Feeling is Believing:

Landscape as Communal Influence on Behaviour and Belief

By

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ABSTRACT

Feeling is Believing:
Landscape as Communal Influence on Behaviour and Belief

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This study integrated and applied effective communication concepts to highlight landscape as both medium and method to improve land use decisions, in the face of uncertainty, such as that posed by global climate change. Grounded theory guided the emergence of a communication model to illustrate impacts of land use scenarios in a study area. Scenarios incorporated socioeconomic trends and biophysical data, including localized climate projections and relevant audience traits assumed from prior assessments. Scenario implications were analyzed by comparing their ecological service values; the communication model's effectiveness was evaluated against principles derived from the literature. Results suggest that a communication framework grounded in landscape can improve comprehension of environmental and human needs; however, further testing is needed. This framework can help enable broader landscape understanding through shared experience and engagement. Enhancing communication channels in this way is required as increasingly complex environmental problems demand more collaborative and communal solutions.

Keywords: *landscape, communication, visualization, land use scenarios, uncertainty*

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CHAPTER ONE: INTRODUCTION

1.0 Overview

If "professionalism depends on a body of knowledge about what *ought* to be" (Duffy 1996, in Mitchell 1996, emphasis added), then the profession of landscape architecture must continue to accelerate forward-thinking study. Speculation on landscape futures, such as the outcomes of land management practices under climate change, is especially befitting for the Canadian Prairies. Covering over half a million square kilometers, the Prairie Ecozone (see Fig.1.1, outlined in green), accounts for eighty percent of Canada's agricultural lands, and this land use alone accounts for ninety-four percent of the entire ecozone's land base. It is the most altered landscape in the country (Sauchyn and Kulshresththa 2008), and many rural landscape patterns continue to put increasing demands on already stretched resources.

In certain instances, these land use patterns have led to increased climatic vulnerability. This phenomenon is certainly true in the context of the settlement of the Palliser Triangle, a rough geographic area defined by semi-arid soil moisture that reaches from southeast Alberta, across southern Saskatchewan, to include small portions of southwestern Manitoba (see Fig.1.1). The region is unofficially named after Captain John Palliser, an agent of the British Crown whose expedition reached the area in the mid-1800s. Palliser was not the first European explorer to reach the Canadian Prairies, as the British and French fur trade had thrived along prairie rivers since the 17th Century. Even prior to the fur trade, archaeologists estimate that aboriginal groups, who already had a transcontinental trading system in place before the arrival of Europeans, had lived in the region for 10,000 years (Fung 2000). Palliser was, however, the first European whose mission went beyond the trade of beaver pelts; his mission was to scout a route for the Canadian Pacific Railway (CPR) to settle the West in an act of Dominion sovereignty (Fung 2000). His ultimate verdict was that the region was far too dry to support agriculture and human habitation, and that the railway and corresponding settlement should be limited to the more fertile lands just outside of the triangle (Fung 2000).

Although Palliser was not that far off in his assertion, the region is in fact characterized more by moisture variability than by overall dryness (Sauchyn 2010). The region is prone to wet-dry cycles, as was evidenced during subsequent explorations that took place during wetter periods. The reports from these latter explorations stated that the Palliser Triangle was indeed capable of supporting settlement, and so immigration began in earnest with the completion of the CPR in 1885, which bisected the Triangle from Winnipeg to Calgary via Regina (see

Fig.1.1). To anticipate and entice settlement, the land was surveyed and turned under plow with little regard for its natural characteristics. In spite of this ecological disregard, and thanks largely to a prolonged wet cycle, farming flourished in the area for several decades. The prosperous times came to a devastating end when a decade-long drought occurred during the 1930s, the beginning of which coincided with the 1929 stock market crash (Marchildon 2009). Widespread devastation was experienced as the land dried up, and, without natural vegetation to hold it in place, literally blew away. Thousands of farms were abandoned as survival forced people to either adapt to changing conditions or move on (Fung 2000).

To this day, adaptation and human livelihood are closely linked in this predominantly agricultural landscape, whose successes hinge as much on coping with climatic variability as it does on the fluctuation of global markets. Due to a position in the rain shadow of the Rocky Mountains, the mostly semiarid South Saskatchewan River Basin (SSRB) contains some of Canada's most vulnerable regions (see Fig.1.2). Vulnerability is described as a function of the exposure to and sensitivity of a system to a given hazardous condition (Smit and Wandel, 2006), the most pressing of which are the impacts of climate and climate change on the region's water availability (Sauchyn and Kulshresththa, 2008). Climate models predict an overall drying effect for the future of this landscape, a pattern that is already well documented in both instrumental records and paleoclimatic evidence (Lemmen et al. 1997; Schindler and Donahue, 2006). Adaptation to changing water availability is therefore a vital cultural component of life in the SSRB and the Palliser Triangle.

In response to the widespread devastation caused during the drought of the Great Depression, the flow of the South Saskatchewan River (SSR), Saskatchewan's eponymous waterway, has been dammed and diverted to provide a regulated domestic and industrial water supply for approximately half of the province (Bruneau et al. 2009). Irrigation has been one of the resultant adaptations that allowed agriculture to continue to thrive in the region, and land use practices have largely been dictated by agricultural markets. In recent decades, these land use practices have been intensified in response to institutional and global market change, and with greater fossil fuel and chemical inputs, both local and downstream effects are now known to be part a growing ecological crisis (David Suzuki Foundation 2008; Barrow 2010; Sauchyn 2010). With increasing trends toward large-scale farming operations, soil and water resources are once again being placed under increasing stress within the region. As climate models predict a drier future for the region (Barrow 2010), it would seem that history might very well be repeating itself.

1.1 Research Question

Current research does not yet fully understand adaptation processes in response to climate variability (Sauchyn and Kulshresththa 2008). How exactly we adapt to changing circumstances such as climate, and how we communicate the urgency to do so, on proactive terms, are research goals that demand interdisciplinary scrutiny. Knowledge of environmental degradation caused by our land use practices and their impacts on climate are well known, and yet action at all levels is slow to respond. In the Palliser Triangle, many rural land use practices exacerbate downstream ecological problems such as the eutrophication of Lake Winnipeg. Landscape architecture provides an ideal platform from which to holistically explore adaptation processes on the land, and the water regime of the SSRB offers support as a metaphor of broader cross-boundary connections.

Several scholars have suggested that the failure to adapt proactively is caused in part by problems with our current communication methods (Dilling and Moser 2007; McKenzie Mohr 2011; Sheppard 2012). Nassauer (2012) suggests that part of our ongoing strategies to address environmental inaction is to utilize the landscape as a medium for synthesizing landscape vulnerabilities, and as a speculative method for discussion of how these vulnerabilities may be mitigated through adaptation. The potential is great, but the question remains: in the context of the Palliser Triangle and beyond, how can landscape be used as a communicative medium and method to influence land use decisions in the context of complex environmental and socioeconomic problems such as climate change?

1.2 Goals and Objectives

The goal of this study is to integrate and apply effective communication concepts to highlight landscape as both medium and method to improve land use decisions, in the face of uncertainty, such as that posed by global climate change. This will be achieved by meeting the following objectives:

- develop integrative communication strategy from the literature;
- synthesize biophysical and socioeconomic data to establish baseline dataset for study landscape;
- complete audience analysis to determine beliefs and target behaviours;
- develop message to address audience beliefs and behaviours;

- downscale global climate models to develop local future scenarios that are applied to the study landscape;
- apply communication flowchart principles to study landscape and integrated dataset to create future scenario visualizations;
- evaluate scenario implications and communication flowchart effectiveness.

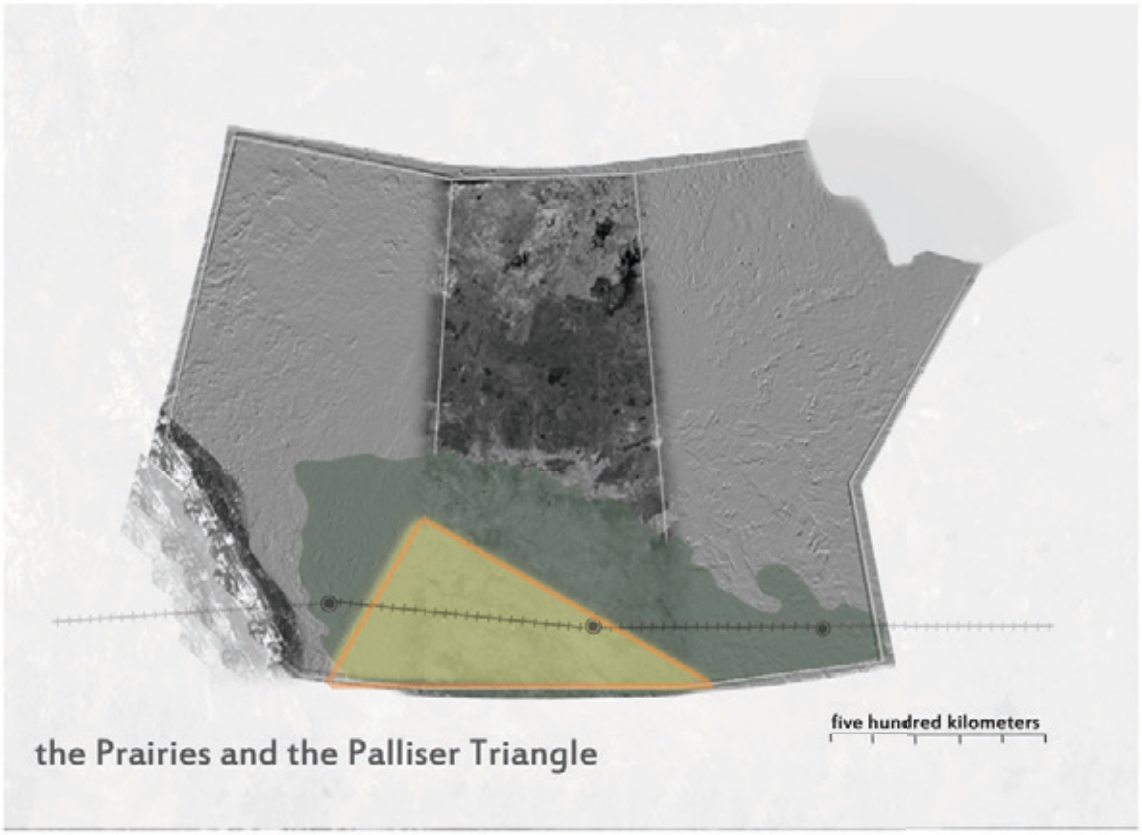

Figure 1.1 The Prairies, The Palliser Triangle, and the Canadian Pacific Railway

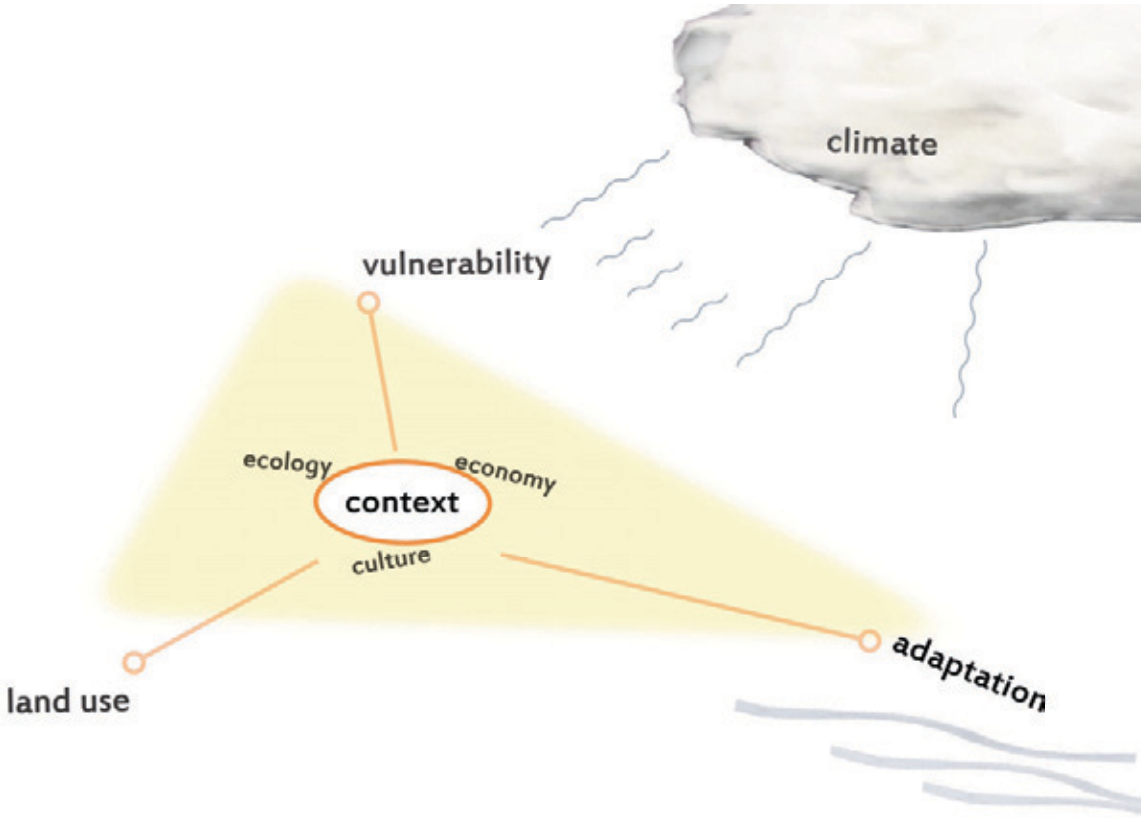

Figure 1.2 First Concepts

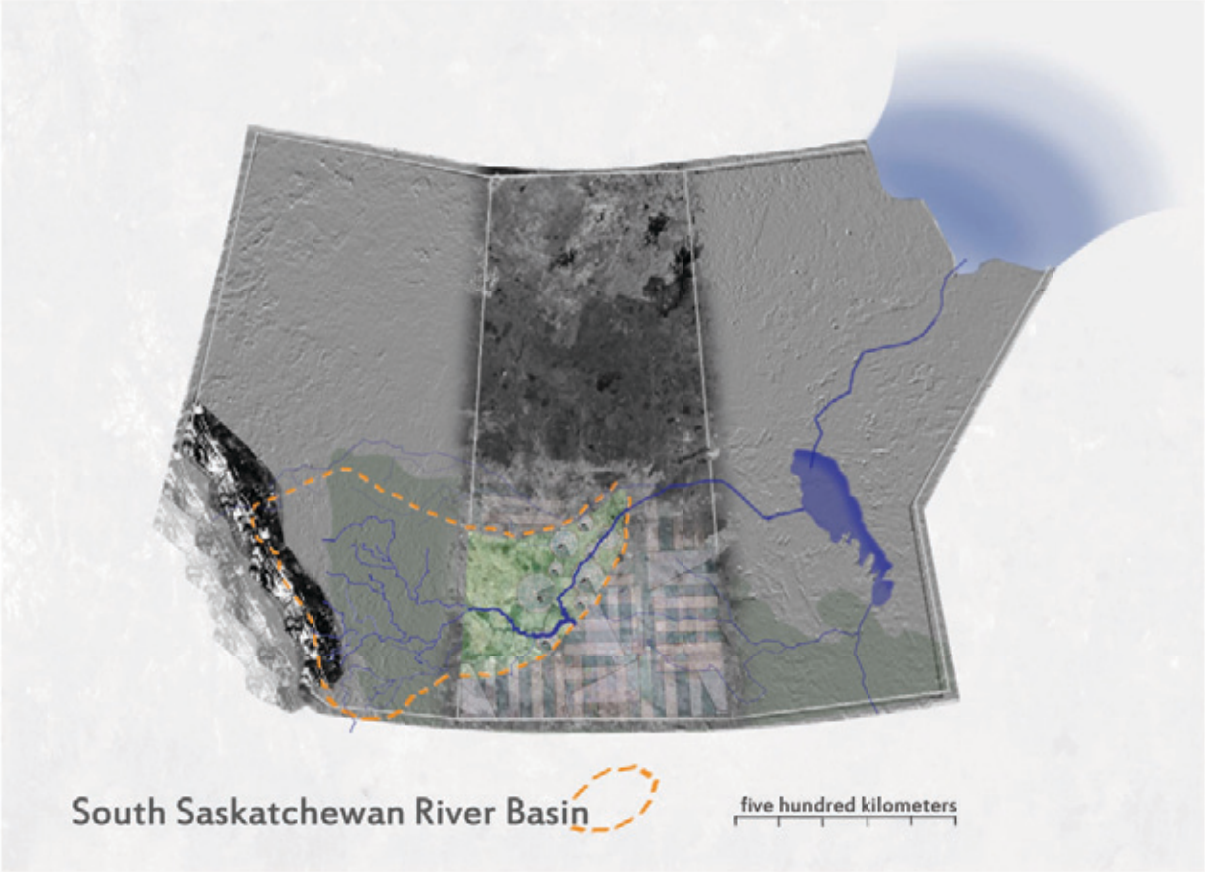

Figure 1.3 The South Saskatchewan River – Water Through a Dry Land

CHAPTER TWO: LITERATURE REVIEW

2.0 Overview

This literature review defines communication from an evolutionary psychology perspective before discussing psychological processes involved in effective influential communication, especially in complex situations such as climate change. It highlights some of the most commonly accepted theories on how persuasive messages are processed to influence behaviour. Visual communication is examined as it relates to the landscape, which is put forth as a medium and method for speculating on shared future outcomes where increased land use complexities are concerned. Ethical considerations of this approach are then briefly discussed.

