernstein & Szuster, 2018).

A study conducted by Twedt et al. (2019) looked at the restorative potential different spaces had to mental states. Like others, Twedt et al. (2019) found that respondents perceived city parks as being more restorative when there were few people in the parks (Nordh et al., 2011). By increasing the number of parks and IGS through the city, the occupancy of any one space can be decreased. A decrease in crowding by people by increasing the number of parks could contribute to perceived restorative potential (Twedt et al., 2019). Most individuals in my survey indicated that they would be willing to walk further than 500m to their preferred park or greenspace (94.5%). Previous research also found that people are willing to travel to find a favorite environment to occupy (Bratman et al., 2015). Further, people who score higher on relating to nature (NR6) attend parks more frequently and seek for those opportunities to relax in nature. Previous studies on frequency of urban nature exposure and depression have yielded mixed results and should be investigated with greater rigger to find the strength of the relationship between the frequency of visits to a greenspace and the level of depression in a given urban population (Jakstis & Fischer, 2021). To increase overall health, Mills et al. (2019) believe that restoration of urban microbiol biodiversity will benefit health of humans and aid in treating urban non-communicable disease.

If researchers, city planners, wildlife conservation and management groups and health care professionals are to be successful in promoting better health for all types of residents in

urban centers, I recommend an increase in Informal Green Spaces (IGS) and City Parks. For each demographic, and aside from coulees, these areas are seen by most as acceptable areas for wildlife and wild plants to live in urban settings. As such, design features in City Parks could promote positive interaction with wildlife, and according to my data that positive interaction would come mostly by viewing wildlife or by wildlife providing an ecosystem service. Those ecosystem services could be disseminated by having signs with information (perhaps via QR codes) to allow the causal or frequent user to walk by (take a picture) and increase their knowledge of the biodiversity that lives outside their doorstep. IGS spaces including front lawns, boulevards, and greened alleyways could greatly impact the movement patterns wildlife in urban spaces would use. These paths of connectivity could be used to "herd" wildlife away from more problematic areas of the city, like busy roadways (Egerer & Buchholz, 2021). I suggest that further research could involve more qualitative analysis of Soga & Gaston's five dimensions to uncover the specific and pointed conflict areas that exist across the five dimensions. These added dimensions coupled with understanding tolerance of urban wildlife will continue to inform the decisions that city planners, and wildlife management groups on how to rectify the conflict that exists between wildlife and humans in urban centers and increase the health, happiness and well-being of all residents (Buijs & Jacobs, 2021; Dallimer et al., 2021).

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## Appendix A- Scales Pilot Study (Chapter 3)

***UWCAS***

***Survey questions---Frequency anchors***

1-never 2- almost never 3- sometimes 4- fairly often 5-very often 6- always

1. How often do you have damage from wildlife to your property?
2. How often do you see wildlife in your backyard?
3. How often do you forget about the wildlife in the community?
4. How often are you happy when you see:
    a. wildlife in my backyard
    b. wildlife in my local green strip or park
    c. wildlife destroying my property
    d. wildlife causing a traffic jam
    e. wildlife getting abused by humans
    f. a dead animal of the side of the road
    g. wildlife in the river bottom area near Indian battle park
    h. wildlife in a national park
5. Over the past 2 weeks how often did you interact with wildlife?
6. Over the past 2 weeks how often did you think wildlife was a problem in your neighborhood?
7. How often do the local birds create a problem for you?
8. How often do the local animals create a problem for you?
9. How often do the local plants create a problem for you?
10. How often do you think wildlife in the community are a liability?
11. How often do you think wildlife in the community are an asset?