2.1 Communication

Communication has been said to "include all of the procedures by which one mind may affect another" (Weaver 1963, p.95). This statement hints at the vast psychological and cultural complexities of communication, and many fields have lent their ongoing efforts to its study. Evolutionary inquiry is one such field that has provided a particularly useful foundation for linking the relationships between communication, cognition, and culture (Franks and Dhesi 2011). Evolutionary psychology, based on Darwin's (1859, as cited in Koerner & Floyd, 2010) theory that, at the genetic level, mutations or adaptations that are beneficial for survival are selected and passed on to offspring, has helped to advance understanding of communication as part of the evolutionary process. This theory includes social compulsions such as communication under the heading of evolved psychological mechanisms, which are continually evolving adaptations (Koerner and Floyd 2010). These adaptations occur within particular environmental and cultural circumstances that favour the adaptation in question, which may eventually seem contrary to contemporary circumstances (Buss 2008; Koerner and Floyd 2010). A well-known example of this phenomenon is the human preference for fatty foods that once ensured a sufficient caloric supply but now poses widespread health problems. Consequently, humans sometimes approach contemporary dilemmas with out-dated adaptive mechanisms (Buss 2008). Viewed through this lens, the potential for communication "to make an adaptive contribution to solving problems" (Franks and Dhesi 2011, p.231) takes on growing relevance in an increasingly complex world. Communication can therefore be regarded as an adaptive

measure whose ongoing adequacies must be continually evaluated against current and projected circumstances.

Communication literature suggests several ways to further define the concept of communication. The most basic model involves the linear transmission of information between sender and receiver (Shannon 1963), while other models emphasize contextual elements such as culture and perception (Windahl, Signitzer and Olsen 2009). Merten (1977, as cited in Windahl, Signitzer and Olsen 2009) categorized 160 definitions of communication as either a one-way process, such as interpretation, or as a two-way process, including any social interaction where messages are exchanged. Data is carried by a message across a medium, and becomes information when received and processed through cognition (Meadow 2002). Information has been defined as the choice among a set of alternatives (Rogers and Kincaid 1981, as cited in Windahl, Signitzer and Olsen 2009), or the reduction of uncertainty when faced with a choice between several options (Wersig 1974, as cited in Windahl, Signitzer and Olsen 2009). In order to reduce uncertainty, information must contain meaning, a construct that is largely context-dependent (Meadow 2002). Communication can therefore be defined as an exchange of information that is laden with subjective meaning (Windahl, Signitzer and Olsen 2009), applied to reduce uncertainty among a set of choices. Whether to inform, warn, convince, entertain, or incite action between two people or among groups (Meadow 2002), communication is adaptive and purposeful. Spitzberg (2003) argues that *communication* and *social interaction* are interchangeable, and the importance of communication as a social function cannot be overstated. Communication skill has been linked to psychological well-being and physical health (Greene and Burleson 2003; Spitzberg and Cupach 2003, as cited in Spitzberg 2003). This link could be arguably extended beyond the health of the individual to that of society and its environment; such problems are exemplified by the communication issues surrounding land use, impacts, and global climate change.

2.1.1 Communication and Global Issues such as Climate Change

There is growing understanding of human behaviour's impact on both causing and alleviating many social problems (Fishbein and Ajzen 2010), and this understanding takes on particular relevance in the context of global climate change. Climate change is one of the most pressing social problems facing the world today, and scientific consensus is that current shifting climatic patterns are largely due to human activity. Burning fossil fuels for energy and land-use

conversions, such as clear-cutting forests for livestock agriculture, are causing greenhouse gases (GHG) such as carbon dioxide, methane, and nitrous oxide to be released into the atmosphere at unprecedented rates. The natural carbon cycle has been pushed beyond its usual balance, trapping C02 in the atmosphere and in the oceans. The combined effects are causing climate patterns to change and global temperatures to rise, particularly at higher latitudes, while raising the acidity of the ocean. Experts agree that even with immediate and drastic mitigation action, current C02 levels will cause impacts felt for decades to come (IPPC 2007).

Complicating matters is the level of inaction in response to the problem in spite of widespread awareness (Dilling and Moser 2007; Pidgeon 2012). Several explanations have been offered to explain this lack of action, and many theories suggest that communication problems are largely to blame (Dilling and Moser 2007; Sheppard 2008; CRED 2009; Pidgeon 2012). A problem is said to be affected by communication when it results from the wrong type or lack of communication, and whether communication can help to solve it (Windahl, Signitzer and Olsen 2009). Climate change inaction is not a matter of a lack of communication or understanding, as information about the issue has been in the realm of common knowledge for decades. Unfortunately, the amount of information a person has about an issue has little to do with performing a certain behaviour related to that issue (Fishbein and Ajzen 2010). This is evident in the case of climate change as global GHG emissions continue to rise at increasing rates in spite of widespread awareness of the issues. The climate change inaction problem must therefore involve the wrong type of communication.

A large cause of global climate change inaction is that personal and local relevance and understanding of the issue have not been emphasized, preventing the need for adaptive measures to be made clear (Sheppard 2005; Dilling and Moser 2007; Sheppard 2008; Sheppard 2012). Some of the obstacles in this regard stem from the uncertainty of climate change modeling, the lack of immediate or visible concern for climate change, and the fact that, relative to the human lifespan, climate change occurs slowly, its effects often lagging significantly behind its causes (IPCC 2007). As such, climate change impacts and its solutions do not evoke a sense of urgency, a problem exacerbated by the media's biased portrayal of the issue (Moser and Dilling 2007). As Moser and Dilling (2007) summarize, it is "the inherent natural characteristics and deep societal roots of climate change stack the deck against the issue being recognized as an urgent and actionable problem" (p.8). It therefore seems clear that the uncertainty of climate change poses particular problems for effectively communicating the urgent need for action, and that new strategies are required to communicate that need.

2.2 The Place for Persuasion

Of the various interrelated facets of communication, this review pays particular attention to persuasion because, as Perloff (2003) suggests, it is at play in nearly every human interaction. Dialogue, while a necessary objective in addressing a given problem with communication, is ineffective in its own right. In order for change of any kind to occur, especially when outcomes are uncertain, influence must play a role. Much of the persuasive communication literature uses influence and persuasion interchangeably (Dillard and Marshall 2003; Perloff 2003Gass and Seiter 2007), and so both terms will be used to describe the same concept from this point forth.

Persuasion has been further defined in many ways. At the simplest level, persuasion is defined as the investigation of attitudes and how they can be changed (Petty and Cacioppo 1986; Perloff 2003). Depending on the author, emphasis is placed on different elements of this definition, either focusing on the belief or attitude to be influenced (Petty and Brinol 2012; Petty and Cacioppo 1986) or the process by which persuasion occurs (Rogers 2007). All consulted definitions emphasize that behavioural change is the ultimate goal of persuasion (Petty and Cacioppo 1986; Perloff 2003; Rogers 2007; Fishbein and Ajzen 2010; Petty and Brinol 2012), which must occur in the context of free choice (Perloff 2003). Persuasion may operate as either the formation, reinforcement, or conversion of beliefs, attitudes, or intentions (Dillard and Marshall 2003). It is thought that beliefs are easiest to change, followed by attitudes, and that behaviours are most difficult to influence (Dillard and Marshall 2003; Perloff 2003; Fishbein and Ajzen 2010). Comprehensively, then, persuasion involves “the activity of creating, reinforcing, modifying, or extinguishing beliefs, attitudes, intentions, motivations, and/or behaviours within the constraints of a given communication context” (Gass and Seiter 2007, p.34).

Aristotle is said to have defined rhetoric as “observing, in a given case, the available means of persuasion” (as cited in Dillard and Marshall, 2003, p.481; Gass and Seiter 2007, p.187). This observation demonstrates the close relationship between persuasion and rhetorical discourse, and suggests that the available means of persuasion largely depend on how a message is received by the audience. Dillard and Marshall (2003) state that two fundamental tasks of persuasion--audience analysis and message production--can be gleaned from this observation. How these two tasks are accomplished depends on other concerns and constraints, and the context in which these latter considerations come into play.

The role of persuasion is often thought to be the realm of politics or advertising, although research has found that most persuasion occurs within intimate relationships (Rule, Bisanz and Kohn 1985, as cited in Dillard and Marshall 2003). What is common to all instances of persuasion is one of seven naturally-occurring influence goals, as outlined by Cody et al. (1994), Dillard (1989), and Rule et al. (1985) (as cited in Dillard and Marshall 2003). These goals include providing advice, obtaining assistance, sharing activity, influencing or changing belief or behaviour, changing a relationship dynamic, acquiring permission and enforcing obligations (compel to fulfill promises or change behaviour). Of these goals, only influence on belief and behaviour will be discussed further in this review.

These primary motivations are typically accompanied by secondary goals. As the number of secondary goals increases so does the complexity of the situation and the skills required to operate within it (Dillard and Marshall 2003). Climate change communication provides a prime example of this increased "goal structure complexity" (Dillard and Marshall 2003, p.483). To be persuasive, communication on something as complex as climate change must take into account not only the goals of the communicator, but also the target characteristics of the audience, including beliefs, attitudes, and relevant behaviours, and the processes by which audiences process persuasive messages (Dillard and Marshall 2003).

2.3 Persuasive Communication Outcomes

One of the most researched behavioural influence models is the theory of reasoned action (TRA), first put forth by Fishbein and Ajzen (1975, as cited in Gass and Seiter 2007)(see Fig.2.1). This theory posits that beliefs, defined as "subjective probabilities," are shaped by various personal and social factors, which in turn influence how people acquire and retain information (Fishbein and Ajzen 2010, p.221). Personal and social factors, including personality traits, emotion, values and stereotypes, risk perception, past behaviour, education, age, gender, religion, income, ethnicity, and culture are shaped by available knowledge and information (Fishbein and Ajzen 2010). As such, people from different backgrounds often develop different beliefs, which variably influence intentions to perform a behaviour or not.

The theory emphasizes the importance of three kinds of primary beliefs as influenced by various individual, social, and emotional factors. Behavioural beliefs involve the subjective probability that performing a behaviour will result in a certain outcome, and these beliefs are assumed to determine the *attitude* toward personally performing the behaviour (Fishbein and Ajzen 2010). If these behavioural beliefs are evaluated to be more positive than negative, then

the resultant attitude is likely to be positive. *Injunctive* or *prescriptive normative beliefs* involve the subjective probability of how significant others may approve or disapprove of performing a behaviour. Injunctive beliefs influence the *perceived norm* or the perceived social pressures to engage in a behaviour or not (Fishbein and Ajzen 2010). If it is perceived that a majority of others approve of a behaviour, and if that same majority performs the behaviour, social pressure will likely be in favor of performing the behaviour. Lastly, *control beliefs* involve the subjective probability that personal and environmental factors may help or hinder performance of a behaviour. Control beliefs influence one's perceived behavioural control, or one's perceived *self-efficacy* to perform a behaviour (Bandura 1986, as cited in Fishbein and Ajzen 2010). If control beliefs are seen to facilitate an action more than impede it, perceived behavioural control should be high. Once formed, attitudes, perceived norms, and perceived behavioural control then guide intention or readiness to perform a behaviour. If the three evaluative components are all favorable, the intention to perform the behaviour is likely to be strong. As Fishbein and Ajzen (2010) note, however, the strength of intention varies according to both the behaviour and the population in question.

As shown in Figure 2.2, a strong intention is further moderated by elements of actual control, which include the possession of required skills to carry out a behaviour or the presence of environmental barriers preventing action from being taken. Therefore, it is only when individuals have actual control that intent can be used to gauge behavioural outcomes. Skills and barriers must therefore be addressed to accurately predict such outcomes.

The three evaluative predictors of intention can vary in their importance for different people in different circumstances. This observation helps to explain why those with similar attitudes, perceived norms, and perceptions of control might behave in dissimilar ways (Fishbein and Ajzen 2010).

According to the TRA, primary beliefs - the behavioural, normative, and control beliefs shaped by various background factors - must be the target of any intervention aimed at changing behaviour (Fishbein and Ajzen 1981, as cited in Fishbein and Ajzen 2010; Yzer 2013). Many such strategies exist, ranging from private therapy sessions to mass media or community-based social marketing campaigns. Perhaps the most widely-used strategy aimed at behavioural change is that of persuasive communication, which must be directed at primary beliefs if it is to be effective. Unfortunately there are "no general guidelines to tell us what kind of information should be included in the message to maximize the likelihood that the desired

changes in primary beliefs will be produced" (Fishbein and Ajzen 2010, p.338).

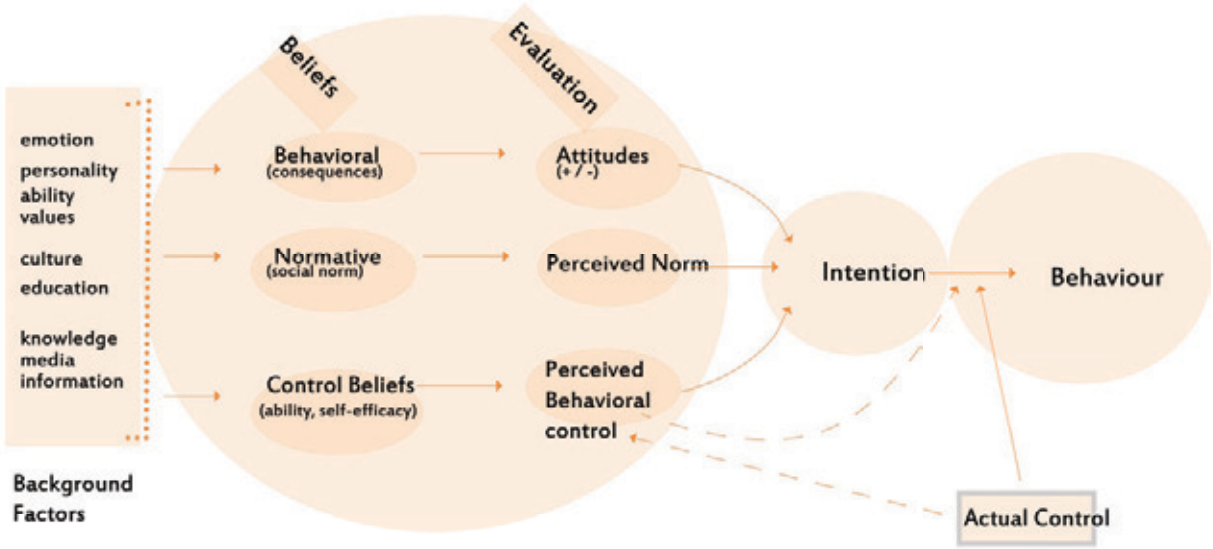

Figure 2.1 Theory of Reasoned Action, adapted from Fishbein and Ajzen (2010)

2.4 Persuasive Communication Processing

In the 1950s and 1960s, Carl Hovland and colleagues at Yale University ran several experiments to analyze the effectiveness of persuasive messages under the assumption that such messages simply had to be attended to, comprehended, and accepted (Fishbein and Ajzen 2010). Like many studies since, the Hovland experiments did not address specific message content (Fishbein and Ajzen 2010) or the cognitive processes used to analyze them (Perloff 2003). These investigators assumed that the same factors would influence message effectiveness regardless of the variable targeted for change, whether belief, attitude or behaviour. Arguments in the Hovland tradition therefore do not address primary beliefs and so may not be very effective (Fishbein and Ajzen 2010). The most generally applicable results from these studies concern the positive correlation between source credibility and effective persuasion (Fishbein and Ajzen 2010).

The knowledge gaps in the Hovland tradition led to the development of the Cognitive Response Approach to Persuasion, which asserts that an individual's own mental reactions to a message are likely more important than the message itself (Brock 1967; Greenwald 1968, as cited in Perloff 2003). While the consideration of cognition greatly advanced persuasion research, it did not shed light on specific processes by which persuasive messages actually

influence people (Perloff 2003). Process-based models of persuasion were then developed to address this question (Perloff 2003).

Petty and Cacioppo's *Elaboration Likelihood Model of Persuasion* (ELM, 1986) is one of the most widely referenced processing models in the persuasion literature (Gass and Seiter 2007; Fishbein and Ajzen 2010). This model operates under a definition of elaboration that involves personal involvement and scrutiny of evidence (Bilandzic and Busselle 2013). This model suggests that persuasion functions within two tandem operations: the central processing route, which relies on high elaboration likelihood and active, evaluative cognition; and the peripheral route, which relies on cues that are indirectly attached to the message due to low elaboration likelihood (See Fig.2.2). Petty and Cacioppo (1986) admit to the possibility of parallel processing, but state that an individual will typically favour one route over the other. A person's motivations and cognitive ability will usually dictate which type of processing is used in a given situation (Fishbein and Ajzen 2010). As Dillard and Marshall (2003) state, "when individuals are unable or unmotivated to expend cognitive effort on message processing, they will turn to heuristics [to] resolve the question of what to do or believe" (p.485).

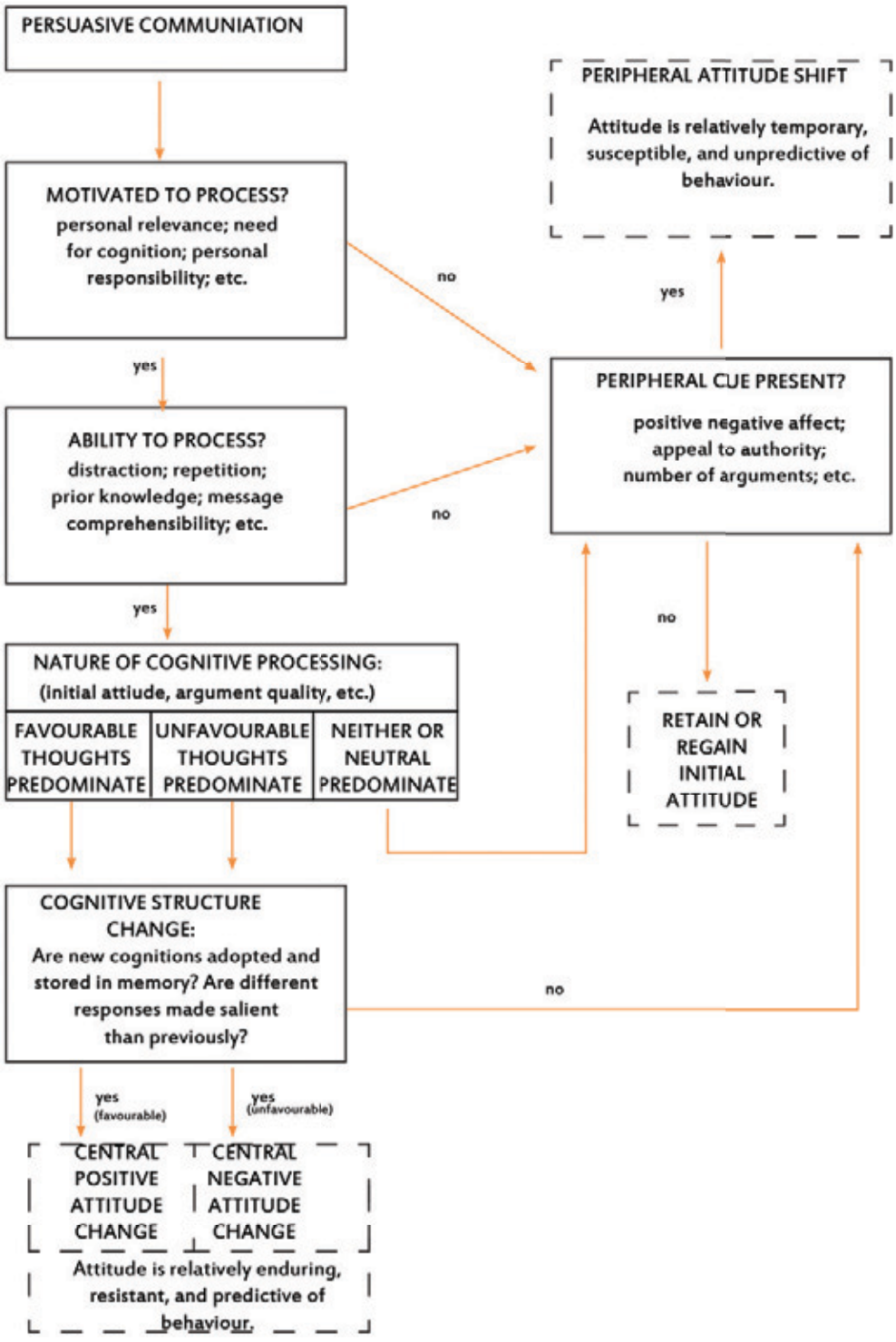

Figure 2.2 Elaboration Likelihood Model of Persuasion (adapted from Petty and Cacioppo 1986)

Shah and Oppenheimer (2008, as cited in Ray 2013) suggest that heuristics, often described as mental shortcuts, involve basic principles such as relying on fewer cues, integrating less information, and examining fewer alternatives. Heuristics can be as simple as the number of arguments present or physical attractiveness of the speaker. There are several examples of well-known heuristic mechanisms that are used to great persuasive effect in fields such as sales and advertising, and Cialdini (2007) ominously dubs these mechanisms as the "weapons of influence" (p.1). Combat imagery aside, Cialdini's (2007) classic examples of heuristic mechanisms include the contrast principle, the social tendency toward reciprocity, commitment and consistency, reliance on social norms, the desire to be liked by others, appealing to celebrity or authority, and the inverse relationship between demand and scarcity.

Western societies stress the importance of conformity, which can be used effectively in persuasion (Dillard and Marshall 2003). Cialdini (2007) terms this phenomenon as *social proof*, where individuals look to others for cues as to how they should act in a given situation. Commitment is another heuristic related to conformity. This principle implies that people are more likely to agree to a given task if they have previously agreed to a smaller related task. This tendency has been termed the *foot-in-the-door* effect (Cialdini 2007; Gass and Seiter 2007). *Door-in-the-face* operates in the opposite direction (Dillard and Marshall 2003). Both principles rely on the *perceptual contrast effect* (as cited in Gass and Seiter 2007, Cialdini 2007), which makes a subsequent option appear much better or worse than it is in reality when compared to the adjacent option. Reciprocity involves the tendency for humans to note social debts and assets, and to comply to requests when they feel obligated to reciprocate. This tendency serves an evolutionary function of collaborative sharing of resources (Cialdini 2007). Responses to these adaptive mechanisms typically rely on mental shortcuts that do not closely evaluate all circumstances, potentially rendering the receiver of such persuasive messages vulnerable to persuasive manipulation. Such strategies can be countered, however, with high elaboration likelihood and central processing.

In order for the central system to be engaged, an individual must be personally involved (Dillard and Marshall 2003; Perloff 2003; Gass and Seiter 2007) and have the ability to cognitively process the message (Fishbein and Ajzen 2010). Novel situations have also been shown to engage central processing (Fishbein and Ajzen 2010; Sheppard 2012). Researchers have provided evidence suggesting that persuasion via the central route tends to be more permanent than persuasion via the peripheral route (Petty, Haugtvedt and Smith 1995, as cited in Gass and Seiter 2007; Fishbein and Ajzen 2010). Emotions have also been suggested to play an important role in processing, in that they "paradigmatically provide for motivation"

(Roeser 2012, p.1033). If emotion is viewed as a key factor in motivation, it can therefore be seen as a vital component in central processing, as per Fishbein and Ajzen (2010).

When the central system is engaged, message effectiveness will be determined largely by the quality of the arguments; strong arguments evoke high elaboration likelihood, while weak arguments are easily countered and have little impact on beliefs about the issue (Fishbein and Ajzen 2010). When the peripheral mode is engaged, argument quality is of little importance and heuristics are used instead (Petty and Cacioppo 1986; Chaiken and Eagly 1993; Cialdini 2007; Fishbein and Ajzen 2010). The ELM posits that central processing must be engaged to bring about lasting fundamental changes in beliefs and attitudes (Petty and Cacioppo 1986; Gass and Seiter 2007; Fishbein and Ajzen 2010). Persuasive messages must therefore engage the central processing mode by making message content personally relevant to the audience, eliminating distraction, and making messages clear and readily understood in novel ways. ELM did not investigate what exactly makes a strong argument, and so far there is no validated method for creating them in a completely objective sense (Fishbein and Ajzen 2010).

The theory of reasoned action can provide some guidelines, however. The most important of these is that primary beliefs must be determined and addressed directly in persuasive messages (Fishbein and Ajzen 2010). Strong arguments can therefore be described as those that address primary beliefs directly, thereby making the issue personally relevant and counter-arguing erroneous beliefs at the same time. Fishbein and Ajzen (2010) caution, however, that this may not be enough to change behaviour. They state that even if a primary belief is changed, it must be remembered that attitudes, perceived norms, and perceived behavioural controls are created by varying primary belief indicators, and the degree to which these primary indices are changed may not be sufficient to change attitudes, perceived norms, or perceived behavioural controls (Fishbein and Ajzen 2010). They also recognize that behavioural change is not an all-or-nothing process, and many stages may be encountered before a behaviour becomes fixed (Prochaska, DiClemente and Norcross, as cited in Fishbein and Ajzen 2010). The process is therefore one that fluctuates; as perceived norms, perceived behavioural control and intentions become more favourable to a behaviour, people move from one stage to another until the behaviour becomes regular (Fishbein and Ajzen 2010).

2.5 Persuasive Messages

2.5.1 Content

Much of the persuasion literature focuses on areas such as oratory or advertising. For the purpose of highlighting research pertaining to visual persuasion, emphasis will be placed on related features and components.

According to Dillard and Marshall (2003), individuals have been shown to rely on certain fundamental perceptual dimensions to process persuasive messages. The first is *explicitness,* or the extent to which the communicator's intentions are made apparent within the message itself (Blum-Kulka 1987, as cited in Dillard and Marshall 2003; Bilandzic and Busselle 2013). Explicitness is not inherent to a message, but is instead a function of the cultural and linguistic context in which it is delivered (Dillard and Marshall 2003). Inexplicit messages therefore require more work on the part of the audience (Dillard and Marshall 2003), but they allow individuals to draw their own conclusions and may therefore be more persuasively effective (Brehm 1966; Brehm and Brehm 1981, as cited Shen and Bigsby 2013). Explicit conclusions have been shown to impact the credibility of the source, since the attempt to persuade the audience is made apparent (Bilandzic and Busselle 2013; Shen and Bigsby 2013). Other studies suggest findings to the contrary (e.g. Perloff 2003; O'Keefe 1997, as cited Shen and Bigsby 2013). The effectiveness of explicit conclusions likely has more to do with audience involvement and responses to the argument in question.

Persuasive effectiveness has been shown to relate to how the argument is presented. The literature discusses these options as being one-sided, two-sided, two-sided refutational, or non-refutational two-sided (Dillard and Marshall 2003; Shen and Bigsby 2013). Meta-analysis has shown the two-sided refutational approach to be most persuasive (O'Keefe 1998, as cited in Dillard and Marshall 2003; Perloff 2003). Two-sided refutational messages are generally regarded to be more persuasive because they include the opposing arguments and reduce counter-arguing by the audience (Shen and Bigsby 2013). The same studies found that sidedness made no difference when the audience was already favourable to the argument, and that two-sided arguments were more effective when the pre-existing attitude of the audience was not favourable (Allen 1998; O'Keefe 1998, as cited in Shen and Bigsby 2013). Two-sided refutational arguments were also found to increase source credibility (O'Keefe 1999, as cited in Gass and Seiter 2007).

2.5.2 Style

The language used to convey a message is mediated by psychological processes on the part of the audience (Shen and Bigsby 2013). Framing (Kahneman and Tversky 1979, as cited in Ray 2013) is a consideration for the structure of any persuasive message, and there are arguments in favour of both the gain frame and the loss frame. Favor of the loss frame relies on the negativity bias, where individuals assign greater value to losses than to gains, even when they are equivalent (Cialdini 2007; Ray 2013; Shen and Bigsby 2013). The loss frame is evaluated more carefully, since the possibility of experiencing loss goes against an individual's expectations and therefore leads to greater involvement (Shen and Bigsby 2013). Daly and Wilson (2001, as cited in Ray 2013) suggest that, in the context of the evolution of social bargaining, giving up prior gains was regarded as a weakness, and could perhaps invite future demands for more allowances.

Explanations in favor of the gain frame emphasize the positive associations of gains, stating that underscoring losses may be viewed as more intense and perhaps manipulative on the part of the communicator (Shen and Bigsby 2013). Research has not clearly revealed which approach is more persuasive. In the health domain, however, gain-framed appeals have been shown to be more effective at encouraging prevention behaviours such as lifestyle changes, while loss-framed appeals were found to be better at encouraging detection behaviours such as self-screening (Rothman and Salovey 1997, as cited in Dillard and Marshall 2003). Based on these findings, it would seem that context and audience involvement are key.

2.5.3 Figurative Language

In their meta-analysis on the persuasive effectiveness of metaphor, Sopory and Dillard (2002) found metaphors to have a slight persuasive advantage over literal structure. Several possible explanations for metaphor's persuasive effect have been put forth. These theories suggest that metaphor brings psychological reward through either pleasure or release of dissonant tension, that it increases source credibility by making novel comparisons, that it reduces counter-arguments by demanding additional cognition, and that it enhances persuasive potential by increasing cognitive processing ability (Shen and Bigsby 2013). Metaphor has been found to be more persuasive when a more familiar base is used (McGuire 1972, as cited in Dillard and Marshall 2003), and novelty is also needed to improve persuasion (Dillard and

Marshall 2003). Sopory and Dillard (2002, as cited in Dillard and Marshall 2003) found that metaphors should be used at or near beginning of argument for greatest effect.