12. How often do you think you neglect to notice the wildlife around you?

13. How often do you walk down the street without looking around you (example: staring at your phone)?

14. How often are you annoyed by animals on the road?

15. How often do you try to name the wildlife in your neighbourhood?

16. How often do you try to name the plants in your neighbourhood?

17. How often are your daily activities restricted by the presence of wildlife?

18. How often are you daily activities enhanced by the presence of wildlife?

19. Name up to 5 animals you would prefer to have in your neighborhood and why

20. Name up to 5 animals you prefer not have in your neighborhood and why

21. Thinking of the wildlife in the city, what area of the city do you think most wildlife should live? (multiselect)

    a. city center
    b. city parks
    c. private gardens
    d. informal urban greenspace
    e. agricultural areas
    f. coulees

22. Thinking of the wildlife in the city, what area of the city do you think most wild plants should live? (multiselect)

    a. city center
    b. city parks
    c. private gardens
    d. informal urban greenspace
    e. agricultural areas
    f. coulees

23. How close do you live to a local greenspace or park?

    a. 0-100m
    b. 100-200m

c. 200-300m
d. 300-400m
e. 400-500m
f. 500+

***Survey questions***- Agreement anchors
1-Strongly Disagree 2 Disagree 3- Neither agree nor Disagree 4-Agree 5- Strongly agree
state whether you Agree or Disagree with the following statements.

1. I get frustrated with the wildlife in my backyard
2. I enjoy the wildlife in my backyard
3. I don't notice the wildlife in my backyard
4. I get frustrated with the wildlife on the roads
5. I enjoy see wildlife and wild plants throughout the city
6. Wildlife and wild plants in the city just cause problems
7. Wildlife and wild plants should be kept out of the city
8. The wildlife in my backyard are unwanted
9. The wildlife in the city is beneficial
10. The wildlife in the city parks is enjoyable
11. I avoid areas of the city where there is a lot of wildlife
12. I tolerate most levels of property damage by wildlife**
13. I tolerate most wildlife nuisance problems**
14. I tolerate the ordinary personal safety hazards associated with some wildlife**
15. To protect urban wildlife and plants we have to accept restrictions in our lifestyle
16. Protecting urban wildlife and plants is important, but not if it means changing our lifestyle
17. To enjoy a pleasant and comfortable lifestyle we must avoid losing urban wildlife and plants

18. I can name at least 5 I wild plants in my neighborhood*

19. I can name at least 5 wild animals in my neighborhood*

20. I can name at least 5 wild birds in my neighborhood.*

21. Name up to 5 animals you would prefer to have in your neighborhood and why

22. Name up to 5 animals you prefer not have in your neighborhood and why

23. How close do you live to a local greenspace or park?

    a. 0-100m
    b. 100-200m
    c. 200-300m
    d. 300-400m
    e. 400-500m
    f. 500+

24. What area of the city do you live in?
    a. North West (North of Whoop-up drive and west of the coulee)
    b. South West (South of Whoop-up drive and west of the coulee)
    c. North Central (North of Highway 3 and Between the Coulee and Mayor Magrath Drive/ 26th St)
    d. South Central (South of Highway 3 and Between the Coulee and Mayor Magrath Drive/ 26th St)
    e. North East (North of Highway 3 and East of 26th St (Mayor Magrath Drive)
    f. South East (South of Highway 3 and East of Mayor Magrath Drive)
    g. Outside of City Limits

*Rupprecht 2017
**Purdy & Decker 1989

Dispositional Empathy With Nature (Tam, 2013)

Nowadays, we often hear news reporting how nature is being destroyed by humans. For instance, rivers are being polluted by chemicals or toxic waste from factories, oceans being polluted by deep-water oil spill, forests being cleared and degraded into wasteland. Many animals and plants living in nature are suffering. We want to know how you think and feel when you hear this type of news. According to this scale (1 - strongly disagree; 2 - disagree; 3 - mildly disagree; 4 - neither disagree or agree; 5 - mildly agree; 6 - agree; 7 - strongly agree), please select a number before each item to indicate your agreement or disagreement with it".