It should be noted that metaphor is not the only effective example of intense language – basically any language that evokes strong emotions is likely to trigger more careful message analysis (Perloff 2003), as personal relevance is increased and the central processing mode engaged.

2.5.4 Evidence quality and source credibility

As discussed above, explicitness is a key factor in claim evaluation, but it may also discourage favourable source judgments (Brown and Levinson 1987, as cited in Dillard and Marshall 2003). Depending on audience traits and other contextual factors, inexplicit messages may result in perceptions of increased source credibility. This may be due to the lack of perceived attempts at coercion (Brown and Levinson 1987, as cited in Dillard and Marshall 2003). Sawyer and Howard (1991, as cited in Gass and Seiter 2007) state that explicitness depends on audience involvement in an issue: when involvement has been secured, implicit conclusions are best used to allow audience members to draw their own conclusions. If a topic is entirely new to an audience, Kardes et al. (as cited in Gass and Seiter 2007), suggest that explicit conclusions are best, while implicit messages are better suited to situations where audience knowledge has increased. Shrader (1999, as cited in Dillard and Marshall 2003) found that explicit arguments led to more negative appraisals of source credibility in high stakes episodes.

Evidence is regarded as more persuasive when attributed to a credible source (Perloff 2003). For evidence to be effective, the audience must be aware that evidence is present, they must then cognitively process the evidence (dual processing modes), and then they must evaluate the evidence positively (Reynolds and Reynolds 2003, as cited in Dillard and Marshall 2003). The presence of evidence has been shown to have a positive impact on persuasive effectiveness and source credibility (Reinard 1998; Reynolds and Reynolds 2003, as cited in Dillard and Marshall 2003), which has been shown to increase when messages are left implicit (Bilandzic and Busselle 2013; Shen and Bigsby 2013).

Involvement in a message is perhaps the most key factor in persuasive effectiveness. When audience involvement has been achieved (i.e. when the central processing of arguments is engaged), fewer arguments can have a greater persuasive effect if they are of greater quality (Gass and Seiter 2007). When the audience is less involved, appealing to peripheral

processing may be more effective (Perloff 2003). Favourability toward a concept has been found to increase with increased exposure to that concept. Zajonc (1968, as cited in Gass and Seiter 2007) called this the *mere exposure effect.* Increased involvement, coupled with increased exposure to a strong argument, can result in more opportunities for scrutiny and persuasion. With less or no involvement this does not matter since central processing is not engaged (Claypool 2004, as cited in Gass and Seiter 2007).

2.6 Visualization and Persuasion

The study of persuasion has traditionally focused on words (Gass and Seiter 2007), although imagery is also capable of achieving the same ends. Such techniques have a long history in landscape design, as exemplified by Humphrey Repton's famous Red Books or the drawings from any contemporary design competition. Bilandzic and Busselle (2013) state that "images have specific implications for beliefs, and by leading readers to infer these, images may oppose and change existing beliefs" (p.207). Mazzocco and Brock (2006, as cited in Bilandzic and Busselle 2013) suggest that three complementary properties of imagery lead to their persuasive effectiveness: they are easily remembered; they may award fictional or unbelievable events reality status; and they provide an experience linked to the senses. It is this evocative quality of visual imagery that makes them so powerful.

In terms of depth of processing, images act as peripheral cues in that they do not require an accompanying argument (Bilandzic and Busselle 2013). However, Mazzocco and Brock (2006, as cited in Bilandzic and Busselle 2013) suggest that, even if at first processed peripherally, imagery can lead to more lasting persuasive impacts as they help to bridge from peripheral processing to the central processing mode. Central processing is also aided by images when they are closely linked with the main message at hand, and may lead to more careful analysis central persuasion (Bilandzic and Busselle 2013). One way that visualizations might help to activate central processing is by engaging emotions (Sheppard 2005).

Nicholson-Cole (2005) highlights potential for landscape visualization to quickly convey strong messages that condense complex information. One possible explanation is that images are able to spur new associations without supporting logic and evidence, enhancing the "presence" of the representing object and thereby increasing its perceived value (Perelman and Olbrecths-Tyteca 1971, as cited in Hill 2004). Presence is linked to psychological concept of vividness, where vivid information is that which is evocative and specific (Hill 2004). Vivid information, either in the form of figurative language, narrative, or image has been shown to be

more persuasive than non-vivid information (Block and Keller 1997; Smith and Shaffer 2000; Wilson, Northcraft and Neale 1989, as cited in Hill 2004; McKenzie Mohr 2011).

Measuring effectiveness of visualization for behaviour change is still in its infancy (Kenney 2004; Sheppard 2005; Messaris 1997, as cited in Gass and Seiter 2007); however, some progress has been made in this regard (Sheppard 2008; Aurambout et al. 2013). There are many factors at work when it comes to behavioural choice (Fishbein and Ajzen 2010), so asserting that visualization is the definitive answer is not sufficient. However, some evidence supports the impact that visualization and imagery can have on affect and behaviour (Sheppard 2005). Slovic et al. (2002, as cited in Sheppard 2005) showed that visual imagery influenced people's decision-making, and Tufte (1990, as cited in Sheppard 2005) suggests that they are cognitively advantageous over written and verbal information. Community-based social marketing, for example, incorporates such techniques to effectively change behaviour (McKenzie Mohr 2011).

2.7 Strategies for Communicating Future Uncertainty such as Climate Change

Many fields of inquiry have expressed an increasing need for comprehensive strategies that positively influence attitude and behavioural change. Community based social marketing is one such strategy that has been readily adopted in the domains of health, finance, and environmental action (McKenzie Mohr 2011). The communication guidelines contained in the material consulted for this review can be categorized by strategies that address the message recipients, the message itself, and larger social groups to be impacted by the message.

With regard to the recipients, the first, and most important strategy follows the classic refrain to 'know your audience' and to frame your message accordingly. As discussed above, framing implies that messages are constructed in a way that fits with the mental models of the audience, or the mental guides audience members use to makes sense of the world (O'Keefe 2006; Thaler and Sunstein 2008; CRED 2009; McKenzie Mohr 2011). The message itself should include clear, vivid and credible content, translating data in a way that enhances its relevance (CRED 2009; McKenzie Mohr 2011), addressing scientific uncertainty where appropriate (CRED 2009). Fishbein and Ajzen (2010) suggest that the effectiveness of any of these strategies is moderated by the degree to which the strategies address primary beliefs. Sheppard (2012) suggests the following strategies when specifically targeting climate change communication :

- Engage experience
- draw on emotions
- make connections between concepts and social groups
- make it local
- use understandable, scientifically credible information
- balance negative and positive information
- tailor the message to the audience
- use knowledge collaboration strategies by sharing data

Regardless of strategy, O'Keefe (2006) argues that "the skill that is most fundamental to persuasive success is that of adapting messages to audiences" by identifying obstacles and tailoring messages that eliminate or minimize those obstacles (p.331). Sometimes an audience has the required positive attitude about a behaviour but they still fail to adopt it (O'Keefe 2006; Fishbein and Ajzen 2010). In order to connect the existing attitude with the desired behaviour, increasing perceptions of the relevance of the attitude to the behaviour, appealing to emotions, and making the problem more salient have been put forth as effective strategies (O'Keefe 2006; CRED 2009; Roeser 2012).

2.8 The Role For Emotions

Emotion is a difficult concept to define, and our common language does not differentiate between feelings, moods, emotions, passions, affect, or motivations (Ray 2013). Rolls (2012) conceives emotions as states elicited by rewards and gains, or punishments and losses (Bechara 2011). Darwin (1872, as cited in Ray 2013) suggested that emotions evolved as a means of social communication. Among humans, evolutionary psychology views emotion or affect as an older, more basic sub-set of cognition, stating that the two are undeniably interrelated while remaining distinct entities (Panskepp 2007). Emotions can be viewed as a separate-yet-related system, a cognitive amplifier for processes such as memory, perception, thought, and action (Tomkins 1962, as cited in Ray 2013). There are eleven criteria common to all emotions, as put forth by Ekert (1999, as cited in Ray 2013), including universality of cause and effect, quick onset, brief duration, and distinctive subjective experience. The brief nature of emotions was part of their adaptive survival value, for example when seeing something frightening, having a reaction, and then moving away (Ray 2013). Repeated emotional response can lead to longer-lasting moods (Ray 2013). Affect is a broad term that includes all

kinds of feelings (Dillard and Seo 2013). The two terms - affect and emotion - will be used interchangeably from this point.

Emotions are generally seen to involve cognitive, physiological, and behavioural processes (Shiota and Kalat 2011, as cited in Mongeau 2013). They can be conceptualized as "distinct, patterned responses" that are observable in six areas: subjective experience, physiological domain, neurological activity, expression, cognition, and motivation (Dillard and Seo 2013, p.152). Emotional processes have been shown to involve different parts of the brain, from the brain stem only (pleasure and distress) to the medial frontal cortex (decision making), or the orbital prefrontal cortex (evaluations of social norms) (MacLean 1990, 1993, as cited in Ray 2013). The amygdala is one of the main structures involved with emotions, and is located between reception of external sensory information and decision-making (Ray 2013). Humans normally recall emotional material better than non-emotional material, but this is not the case after the amygdala has been damaged (Bechara 2011; Ray 2013). The amygdala has also been shown to be activated in gain vs. loss-framing experiments, supporting the theory that the framing effect is an emotional response to keeping gains and taking risks when losses are perceived (De Martino, Mumaran, Seymour and Dolan 2006, as cited in Ray 2013).

The amygdala has been shown to play an important role in emotion and decision making, and it triggers emotions from particular stimuli called *primary inducers* (Bechara and Damasio 2005, as cited in Bechara 2011). An example is how the amygdala binds the features of a snake with the reaction of fear, since removal of the amygdala in monkeys completely removes their fear response (Bechara 2011)

The primary function of emotion is to guide behaviour (Dillard and Meijnders 2002, as cited in Mongeau 2013), and emotions have long been regarded as having the ability to persuade (e.g. Aristotle 2007, as cited in Dillard and Seo 2013). Emotions function as behavioural motivator, communication of reward or punishment, and social bonding (Rolls 2012; Bechara 2011). As discussed above, emotions are a background factor in belief formation (Fishbein and Ajzen 2010). Moods and emotions, like other background factors, have a strong but indirect impact on intentions and behaviours (Fishbein and Ajzen 2010). People in positive moods tend to evaluate events more favourably than those in a negative mood (e.g., Forgas, Bowere and Krantz 1984; Schaller and Cialdini 1990, as cited in Fishbein and Ajzen 2010; Dillard and Marshall 2003). These effects are "likely to influence behavioural beliefs, such that pleasant affective states would make favorable outcomes appear more likely and the outcomes themselves more positive, whereas unpleasant states would increase the likelihood and negative valence of undesirable outcomes" (Fishbein and Ajzen 2010, p.247).

Fishbein and Ajzen (2010) state that the effects of generalized affective states may not be strong enough to impact evaluative beliefs, though they state that this issue has not yet been systematically investigated.

With regard to persuasive message processing, the ELM (Petty and Cacioppo 1986) suggests that relevant affective states should serve as persuasive arguments by aiding in "assessing the cogency" of arguments when elaboration is high (p.214). When elaboration is high but affective state is irrelevant, bias is likely to result as affect becomes more easily remembered. When elaboration is low due to lack of motivation or ability, affect serves as cue, enhancing attitudes when emotion is pleasant and having a negative effect when unpleasant. When an individual is uncertain about whether to process a persuasive message (moderate elaboration), affect can tip the balance either way (Petty and Cacioppo 1986). In this way, affect can serve as cognitive gatekeepers or amplifiers, depending on whether mood is negative or positive. Several researchers have demonstrated that the quality of decision making suffers when emotional contributions are suppressed by forcing decision makers to systematically consider pros and cons (Zajonc 1980; Wilson and Schooler 1991; Wilson et al. 1993; Damasio et al. 1997; Damasio 1994, as cited in Lowenstein et al. 2001).

2.8.1 Theoretical Emotional Models

Scholars of the discrete emotional model generally agree about the number of basic or discrete emotions, but their lists are not identical (Metts and Planalp 2011). Discrete emotions are believed to be "qualitatively distinct neurological responses" that originate in the amygdala and neocortex regions of the brain (Metts and Planalp 2011, p.285) and are accompanied by physiological responses to automatic evaluations of the environment. They are not cognitive in the intentional sense, but are more like cognitively-recognized automatic signals that are assumed to be expressed universally (Metts and Planalp 2011).

Cognitive appraisal theories provide a widely accepted framework for understanding distinct emotions (Scherer, Schorr and Johnstone 2001, as cited in Dillard and Seo 2013). These theories underscore the link between a cognitive event or appraisal and a particular affective response (Dillard and Seo 2013). Applied to persuasion, appraisals are based on message content and style, and will consider aspects such as relevance, congruence, certainty, cause, control, and legitimacy (Dillard and Seo 2013). The emotional response occur across the six observable areas mentioned above, which impact beliefs, attitudes, intentions and behaviour (i.e. whether persuasion occurred or not) (Dillard and Seo 2013).

Appraisal theorists do not believe that emotions are innate, automatic neurological and physiological response patterns, but suggest rather that they are evaluations of an event (Metts and Planalp 2011). Appraisal theory is helpful in explaining variation in the human experience of emotion (Metts and Planalp 2011) and identifying message content that might incite emotional responses (Dillard and Seo 2013). Fear, for example, is aroused by a sense of danger or high probability of severe harm; anger by a social offense; sadness by loss; happiness by progress; hope by potential progress (Dillard and Seo 2013). Message style refers to how the content is expressed, classically focused on language but now broadened to include editing, point of view and pacing (Dillard and Seo 2013). Language emphasis has focused inquiry on framing, or the view that "stylistic variations shape understanding by selecting, then making salient, certain aspects of a perceived reality to the exclusion of other elements" (Entman 1993, as cited in Dillard and Seo 2013, p.155). Relative to thematic framing, episodic framing has been shown to increase feelings of compassion, pity, anger and disgust (Aaroe 2011; Gross 2008, as cited in Dillard and Seo 2013), but it must be remembered that emotional responses may vary from person to person, and so simplistic generalizations are not advised (Dillard and Seo 2013). As discussed above, gain-frame and loss-frame results are varied (Dillard and Seo 2013). Message accompaniments refer to things such as imagery (Dillard and Seo 2013). Dimensional models of emotion share with appraisal theory that emotions do not have discrete response outcomes or facial expressions, and account for affect bipolarity, or emotional response along a continuum (Metts and Planalp 2011).

What separates human emotional response from other animals is that we can think about emotions, inhibit them, and create them; as Hughlings Jackson noted, "our higher level cognitive processes can re-represent, and thus transform, the lower level emotional processes" (as cited in Ray 2013, p. 209). This means that we can add to or subtract from past emotional reactions and experiences. Humans can also experience emotional responses to music and art (Ray 2013), and it is likely that a parallel can be drawn between landscape and music. The evolution of music has been regarded as closely linked with emotionality, and the creation and maintenance of social bonds. Several studies from around the world suggest that making or enjoying music with others leads to positive emotional feelings and a sense of connectedness, perhaps due to the release of oxytocin in the brain (Freeman 2000, as cited in Ray 2013), a neurochemical linked to pleasant feelings and social attachment (Panskepp 2007; Ray 2013). Other functions of oxytocin are emotional regulation and social engagement and reducing stress levels as measured by heart rate and cortisol (Carter and Porges 2013). Emotional experience in landscape therefore has potential to move from subjective experience to objective dialogue.

2.8.2 Emotion and Climate Change Communication

Roeser (2012) suggests that emotions are the missing component in communicating climate change, and that this more basic level of consciousness must be engaged in order to bring about desired belief and behavioural change. Current thought on the function of emotions suggests that such responses are both cognitive and affective (Roberts 2003, as cited in Roeser 2012) and that they reveal insight into our moral valuations (Zagzebski 2003, as cited in Roeser 2012). Emotional responses of laypeople to risk therefore reflect ethical considerations.

Common thought has often been that emotions can mislead because they are irrational; however, rational thought alone has been shown to be insufficient when making all moral judgments (Damasio 1994, as cited in Roeser 2012) and even in need of emotional correction: "emotions can enable us to make better moral judgments, by helping us to reverse our mistaken rational judgments" (Roeser 2012, p.1036). Rational thinking might actually have a numbing effect, overwhelming with statistics that rational thought renders insurmountable (Slovic 2007, as cited in Roeser 2012). Irrational fears may need correction by rational thought (i.e. statistics), but the latter must be presented in an "emotionally accessible" way (Roeser 2012, p.1036).

Narrative, for example, helps to make the required emotional connection between climate change statistics and meaningful attachment (Damasio 1994, as cited in Roeser 2012), as can art (Nussbaum 1997, as cited in Roeser 2012). Narrative has been broadly defined as symbolic representation of events (Abbott 2002, as cited in Bilandzic and Busselle 2013). Narrative and argument are often placed in opposition to each other in the context of persuasion, a separation likely stemming from Aristotle's distinction between logos and pathos: logic and reason on one hand, emotion and poetry on the other (Herrick 1997, as cited in Bilandzic and Busselle 2013). The distinction was long thought to imply different processing systems as well (Bilandzic and Busselle 2013). This dichotomy fails to recognize the presence of narrative elements in arguments and rhetorical elements in narrative (Bilandzic and Busselle 2013). The two therefore go hand in hand, and narrative is not a mutually exclusive type of persuasion (Bilandzic and Busselle 2013).

The same rules as above apply: effectiveness depends on context, audience motivation, and ability to understand, relevance, explicitness, and so on. Other definitions focus on the plot-independent experiential qualities of narrative, which underscore the notion of empathy (Bilandzic and Busselle 2013). This is why landscape is important, since it itself involves a shared experiential element (Nassauer 2012).

Narrative persuasion is “any influence on beliefs, attitudes or actions brought about by a narrative message through processes associated with narrative comprehension and engagement” (Bilandzic and Busselle 2013, p.201). Most research on the effectiveness of narrative persuasion has focused on health issues, and findings are somewhat contradictory (for a review see Bilandzic and Busselle 2013). A recent meta-analysis found no difference between statistical and narrative messages when all factors were considered, but narrative was found to be more effective when attitudes were singled out as outcome measures (Reinhard and Feeley 2007, as cited in Bilandzic and Busselle 2013). Factors such as audience involvement in the topic, the nature of both narrative and non-narrative evidence, and congruence again come into play. According to accepted narrative theory, the audience of a narrative message counterargue less, explore concepts in more detail, utilize imagery, and vicariously experience the fate of the characters (Bilandzic and Busselle 2013).

With regard to the ELM, only high involvement will lead to careful scrutiny of argument quality, which can result in counterarguing. Narrative processing is different from this type of involvement in that it is emotionally transportative, and may not activate the recipient’s self-concept. However, both models involve intense and active processing, but involvement in narrative should not lead to counterarguing (Bilandzic and Busselle 2013). This is because in narrative persuasion processing the ego is not involved (Bilandzic and Busselle 2013). In other words, narrative helps to reduce counterarguing. Central processing is encouraged by personal relevance that may increase persuasive effects while adding autobiographical emotions evoked by the narrative (Bilandzic and Busselle 2013). Many studies have revealed connections between narrative and behavioural impacts (see Bilandzic and Busselle 2013 for a review).

Landscape aesthetics also has its theoretical roots in emotion, in that “many topographical features of landscapes may be aesthetially attractive because they tap into brain systems that evolved to provide signals of safety and food” (Rolls 2012, p.270). Verdant landcapes evoke health and food availability, and flowers suggest coming fruit (Rolls 2012). From an evolutionary psychology perspective, the landscape is ripe with emotional experience. It is this emotional experience, connoting adaptive survival, that must be harnessed in the climate change discussion.

2.8.3 Emotional appeals

Research has shown that fear appeals can work in persuasive communications (Mongeau 2013). Fear is an internal, negative emotion, while threat involves an external, environmental quality that suggests a potential negative outcome; messages communicate threats, which are then processed into fear (Mongeau 2013). Fear is an emotion that has been linked to increased perceptual attention (Ray 2013; Meijnders et al. 2001, as cited in Roeser 2012), which has made it a focal point in the climate change communication literature. Unfortunately, the discussion of emotional appeals within the literature focuses largely on fear and guilt appeals, largely leaving positive emotional appeals aside.

2.9 Landscape as Medium and Method: Bringing it All Together

Building on J.B. Jackson's (1984) insights on landscape, a strategy captured by Nassauer in her 2012 essay is to utilize the visible, experiential qualities of landscape to engage various interest groups in the discussion of how best to address complex problems that would arguably include those posed by climate change. The strategy is based on two landscape 'laws': the first is that landscape integrates environmental processes; the second is that the visual landscape experience is accessible to everyone (Nassauer 2012)(see Fig.2.3). Jackson (1984) cautions that, in a figurative sense, not all aspects of the landscape are 'visible' to every observer, and that such visibility is a function of personal background and motivation. It is this variation of landscape visibility, knowledge, and interpretation that demands consideration of all viewpoints regarding that landscape. As such, Nassauer (2012) takes the position that a defined landscape can serve as a familiar *boundary object* supported by a shared dataset. Anyone with experience in that landscape, however differentiated, therefore becomes a stakeholder, bound by unique *experiential* qualities in that landscape. These experiential qualities can be argued to be based on emotion.

Beyond serving as medium for engaging all stakeholders in a dialogue, Nassauer (2012) offers landscape as the method, a canvas with which to create speculative, data-based scenarios about the future. This view of landscape as a visionary tool is supported by other scholars (Lange and Bishop 2005; Sheppard 2005; Sheppard 2008; Sheppard 2012;). It is the visual, accessible quality of landscape that makes it an ideal platform for addressing the communication problems associated with climate change. Specifically, visualizations can help by increasing the relevance of global climate science to inspire local action (Sheppard 2008).

Action in this case of course involves decision-making and subsequent behavioural change. In order to evaluate the potential for landscape as medium and method to address climate change and land use related issues, we must look at its potential communicative impacts on communication, and at elements of persuasion in particular.

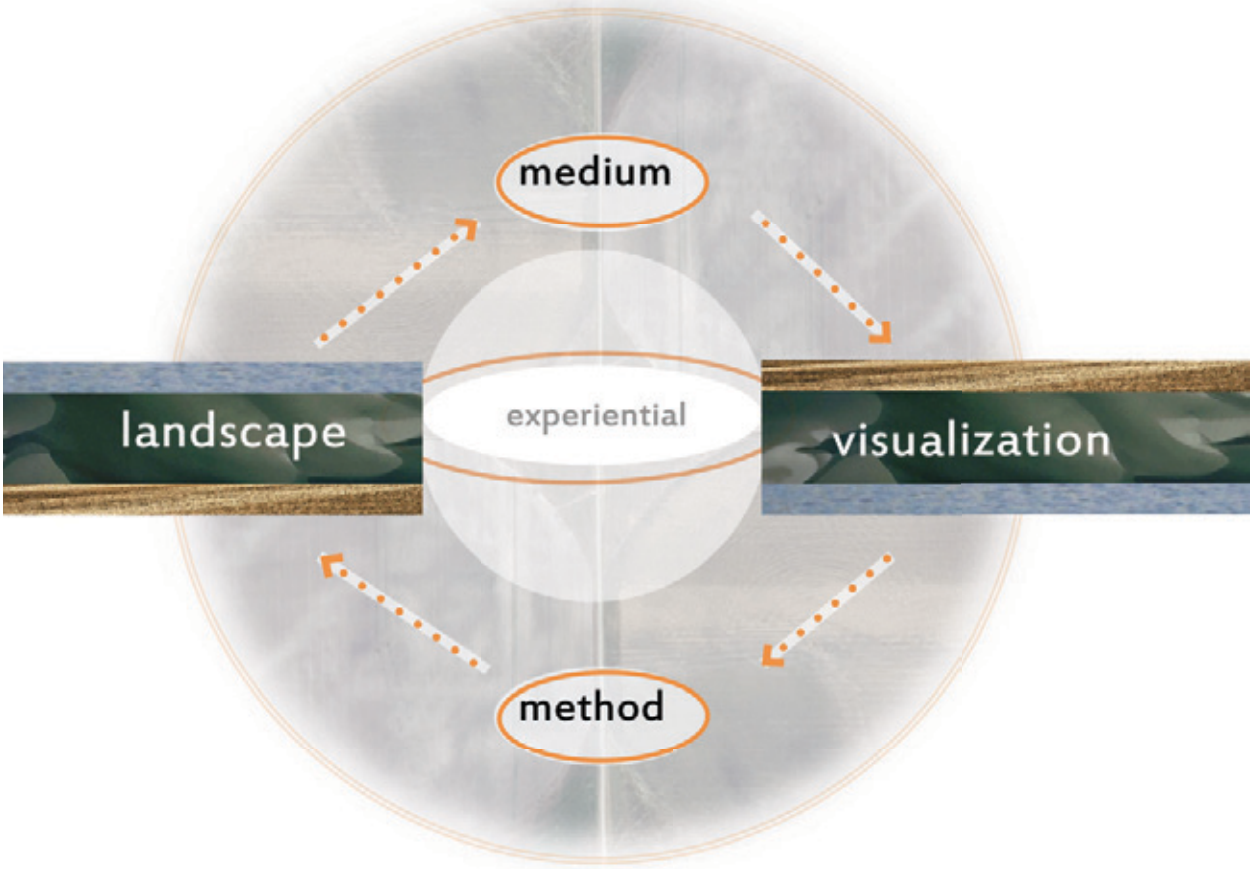

Figure 2.3 Landscape as Medium for Synthesis and Speculative Method

2.10 Landscape Visualization and Ethical Considerations

Sheppard (2005; 2008) stresses the ethical considerations that must be addressed when using visualizations to communicate potentially sensitive data to the end of influencing or bringing about change, and no discussion of persuasive communication would be complete without mention of ethics. Some have argued that persuasion by its nature is unethical, since information is being used to influence. To be sure, there are many historical accounts of persuasive messages being used to horrible ends, though it is important to note that propaganda is distinct from basic persuasion in that the former involves a single group exerting

total control over message transmission (Perloff 2003). In reality, however, persuasion is the basis of many positive, pro-social efforts, such as health promotion and environmental campaigns (Perloff 2003; Gass and Seiter 2007; Fishbein and Ajzen 2010). It must also be noted that suspicion of manipulative persuasion assumes little autonomy and critical thinking on the part of the audience (Roeser 2012).

Thaler and Sunstein (2008) argue that manipulation is an inevitable outcome of presenting information, and encourage its use through "nudges" in a particular behaviour al direction. In effect, the mechanisms of persuasion are themselves amoral, but can be put to good use or bad use depending on the user's motives (Gass and Seiter 2007). Due to the pervasiveness of persuasion, it is impossible to provide information without involving persuasive communication (Fishbein and Ajzen 2010). As Gass and Seiter (2007) suggest, even those who criticize persuasion as unethical are themselves attempting to persuade.

2.11 Summary

This chapter provided an overview of recent communication theory, from its base in evolutionary psychology to strategies aimed at influencing behaviour and belief through persuasion. Theory suggests that any communication strategy with the goal of behavioural change, such as those addressing complex issues (e.g. climate change), must first determine the behaviour in question and the beliefs of the audience regarding that behaviour. Such strategies must make the issue relevant to the audience to ensure the message will be processed with greater cognitive attention, leading to greater chances at lasting changes in belief and behaviour.

Strategies to increase relevance of global issues such as climate change include landscape visualizations, especially when such techniques can harness the shared experiential qualities of landscape. These qualities, arguably based in emotional responses, can improve collective discussions regarding landscape futures. Alternative future landscape scenarios, which use the landscape as medium for synthesis and method for speculation, have been shown to be useful when communicating possible outcomes of our current land use choices.

CHAPTER THREE: METHODS

3.0 Overview

An approach informed by grounded theory was used to derive an influential communication framework from the literature, which was then applied to the analysis of a study site. Application of the developed theory was done by synthesizing and modifying the approaches offered by Nassauer (2012), Sheppard et al. (2010) and Santelmann et al. (2001). The quantitative analyses included calculating projected aridity for the study area, calculating surface areas and corresponding natural capital values by geospatial land cover data. As well, past ecological service values for the study landscape were estimated based on soil types and associated land cover while future landscape scenarios were established based on assumptions of relevant socioeconomic trends within downscaled global climate models of the International Panel on Climate Change (IPCC 2007). Natural capital, or ecological service valuations (ESV), was treated visually rather than using climate change data due to assumed audience beliefs and project timeline limitations. Total ecological service values were calculated for each scenario and then compared. Data were visualized according to the communication principles derived in the framework, which were also used to evaluate communication effectiveness.

3.1 Grounded Theory Methodology and Conceptual Emergence

Grounded theory methodology (GTM) (Glaser and Strauss 1967) was used to derive an influential communication flow chart from the literature. Conceptual emergence (Glaser 1992, cited in Urquhart 2013), a cornerstone of GTM, was deemed to be appropriate to this study since more formal methods are not always appropriate for complex social realities (Landman 2003). Glaser and Strauss, the originators of the GTM, state that grounded theory involves the discovery of theory from data (cited in Urquhart 2013), rather than forcing data to conform to existing theory (Landman 2003; Urquhart 2013). According to Glaser (1992, cited in Landman 2003), the goal of grounded theory is to develop a hypothesis rather than to verify any preconceived ideas, thereby placing the emphasis on exploratory research (Palys 1997, cited in Landman 2003). The new, emergent theory is represented with either a narrative framework, diagrams, or statements of hypotheses (Urquhart 2013). The resultant hypotheses then

contribute to an evolving body of knowledge that is grounded in data (Calloway and Knapp 1995, cited in Landman 2003).

Urquhart (2013) states that guidelines for GTM include constantly comparing data within categories against each other, iterative and theoretical conceptualization of codes to reveal different relationships between them, and theoretical integration. Relationships between constructs are not often causal, since the theory is generally based on qualititative data. Instead the relationships are described as 'A is part of B' or 'A influences B' (Urquhart 2013).

It must be remembered that conceptual coding is reflexive in nature, and does not always follow the same path (Urquhart 2013). This trajectory can lead to the development of cyclical, complex theory that is grounded in particular data yet applicable to a wider context (Hueser 1999, cited in Landman 2003). The systematic process leaves room for exploration of unexpected connections, creativity, and intuition, which leads the researcher to critically examine and reflect on the process (Bailey et al. 1999, as cited in Landman 2003). As an exploratory research methodology, grounded theory is appropriately paired with design-led alternative landscape future strategies (e.g. Hulse et al. 2000; Statesman et al. 2001; Nassauer and Corry 2002; Steinitz et al. 2003). GTM was used under the assumption that a time-constrained literature review of vast subject matter was achievable according to its guiding principles.

3.2. Application of Theory

Grounded theory methodology was used to derive a theoretical framework from the communication literature. The resultant framework or flowchart was then applied to a study landscape and associated dataset.