1. I imagine how I would feel if I were the suffering animals and plants
2. I get involved with the feelings of the suffering animals and plants

3. I feel as though I were one of the suffering animals and plants
4. I can very easily put myself in the place of the suffering animals and plants
5. I try to understand how the suffering animals and plants feel by imagining how things look from their perspective
6. I visualize in my mind clearly and vividly how the suffering animals and plants feel in their situation
7. I have tender, concerned feelings for the suffering animals and plants
8. I feel what the suffering animals and plants are feeling
9. I feel the pain the suffering animals and plants are experiencing
10. I feel sympathetic toward the suffering animals and plants

i. Dispositional Empathy with Nature Revised

Nowadays, we often hear news reporting how nature is being destroyed by humans. For instance, rivers are being polluted by chemicals or toxic waste from factories, oceans being polluted by deep-water oil spill, forests being cleared and degraded into wasteland. Many animals and plants living in nature are suffering. We want to know how you think and feel when you hear this type of news. According to this scale (1 - strongly disagree; 2 - disagree; 3 - mildly disagree; 4 - neither disagree or agree; 5 - mildly agree; 6 - agree; 7 - strongly agree), please select a number before each item to indicate your agreement or disagreement with it".

1. When I see or think of pollution, I imagine how I would feel if I were the earth (mother earth).
2. When I see or think of the pollution of the Oldman, I get involved with the feelings of the suffering waterways.
3. When I see or think of the pollution of the Liaohe River, I get involved with the feelings of the suffering waterways.
4. When I see or think of the pollution of the Mississippi River, I get involved with the feelings of the suffering waterways
5. I feel sick when I see or think of pictures of mass air pollution in Lethbridge Winters.
6. I feel sick when I see or think of pictures of mass air pollution in Shanghai, China.
7. I can easily put myself in the place of the suffering waterways and earth.
8. I can easily put myself in the place of the suffering St. Mary's waterways.
9. I can easily put myself in the place of the suffering polluted beaches in Santa Monica California.
10. I can easily put myself in the place of the suffering polluted river banks in Lethbridge.
11. I try to understand how the suffering water and earth feel by imagining how things look from their perspective.
12. I visualize in my mind clearly and vividly how the suffering waterways and airways feel from being polluted.
13. I have tender, concerned feelings for the suffering waterways and airways.
14. I have tender, concerned feelings for the suffering and polluted Oldman River and Lethbridge airways.

15. I have tender, concerned feelings for the suffering and polluted Liaohe River in China and Shanghai China airways.
16. I have tender, concerned feelings for the suffering and polluted Mississippi River and Los Angeles CA, airways.
17. I feel what the suffering polluted waterways and earth feels.
18. I feel sick when I see or think of polluted tap water in the City of Lethbridge.
19. I feel sympathy toward the polluted waterways and the destruction of natural resources.
20. I feel sympathy toward the polluted Oldman River.
21. I feel sympathy toward the polluted Liaohe River in China.
22. I feel sympathy toward the polluted Mississippi River in the USA.
23. It's easy for me to get carried away in anger by seeing the destruction of the environment

**Nature Relatedness Short Form (**Nisbit & Zelenski, 2013)

**Instructions**: For each of the following, please rate the extent to which you agree with each statement, using the scale from 1 to 5 as shown below. Please respond as you really feel, rather than how you think "most people" feel.

| **1** | **2** | **3** | **4** | **5** |
|---|---|---|---|---|
| **Disagree strongly** | **Disagree a little** | **Neither agree or disagree** | **Agree a little** | **Agree strongly** |

1. My ideal vacation spot would be a remote, wilderness area.
2. I always think about how my actions affect the environment.
3. My connection to nature and the environment is a part of my spirituality.
4. I take notice of wildlife wherever I am.
5. My relationship to nature is an important part of who I am.
6. I feel very connected to all living things and the earth.

## Appendix B- Scales Study 2-Lethbridge Residents (Chapter 4)

***Survey questions***- Agreement anchors
1-Strongly Disagree 2 Usually Disagree 3- Moderately Agree (or disagree depending on the question) 4- Usually agree 5- Strongly agree
state whether you Agree or Disagree with the following statements.