3.2.1 Defining the "Medium" and Associated Dataset

Nassauer (2012) states that when using the landscape as communicative medium and speculative method, it must be defined as both a boundary object and shared dataset. The study landscape in this instance was pragmatically selected based on data availability. It was chosen due to its location within the Palliser Triangle, and because of the previous vulnerability and focus group assessments of it that had been undertaken by the Institutional Adaptation to Climate Change Project (2011).

Since time and resources were a limiting factor, mini-watershed systems with upland agricultural land use were looked to as a tractable synecdoche for larger interconnected systems. The study area drains into the South Saskatchewan River, one of Canada's threatened rivers whose current status is 'poor' and is forecasted as 'declining' (Huntely 2009), representing even larger systems. The SSR drains into Lake Winnipeg, which was recently named the world's most threatened lake by the Global Nature Fund (2013). This aspect of interconnected vulnerability was similarly used as a criterion in the selection of a study area for climate change visualization in the lower mainland of British Colombia by Shaw et al. (2009). The availability of socio-economic data and vulnerability assessments (c.f. Wittrock et al. 2007; Pittman et al. 2010) was also a key consideration.

3.2.2 Study Area

The study landscape was defined by both geo-political and biophysical features. The South Saskatchewan River forms its eastern boundary, and the surveyed township lines form the boundaries on the other sides. This portion of the township was selected to exclude the town site of Outlook, since the focus of this study is on rural land use. The selected study area is therefore roughly the western half of the township surrounding the town of Outlook (see Fig.3.1).

Corresponding data was not available for the township specifically, so previous assessments of the adjacent rural municipality and town of Outlook were relied on as a proxy. Approximately 2520 people reside in the rural municipality (RM) of Rudy, 2020 of whom reside in the town of Outlook (Statistics Canada 2011). The RM is located along the South Saskatchewan River (SSR) downstream of the Gardiner Dam, which highly regulates water flow for the RM and town of Outlook. The SSR's headwaters are on the eastern slopes of the Rocky Mountains and are predominantly fed by melt water in the spring (see Fig.1.3). The river provides the community with water for domestic use, stock watering, and irrigation. Agriculture is the primary economic activity in the RM, with 11,350 ha. irrigated and 66,296 ha. dryland agriculture (Statistics Canada 2006, cited in Pittman 2010). As of 2006, the primary crops grown in the region were spring wheat, durum wheat, canola, lentils, field peas, canary seed, hay, oats, potatoes, barley and flax. Employment and business opportunities in the area are largely related directly or indirectly to agriculture (Wittrock et al. 2007, cited in Pittman 2010).

Median income for individuals (ages 15 and over) of Outlook after tax was $20 946 in 2005, with only 4.5% of the population considered to be living in low income households after

tax has been deducted (Statistics Canada 2006, cited in Pittman et al. 2010). In the RM of Rudy, median income for individuals (ages 15 and over) after tax in 2005 was $23 181, with 16.1% of the population considered low income after tax (Statistics Canada, 2006b). For comparison, in Saskatchewan 15.8% of the population lives under low-income conditions (Statistics Canada 2006).

Climate varies significantly seasonally and annually (see Fig. 3.2) and extreme weather events are fairly common. Data from the weather station at Outlook, approximately five kilometers from the study area, shows an average annual temperature of 3.4°C and normally receives 337.8 mm of annual precipitation based on the 1971 to 2000 averaging period. The seasonal temperature ranges from an average winter (December, January, February) temperature of 12.6°C to 17.6°C in the summer (June, July, August) (Environment Canada 2009, cited in Pittman et al. 2010). The highest temperature ever recorded in Outlook was 40°C in June 1987 and temperatures dipped down to -42°C in February 1994 (Environment Canada 2009, cited in Pittman et al. 2010). Summer is the wettest season with an average 159.1 mm of precipitation and winter the driest with 40.1 mm (Environment Canada 2009, cited in Pittman et al. 2010). The driest year in Outlook on record was 2001 (198.5 mm) and the wettest year 2005 (534.1 mm), further demonstrating the variable nature of local climate. Drought and extreme precipitation events are familiar aspects of local climate (Wittrock et al. 2007, cited in Pittman et al. 2010).

It was assumed that the data obtained from disparate sources, whose political or biophysical borders did not always overlap exactly, would produce appropriate and valid results. The study area was actually outside of both the RM Rudy and the town of Outlook, but separated only by the South Saskatchewan River. The data used was therefore assumed to be representative of the study area by proxy.

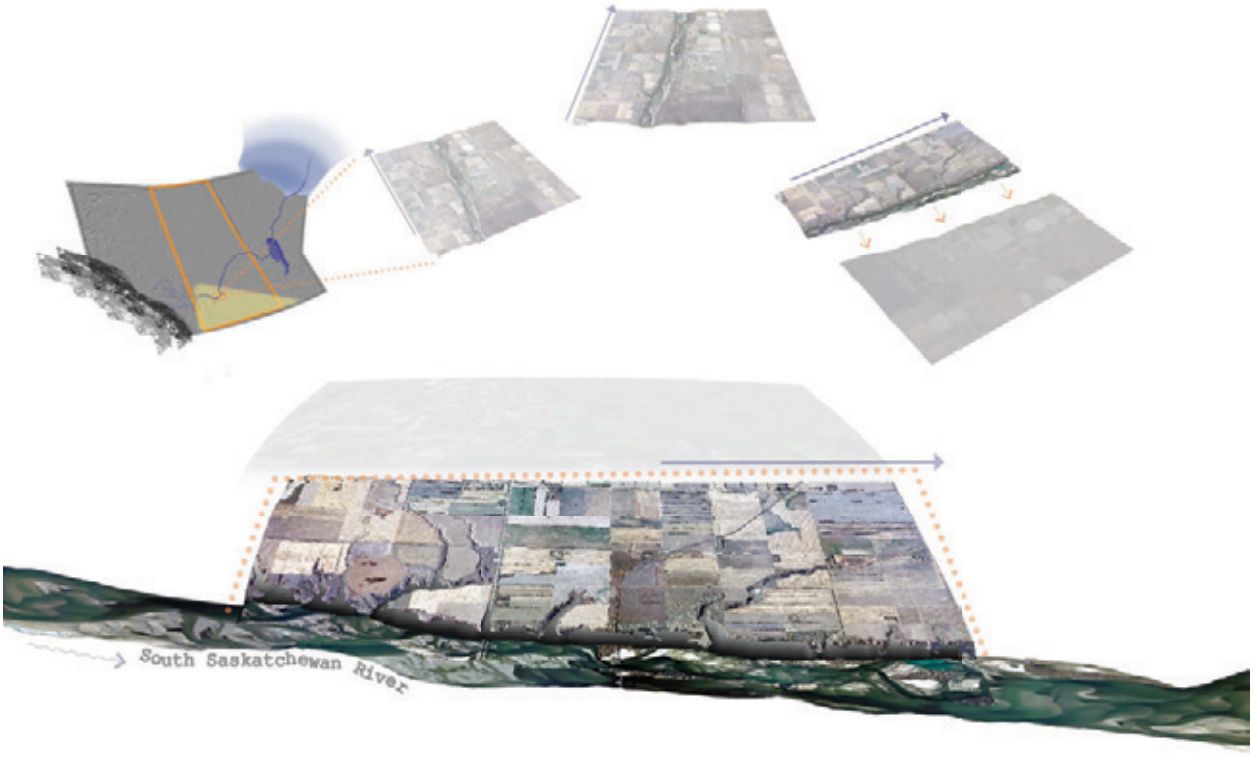

Figure 3.1 Study Landscape – the "medium"

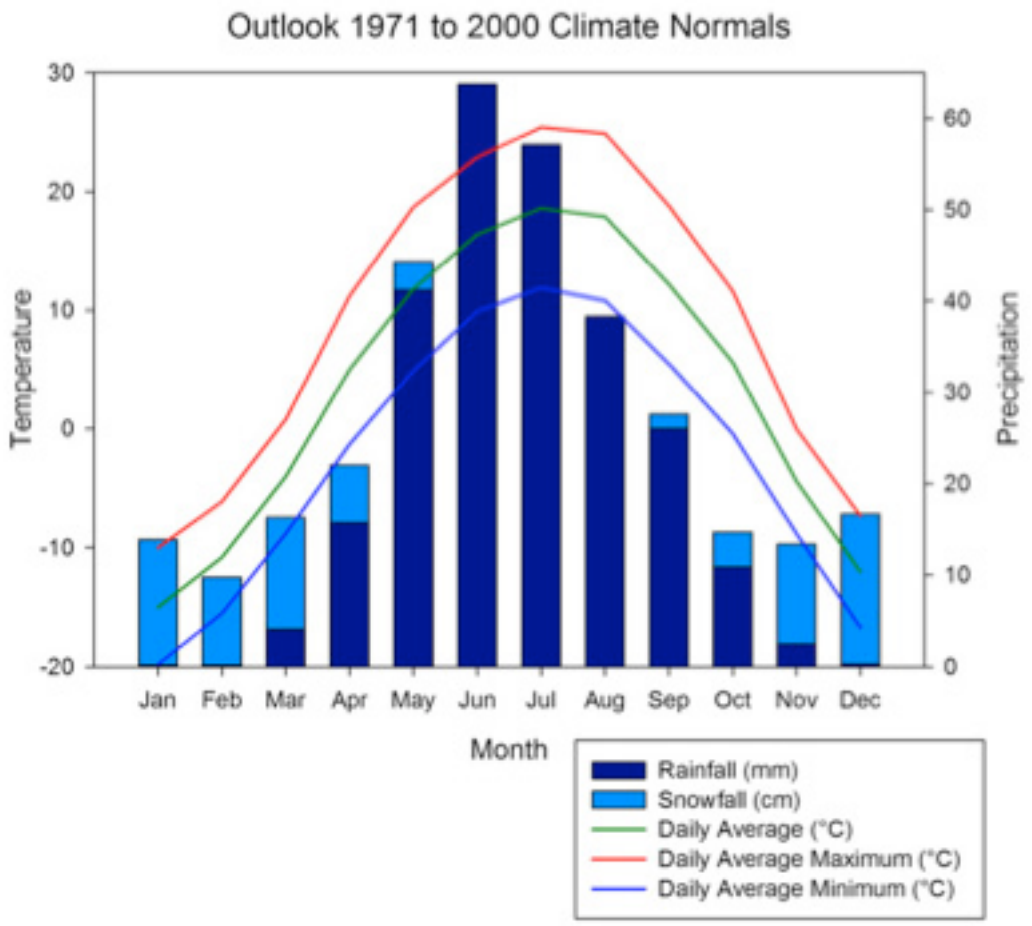

Figure 3.2 Climate normals for Outlook, SK, 1971 to 2000

(Environment Canada 2009, taken from Pittman et al. 2011)

3.2.3 Defining the Audience Beliefs, Attitudes, and Behaviours

Familiarity with audience traits is a common theme in the broad communication literature. Fishbein and Ajzen (2010) stress the importance of knowing audience beliefs regarding behavioural change. Nassauer (2012) refers to inclusion of local conditions in landscape scenario design, while the climate change visioning process outlined by Sheppard et al. (2010) assumes local input due to multi-player team. Because the project timeline did not allow for actual stakeholder participation or interdisciplinary consultations, assumptions were made from previous assessments.

The audience was assumed to be rural landowners in the Outlook area whose land use decisions directly or indirectly impact environmental health in the immediate context and

beyond. As general discussion points, selected considerations for environmental health included soil erosion and sediment control, water quality and quantity through overland runoff and infiltration, and biodiversity. These considerations were selected based on their previous treatment in the literature (e.g. Santelmann et al. 2001; David Suzuki Foundation 2008). Since other data collection methods were not achievable in the allotted timeframe, audience beliefs and behaviours were gleaned from census data (Dillard and Marshall 2003) and previous vulnerability and adaptation assessments that were conducted in the area (Wittrock et al. 2007; Pittman et al. 2010; Institutional Adaptation to Climate Change Project 2011;).

Fishbein and Ajzen (2010) stress the importance of clearly identifying the behaviour in question, while conceding to grouping behaviours as long as the behaviours within such a coarse behavioural aggregate are strongly correlated (Fishbein and Ajzen 2010). At least one study involving aggregate behaviours has shown that general attitudes about religion were shown to correlate strongly with a broad aggregate of behaviours related to religion (Fishbein and Ajzen 1974, as cited in Fishbein and Ajzen 2010). The assumption of treating aggregate behaviours led to the selection of target behaviours as those involving land use practices that impact the environmental health indicators mentioned above, such as wetland preservation and restoration, and use of forage crops, shelterbelts, and riparian buffers.

When planning a strategy such as watershed protection, or improving watershed water quality or quantity, McKenzie Mohr (2011) states that it makes most sense to look at the numbers to ask which sector should be targeted. In this case, agricultural land use was targeted since agriculture is the most consumptive water use in the prairie ecozone, and the downstream implications of this use have become widely publicized. Behaviours were selected based on overlap between interview or focus group responses from area residents, farming trends in the study region, and corresponding data availability such as land cover. Since wetlands provide the most ecological service value return per hectare (Voora and Venema 2008), preservation and/or restoration of wetlands was determined as a primary focus for the study. Shelterbelts, riparian buffers, native grassland areas, cropland, and forests were the other indicators selected based on data availability and their previous treatment in the literature (David Suzuki Foundation 2008; Voora and Venema 2008). It was assumed that the data were applicable to the smaller study area, and still applicable today.

3.2.4 Socioeconomic, Biophysical, and Climate data

As mentioned above, socioeconomic data for the study area were obtained from the Census of 2011 (Statistics Canada 2011) and previous surveys of the region (Pittman et al. 2010; Institutional Adaptation to Climate Change Project 2011; Wittrock et al. 2007). The 2011 Census of Agriculture (Statistics Canada 2011) provided data on trends in farming size and practice. Biophysical data were gleaned from soil reports, GIS data, and previous vulnerability assessments. Geospatial data was collected from several government agencies. Land cover and soil data were obtained from Natural Resources Canada; orthoimagery and a digital elevation model for the study area were purchased from the Saskatchewan Information Services Corporation.

3.2.5 Downscaling Global Climate Scenarios

To be applied at a local level, global climate models must be downscaled in their scenarios and related assumptions (Sheppard et al. 2011). As Sheppard et al. (2011) state, this approach "essentially means drawing on the extensive work of the IPCC and its recognized families of scenarios, with attendant quantitative information on various climate change parameters based on multiple models" (p.404).

Whether looking at climate change projections in particular or more simply evaluating the implications of different land use decisions, other studies have successfully used the downscaled alternative future scenario approach (e.g. Santelmann et al. 2001; Hulse, Gregory and Baker 2002; Steinitz et al. 2003; Sheppard 2008). With global scenarios in mind, downscaled "non-probabilistic" scenarios were established to explore the consequences of different land use decisions, rather than trying to predict the most likely outcome (Shaw et al. 2009). This approach was used together with the "no regrets" policy taken regarding best land management practices discussed elsewhere(Government of Canada 2002; Sauchyn and Kulshreshtha 2008; Diaz and Warren 2012).

The steps in the scenario design, taken from Shaw et al. (2009) are:

1) generating a conceptual framework from pre-defined climate worlds (IPCC 2007)
2) synthesizing global climate change scenarios – substantiated and validated climate worlds
3) downscaling global scenarios into local scenarios
4) visualizing local scenarios

The global climate scenarios looked at were A2, a high-greenhouse-gas-emission scenario, and B1, a low-emission scenario (IPCC SRES 2007). SRES scenarios are detailed by Nakicenovic et al. (2000). Several economic, institutional, and socio-cultural assumptions were made in the scenario designs, adapted from Santelmann et al. (2001).

3.2.6 Natural Capital and Ecological Service Value Estimations

Climate uncertainty was deemed to be an all too regular part of life in the study context, and since economics were assumed to be of greater concern, emphasis was shifted from climate change visualization to natural capital visualization--the invisible part of the landscape services that impact and are impacted by a changing climate.

The Millenium Ecosystem Assessment (2003, as cited in Voora and Venema 2008) divides ecosystem services into four service categories: provisioning, regulating, cultural, and supporting. Provisioning services include the supply of food, fresh water, fuel, fiber, biochemicals and genetic resources. Regulating services include regulation of climate, disease, water, water purification and pollination. Nonmaterial benefits attributed to cultural services include spiritual and religious, recreation, aesthetic, inspirational, educational, sense of place, and heritage. The supporting services are necessary for all of the other services, and include soil formation, nutrient cycling, and primary production of energy. Valuation of ecosystem services is a difficult task that is made easier by using a combination of a generalized set of services, revealed preferences based on consumer behaviour analysis, and stated preferences that are based on the 'willingness to pay' principle to gauge hypothetical situations (Voora and Venema 2008). The latter is the most widely used method for valuating ecosystem services.

Natural capital has been defined as the "stocks or assets that provide resources and a flow of services" among the earth's natural ecosystems (David Suzuki Foundation 2008, p.1). The benefits derived from ecosystems, which form the basis of life, are dependent upon the processes (physical, chemical and biological) or characteristices that maintain the systems and the species within them (David Suzuki Foundation 2008). In the Canadian context these benefits have been quantified by private research groups; estimations are likely conservative since knowledge is incomplete (Voora and Venema 2008). As public goods, ecosystem services are typically undervalued in our market-based economies (Jenkins et al. 2010; Olewiler 2004; David Suzuki Foundation 2008). Natural capital helps us to quantify otherwise unrelatable measures, such as a swath of forest or cropland, or a 2 ha wetland (Olewiler 2004). Assigning values to ecosystem services provides an economic rationale for the preservation and

restoration of environmental assets (Voora and Venema 2008; Olewiler 2004; David Suzuki Foundation 2008).

Ecosystem service categories include climate change, material benefits, social benefits, water quality and quantity, biological control, and environmental integrity. Ecological Service Value (ESV) refers to the estimated economic value of various ecological typologies, such as wetlands, various forest types, grasslands, and agricultural lands.

Ecosystem service values were calculated for the study area based on results from previous studies (e.g. Olewiler 2004; David Suzuki Foundation 2008; Voora and Venema 2008). Assumptions were made regarding the contextual relevance and transferability of values from one Canadian context to the study area. For example, ESVs for the Ontario Greenbelt represent the highest service value estimations in the Canadian ESV literature (see David Suzuki Foundation 2008), likely due to larger population densities and increased land values. In spite of contextual differences, similar ESV amounts were applied to the study area in the interest of simplification. Environmental Integrity values were not included by Voora and Venema (2008) due to lack of information. However, these values were obtained from the report by the David Suzuki Foundation (2008). Riparian buffer ESV was not included in any of the consultants' reports; there seems to be a dearth of ESV information for riparian zones. However, Voora and Venema (2008) estimate agricultural land ESV to be half that of native prairie, and so riparian buffers were estimated to be the same ESV as native prairies, even though this is likely a conservative estimate.

Air quality natural regeneration amounts were subtracted from the Suzuki Foundation (David Suzuki Foundation 2008) figures to contextualize them to the prairie context, as with Voora and Venema (2008). This resulted in a decrease in forest productivity by $914 per hectare and native grassland productivity by $12 per hectare. Material benefits such as food, raw material and genetic resources were assumed and not included in the calculations. Flood prevention was also excluded from the calculations due to the assumption that such a low-density area as rural Saskatchewan is not at the same degree of flooding risk. This assumption was made due to the regulated flow of the South Saskatchewan River at the Gardiner Dam upstream.

Regardless of the wide spectrum of values assigned, wetlands are consistently regarded as the clear winner when it comes to $/ha value (Olewiler 2004; Voora and Venema 2008; David Suzuki Foundation 2008). Estimates range from $939/ha (Voora and Venema 2008) to $14,385/ha (David Suzuki Foundation 2008), the latter figure calculated in the context of the Ontario Greenbelt.

3.2.7 Establishment of Current, Past, and Future Land Use Scenarios

A current landscape conditions map was created by calculating current ESVs based on existing land cover data supplied by the Canada Land Inventory (2000) through Natural Resources Canada. Land cover types included deciduous forest, shrubland, native grassland, annual cropland, perennial cropland, and built-up areas such as roads. Surface areas in hectares were calculated for each land cover type using GIS analysis. The areas were then mulitplied by ESV per land cover type. Based on the estimations of Voora and Venema (2008), the ESV for forest and shrubland were aggregated, as were annual and perennial croplands. ESV for each land cover type, namely forest (including shrubland), cropland (including both perennial and annual crops), and wetlands were calculated. Shelterbelts were digitized in ArcMap from high-resolution (0.6m) ortho-imagery, and corresponding ESV values were calculated based on hedgerow values in the David Suzuki Foundation's (2008) Ontario Greenbelt study. Farmyard shelterbelts were not included under the assumption that residential shelter would remain constant across scenarios.

Once ESV were calculated per current land cover type, past ESVs were estimated based on soil type and associated land covers, as done by Voora and Verema (2008). Soil data from the Canada Land Inventory (2000) were reclassified according to associated landcover, as per Voora and Venema (2008). The past land cover surface area estimates were then multiplied by current ESV amounts to provide a past ESV total. Missing vector data, including shelterbelts, gravel roads, and farm sites, were digitized in ArcMap. Farm sites were only considered for siting wetlands and proximity to buffers, since residential lands were not accounted for in the base land cover data. The ecological service value of farm sites was not considered in this study, even though they undoubtedly provide many.

Future land cover scenarios were then estimated according to downscaled climate models with recommended design guidelines for shelterbelts, wetlands and riparian buffers in mind (Agriculture and Agri-Food Canada 1998). For example, Morandin and Winston (2006) found that leaving uncultivated just 30% of land within 750m of field edges increased crop yields due to abundance of pollinators such as bees. Total ESV was calculated for each future scenario by multiplying the current ESV by surface area per land cover type. Since no approprate figure could be found in the literature, riparian buffers were assumed to be of at least

equal ESV as native grasslands. Similar estimations were used in prevous ecological valuation studies (e.g. Olewiler 2004; Voora and Venema 2008).

Standard ecological valuation and compensation practices are typically based on land rental rates, which vary by region and soil productivity.

3.3. Scenario Visualizations

Sheppard (2005; 2008; 2012;) recommends using the most realistic visualization tools available, from simple 3D visualizations in ArcScene to 2D rendering using software such as Photoshop. The '3 D's' are also recommended as guiding principles for the visualizations: disclosure, drama, and defensibility (Sheppard 2008b). Both 3D and 2D techniques were applied to the landscape and corresponding dataset with disclosure, drama, and defensibility in mind. Visualizations were then analyzed according to communication principles derived from the literature.

3.4 Summary

This chapter outlined the research methodology used in this investigation. Grounded theory guided the review of communication literature that informed an integrated communication flowchart, which was then applied to a study area and associated dataset. The study area is found along the South Saskatchewan River in the Palliser Triangle region of Saskatchewan. The audience was determined to be land-users in the area, including farmers and ranchers and their families, or anyone with experience in that landscape. Target behaviours were determined to be those with local and downstream environmental impact, such as wetland preservation, use of shelterbelts, and use of riparian buffers. Audience beliefs were gleaned from census data and previous climate vulnerability assessments based on interviews and focus groups. Global climate scenarios from the IPCC (2007) were downscaled to create local future scenarios, which were framed according to natural capital and ecological service value estimations. Four scenarios were then visualized according to communication principles derived from the literature, which were then used in the analysis of the visualization products.

CHAPTER FOUR: RESULTS + ANALYSIS

4.0 Overview

Two sets of results were obtained from this study. A substantive theoretical communication framework was first derived using principles from grounded theory. This framework was then applied to a dataset and a particular landscape to produce a series of landscape scenarios and visualizations; land cover and associated ecological service values were used as the comparative base. Scenario implications were analyzed by comparing their ecological service values; the theoretical framework's effectiveness was evaluated against principles derived from the literature. The results from both streams – theory, and the application thereof - were regarded as visualization objects in their own right, and communication principles derived from the literature were used to analyze both sets of results.

4.1 Theoretical Framework

Grounded theory methodology guided the exploratory approach taken for the theoretical component of this study. Major principles derived from the GTM approach were used to analyze the results form this portion of the study.

4.1.1 Communication Flow-Charts: Conceptual evolution and outcomes

One of the major tenets of grounded theory methodology is that existing theory is incorporated into new theory (Urquhart 2013). An initial review of the literature revealed the concepts of land use, adaptation, climate change, vulnerability, which were then included with other related concepts such as adapting to uncertainty through communication (see Fig.4.1).

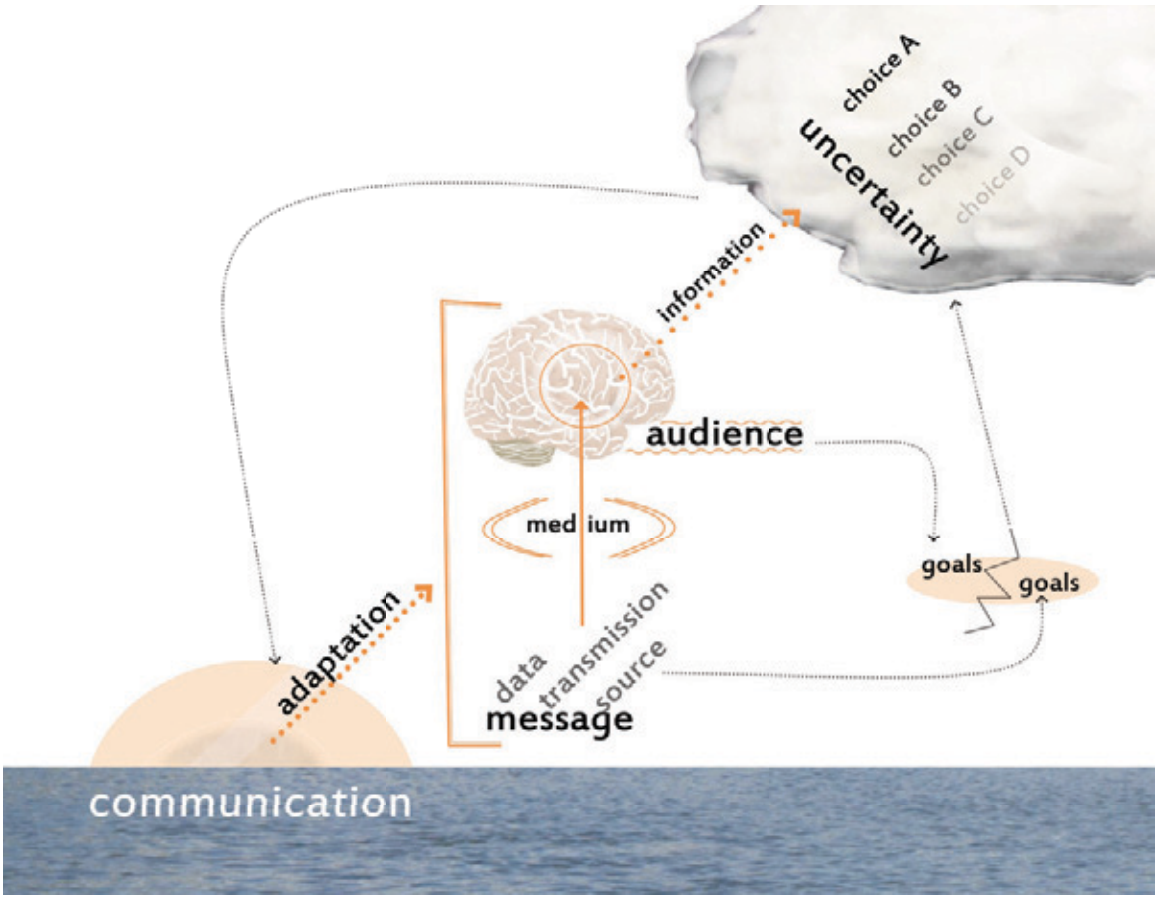

Figure 4.1 Communication as Adaptation Flow Chart

Because of its fundamental prominence, communication was regarded as a focal area for further review, and elements of behavioural psychology were examined as they applied to a general communication framework. The framework incorporated concepts from Theory of Reasoned Action (Fishbein and Ajzen 2010), the Elaboration Likelihood Model (Petty and Cacioppo 1986), Cognitive Appraisal Theory (Scherer, Schorr and Johnstone 2001, as cited in Dillard and Seo 2013) and the importance of emotion in decision-making processes (Roeser 2012). These theoretical bases were considered and combined to form the influence flowchart (see Fig.4.2). Landscape was then included as a communicative medium and method keystone (Nassauer 2012). A cyclical flow chart was established to highlight the ongoing and dynamic nature of the influential communication process as potentially expressed through landscape (see Fig. 4.3)

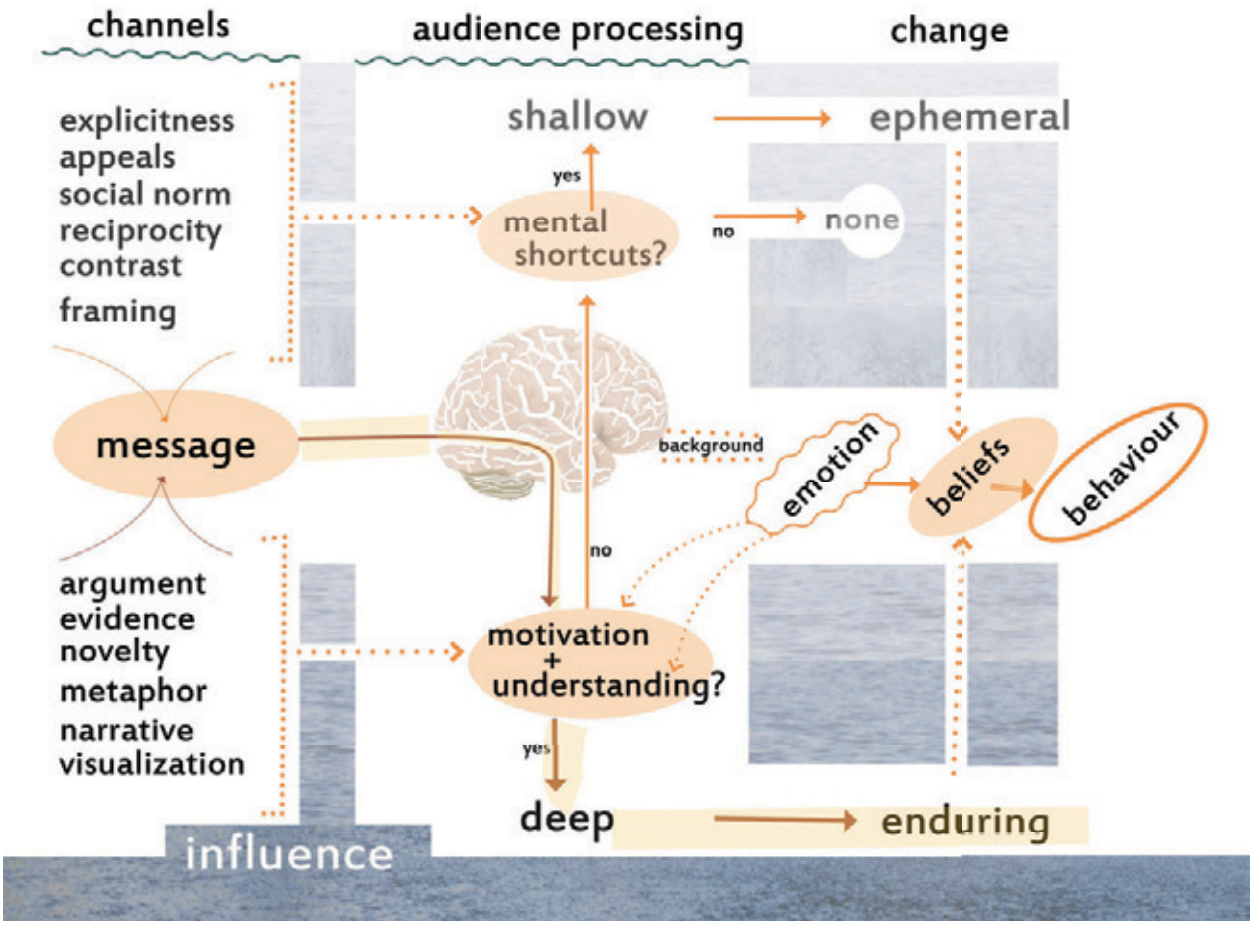

Figure 4.2 Influence Flow Chart (adapted from Fishbein and Ajzen 2010; Petty and Cacioppo 1986)

This flowchart emphasizes concepts of what an influential communication is targeting or can impact (i.e. behaviours by way of belief) as per Fishbein and Aszjen's (2010) Theory of Reasoned Action, the dual-processing modes of the ELM (Petty and Cacioppo1986), and key strategies that emerged from various literature categories such as communication and evolutionary psychology, climate change communication, and social marketing strategies. Emphasis is placed here on the deeper processing mode at the bottom half of the diagram, which has been shown to result in more enduring attitudinal and behavioural change.