1. I get frustrated with the wildlife in my backyard
2. I enjoy the wildlife and wild plants in my backyard
3. I get frustrated with the wildlife on the roads
4. I enjoy see wildlife and wild plants throughout the city
5. Wildlife and wild plants in the city just cause problems
6. Wildlife and wild plants should be kept out of the city
7. The wildlife in my backyard are unwanted
8. The wildlife in the city is beneficial
9. The wildlife in the city parks are enjoyable
10. I avoid areas of the city where there is a lot of wildlife
11. I tolerate most levels of property damage by wildlife**
12. I usually walk down the street without looking around me (example: reading a book or looking at my cell phone)
13. To protect urban wildlife and plants we have to accept restrictions in our lifestyle
14. I think that the City of Lethbridge needs to have more parks and greenspaces in the city.
15. I am willing to walk or bike more than 5 blocks to get to a preferred park or greenspace.
16. I can name at least 5 wild plants in my neighborhood*
17. I can name at least 5 wild animals in my neighborhood*
18. I can name at least 5 wild birds in my neighborhood.*
19. Name up to 5 local wild plants you would prefer to have in your neighborhood and why

20. Name up to 5 local wild animals you prefer not have in your neighborhood and why

21. On average, I go to a local park or greenspace at least:

    a. once a year
    b. once a month
    c. twice a month
    d. once a week
    e. three times a week
    f. almost every day

22. Thinking of the wildlife in the city, what area of the city do you think most wild plants should live? (multiselect)*
    a. city center
    b. city parks
    c. private gardens
    d. informal urban greenspace
    e. agricultural areas
    f. coulees

23. Thinking of the wildlife in the city, what area of the city do you think most wildlife should live? (multiselect)*
    a. city center
    b. city parks
    c. private gardens
    d. informal urban greenspace
    e. agricultural areas
    f. coulees

24. How close do you live to a local greenspace or park?

    a. 0-100m
    b. 100-200m
    c. 200-300m
    d. 300-400m
    e. 400-500m
    f. 500+

* Rupprecht, 2017
**Purdy & Decker 1989

## Appendix C- Scales Study 5- MultiCity Comparison (Chapter 5)

***Survey questions***- Agreement anchors
1-Strongly Disagree 2 Usually Disagree 3- Moderately Agree (or disagree depending on the question "~") 4- Usually agree 5- Strongly agree
state whether you Agree or Disagree with the following statements.

1. I get frustrated with the wildlife in my backyard~
2. I enjoy the wildlife and wild plants in my backyard
3. I get frustrated with the wildlife on the roads~
4. I enjoy see wildlife and wild plants throughout the city
5. Wildlife and wild plants in the city cause problems
6. Wildlife and wild plants should be kept out of the city
7. The wildlife in my backyard are unwanted
8. The wildlife in the city is beneficial
9. The wildlife in the city parks are enjoyable
10. I avoid areas of the city where there are a lot of wildlife
11. I tolerate most levels of property damage by wildlife**
12. I usually walk down the street without looking around me (example: reading a book or looking at my cell phone)
13. To protect urban wildlife and plants we have to accept restrictions in our lifestyle
14. I think that the City needs to have more parks and greenspaces in the city.
15. I usually walk or bike more than 5 blocks to get to a preferred park or greenspace.
16. What wildlife are common to your neighborhood?
17. How abundant are the wildlife in your neighborhood?

18. I can name at least 5 wild plants in my neighborhood*

19. I can name at least 5 wild animals in my neighborhood*

20. I can name at least 5 wild birds in my neighborhood*

21. Name up to 5 local wild animals would prefer to have in your neighborhood and why

22. Name up to 5 local wild animals you prefer not have in your neighborhood and why

23. On average, I go to a local park or greenspace at least:

    a. once a year
    b. once a month
    c. twice a month
    d. once a week
    e. three times a week
    f. almost every day

24. Thinking of the wildlife in the city, what area of the city do you think most wild plants should live? (multiselect)*
    a. city center
    b. city parks
    c. private gardens
    d. informal urban greenspace
    e. agricultural areas
    f. coulees

25. Thinking of the wildlife in the city, what area of the city do you think most wildlife should live? (multiselect)*
    a. city center
    b. city parks
    c. private gardens
    d. informal urban greenspace
    e. agricultural areas
    f. coulees

26. How close do you live to a local greenspace or park?

    a. 0-100m
    b. 100-200m
    c. 200-300m
    d. 300-400m
    e. 400-500m
    f. 500+

# Appendix D: Chapter 4 Descriptive Statistics

Table 4.10
*Descriptive Statistics for Items on the Nature Relatedness Scale Short Form*

| Item Label | Item Details | n | mean | sd | median | min | max | range | skew | kurtosis |
|---|---|---|---|---|---|---|---|---|---|---|
| NR6.1 | My ideal vacation spot would be a remote, wilderness area. | 440 | 3.63 | 1.15 | 4 | 1 | 5 | 4 | -0.64 | -0.31 |
| NR6.2 | I always think about how my actions affect the environment. | 436 | 4.22 | 0.85 | 4 | 1 | 5 | 4 | -1.39 | 2.61 |
| NR6.3 | My connection to nature and the environment is a part of my spirituality. | 434 | 3.73 | 1.16 | 4 | 1 | 5 | 4 | -0.76 | -0.16 |
| NR6.4 | I take notice of wildlife wherever I am. | 436 | 4.54 | 0.71 | 5 | 1 | 5 | 4 | -2.09 | 6.23 |
| NR6.5 | My relationship to nature is an important part of who I am. | 436 | 4.11 | 0.93 | 4 | 1 | 5 | 4 | -1.11 | 1.25 |
| NR6.6 | I feel very connected to all living things and the earth. | 437 | 4.03 | 0.96 | 4 | 1 | 5 | 4 | -0.93 | 0.66 |

Table 4.11
*Descriptive Statistics for Items on Demographics*

| Item Label | Item Details | n | mean | sd | median | min | max | range | skew | kurtosis |
|---|---|---|---|---|---|---|---|---|---|---|
| AGE | What is your age? | 443 | 3.38 | 1.77 | 3 | 1 | 7 | 6 | 0.17 | -1.21 |
| EDUC | What is the highest level of school you have completed or the highest degree you have received? | 441 | 4.2 | 1.47 | 4 | 1 | 8 | 7 | 0.31 | 0.02 |
| RACE | Choose one or more races that you consider yourself to be | 437 | 5.87 | 0.98 | 6 | 1 | 8 | 7 | -2.73 | 10.87 |
| INCOME | Information about income is very important to understand. Would you please give your best guess? Please indicate the answer that includes your entire household income (previous year) before taxes | 418 | 6.93 | 3.74 | 7 | 1 | 12 | 11 | -0.13 | -1.37 |
| RELIG | What is your religious affiliation? | 429 | 2.7 | 1.84 | 1 | 1 | 5 | 4 | 0.22 | -1.85 |
| AOFCITY | What area of the city do you live in? | 443 | 3.13 | 1.95 | 2 | 1 | 7 | 6 | 0.71 | -0.83 |
| GENDER | To which gender do you identify? | 439 | 1.63 | 0.51 | 2 | 1 | 3 | 2 | -0.21 | -1.25 |
| SURVEY1 | How did you learn about the survey? | 333 | 1.65 | 0.92 | 1 | 1 | 3 | 2 | 0.75 | -1.39 |
| SURVEY2 | Willing to participate in future research | 431 | 1.69 | 0.46 | 2 | 1 | 2 | 1 | -0.81 | -1.34 |
| SURVEY3 | Which item did you choose for spinning the wheel | 200 | 1.52 | 0.78 | 1 | 1 | 3 | 2 | 1.06 | -0.55 |

## Appendix F- Recruitment Statement- City of Lethbridge, Calgary and Red Deer

Multiple groups of recruiters will be used in teams of two. We will use a “wheel of fortune” reward board placed in public spaces around the city at various times of the day and week. Recruiters will say,
“Hi, I am _____ and we want to know what you like and don’t like about our urban parks and wildlife. If you are willing to take a short five-to-ten-minute survey you will have a chance to spin our wheel of fortune. You can choose whether you want one of the interior prizes which you get right after you spin, or you can choose the outer prizes and be put into one of the draw amounts.
You must be 18 years old to participate. Are you over 18?”