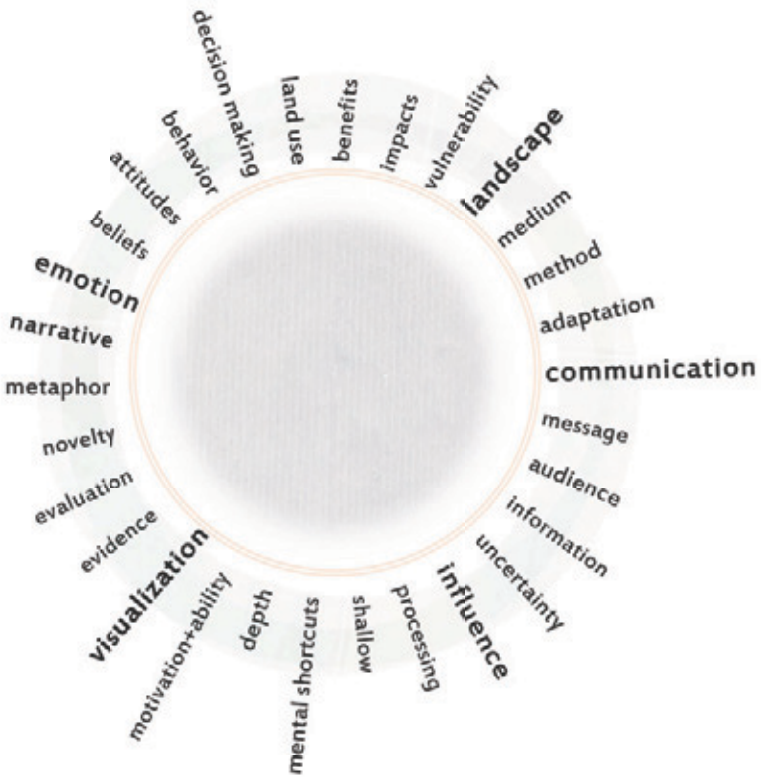

Figure 4.3 The Communication Cycle Through Landscape

This dynamic diagram, here shown statically, resulted from emergent themes connecting communication, influence, visualization, emotion and landscape. The secondary concepts connecting these primary categories are equally important in the overall flow, involving the need for adaptation, a response, and an impact, especially as those needs, responses and impacts play out in the landscape. This diagram is not necessarily exhaustive and is only representative of the cyclical nature of the communication and decision-making process.

4.2 Defining the "Medium"

Data availability was the main driver behind the selection of the township surrounding Outlook, Saskatchewan, as the study area. The area was selected due to its location within the Palliser Triangle and the South Saskatchewan River Basin, and its proximity to the South Saskatchewan River. High-resolution ortho-imagery for Township 29, Range 8, West of the 3rd Meridian, the township including Outlook and area, and a corresponding digital elevation model

(DEM) were available for purchase from the Saskatchewan Information Corporation. These data were used in ArcGIS to provide preliminary boundaries for the study area (See Fig.3.1). Previous socioeconomic vulnerability assessments of the area (Pittman et al. 2010; Institutional Adaptation to Climate Change Project 2011) provided socioeconomic data for this study that was supplemented by data from Statistics Canada (2011).

4.3 Defining the Audience, Beliefs, Attitudes, and Behaviours

In their vulnerability assessment for the residents of the Rural Municipality (RM) of Rudy No. 234, Pittman et al. (2011) noted the following categories were discussed most frequently during thirty four at-home interviews with RM residents. These were based on coding the results of personal in-home interviews with farmers (Pittman et al. 2011). The categories of discussion and coding frequencies can be seen in Table 4.1.

Exposure

Socioeconomic conditions	275
Water availability	250
Institutions	140
Climate variability and weather	138

Adaptive strategies

Financial management	105
Farming practices and technology	55
Water management and technology	25
Institutional initiatives	20

Table 4.1 Exposure and Adaptive Stategies Coding Frequencies, adapted from Pittman et al. (2011)

These coding frequencies suggest that, according to these particular interview subjects:

- decision-making is driven by economics, which impacts both perceived vulnerability and the perceived capacity to adapt;

- water availability is a close secondary concern to economics (with regard to perceived vulnerability), and a far third (with regard to adaptive capacity)
- climate – or specifically climate change - is regarded lastly, likely due to ongoing familiarity with climatic variation and safety nets like crop insurance and irrigation
- most land use decisions are in some way related to agriculture;
- these decisions include increasing farm size, or renting/selling land (typically to larger farms) as adaptive mechanisms;
- start-up costs of diversification and irrigation are prohibitive
- institutional measures are seen to be of secondary concern, due to distrust, distance, and lack of funding commitments
- uncertainty is a barrier to change and decision making
- personal independence is highly valued and community collaboration is not yet common
- dryland farming benefits from various farming practices (even though Statistics Canada data show that many of these practices, except for zero-tillage, are declining, sometimes drastically, e.g. shelterbelts by - 42% and riparian buffer strips by -14% between 2006 and 2011 in the census district, in terms of number of farms reporting)

These inferred beliefs were supplemented by focus group assessments that were held in the town of Outlook with many different stakeholders; many participants were farmers, but others from the community were included (Institutional Adaptation to Climate Change Project 2011):

- water is assumed to be abundant, although water conservation is important among all groups
- uncertainty is a hindrance to proactive adaptation.
- local desire is to share information, to collaborate, and to bring about change (focus groups – not necessarily the same result from at-home interviews)
- water storage could be achieved in wetlands while increasing habitat
- education is a key adaptive strategy that is not only for youth.

While the study area is technically located in a neighbouring RM, it was assumed that these assessments are relevant for landowners on both sides of the river.

4.4 Defining Downscaled Future Scenarios

Together with audience beliefs and assumptions, Global Climate Models (GCM) from the IPCC (2007) Special Report on Emission Scenarios (SRES) were used as a broad-scale basis for establishing downscaled land-use scenarios. Two GCMs were used to provide contrasted future land use outcomes. This section provides two future landscape scenarios: the Do Nothing Scenario and the Efficient Development Scenario (as termed by Sheppard 2008). Each scenario presents global conditions and local conditions that, together, shape both the economic realm and the human practices that result in varying changes in the landscape.

4.4.1 Scenario A2 - "Do Nothing"

As its name suggests, this scenario maintains the economic and environmental status quo both globally and locally.

Global conditions:

- self-reliance/preservation among regions
- largest population estimate for all scenarios
- resource-rich regions continue resource intensive economies
- disparities result from regional economies
- weak environmental concern
- widespread soil erosion and water quality issues
- slower technological change

Local conditions:

- agricultural profit is the driver
- reliance on fossil fuels for energy
- shelterlbelts destroyed, minimal riparian buffers, large scale farming

- erosion and water quality issues become central
- farm sizes increase, number of farms decrease

In this downscaled scenario, agricultural profit is the driver, and short term economic return is the goal. Increased farm sizes leads to destruction of shelterbelts and wind erosion which is further exacerbated by drought and desertification. Due to impacts of drought conditions and diminished water flow in the SSR, dryland farmers are hit especially hard. This scenario assumes high demand for district crops, high use of fossil fuel, large chemical and technological inputs, and large-scale industrial agriculture. It assumes that public trust in industrial agricultural food quality remains high, that public perceptions of the resultant landscape is environmentally acceptable, that fossil fuel remains economically viable, and that the public remains supportive of these practices, through research, crop insurance, and direct payments to farmers. Wetlands, woodlands and shelterbelts are mostly removed to make way for more cultivation, and riparian areas are only marginally protected using 50m buffer strips. Agricultural lands are left largely to large scale farm corporations.

4.4.2 Scenario B1 - "Efficient Development"

This scenario involves a markedly different trajectory at both global and local levels, emphasizing interregional collaboration on issues such as food production and sustainability.

Global conditions:

- balanced global economy
- global solutions to sustainability
- transition to clean and resource-efficient technologies and alternative/renewable energies (pushed by declining oil reserves)
- clear evidence regarding land use impacts on water and soil raise level of environmental and social consciousness
- land use is carefully managed

- incentives for low-input, low-impact agriculture
- more lands set aside for reserves
- higher food prices lead to decreased demand for meat

Local conditions:

- careful regional land management strategies involving community participatory planning and collaboration
- emphasis on resource management through shelterbelts, riparian buffers/protection, biodiversity enhancement
- emphasis on reducing farm inputs and energy conservation
- 30% land left uncultivated for pollinator species (Morandin and Winston 2006, cited in David Suzuki Foundation 2008)
- diversification of crops
- number and size of farms remains relatively constant from today

In this downscaled scenario, federal incentives to increase biodiversity and improve water quality have helped to establish a core indigenous reserve system in the area, perhaps as part of the joint-governmental Irrigation and Crop Diversification Centre located in Outlook. Measures to enhance wetlands and riparian corridors have been introduced with government policy and incentives. Increased public investment has led to more public use of the landscape with trail systems and recreation infrastructure. Farm sizes remain constant, more or less. Water quality and quantity performance standards have been enforced by policy and are measured on a farm-by-farm basis. Public environmental concerns focus on clean water availability, and public support is for agricultural practices that reduce soil erosion, reduce sediment and nutrient delivery to streams, and preserve riparian systems, and these practices have been widely adopted as profitable measures that help to meet required standards. Woodlots and shelterbelts remain intact, and urban and rural dwellers make more recreational use of the landscape.

4.5 Estimating Ecological Service Values

Based on the ESV figures from the David Suzuki Foundation study (2008), and with the changes and assumptions mentioned in Chapter 3 (see Section 3.5) in mind, each land cover's contribution to the overall ESV can be broken down as follows (see Fig.4.4):

Climate Change services, including carbon storage and sequestration:

- forest - 39%
- native grasslands - 10%
- wetlands – 23%
- croplands – 14%
- shelterbelts – 15%

Water quality, including regulation and supply, filtration, erosion control, and waste treatment:

- forest - 35%
- native grasslands - 4%
- wetlands – 60%
- croplands – n/a
- shelterbelts – 1%

Environmental integrity, including soil formation, nutrient cycling, and pollination:

- forest - 33%
- native grasslands - 32%
- wetlands – n/a
- croplands – 1%
- shelterbelts – 34%

Biodiversity, including habitat and biological control:

- forest - 1%
- native grasslands - 1%

- wetlands – 97%
- croplands – n/a
- shelterbelts – 1%

Social well-being, including recreation, cultural/spiritual, and disaster control:

- forest - 7%
- native grasslands – n/a
- wetlands – 88%
- croplands – 2%
- shelterbelts – 3%

The total ecological service value contributions by service category, across land cover type, were broken down as follows (see Fig.4.4):

- climate change – 11%
- water quality and quantity – 26%
- environmental integrity – 15%
- biodiversity – 26%
- social well-being – 22%

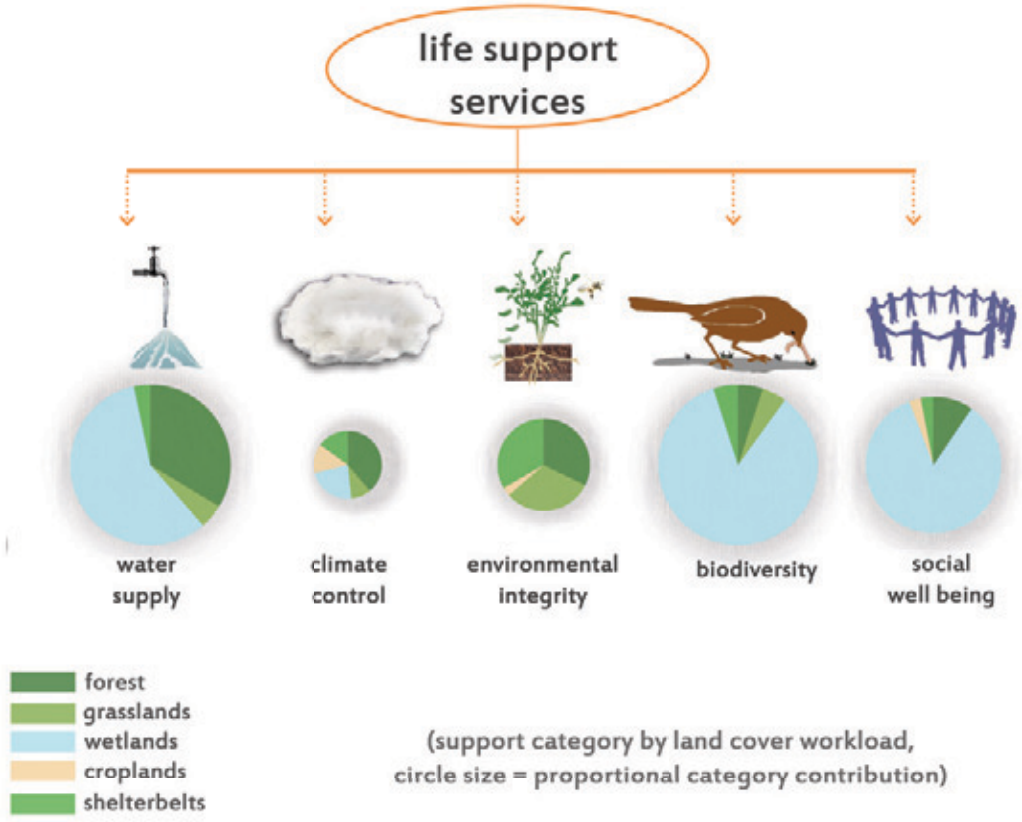

Figure 4.4 Proportional Breakdown of Life Support Services by ESV

Pie graphs and proportionality were selected as the means to relate quantitative data due to their common usage and assumed ease of understanding. It was deemed that this was the best method to quickly convey relationships between figures, rather than emphasizing numeric figures. Pie graphs were assumed to be a familiar and easily understood method for communicating complex data.

4.6 Visualizations: Bringing it all together

A total of four visualizations were produced, including 3D birds-eye view maps, 2D ground-level perspectives, and pie graph and proportional comparison graphs. The first visualization established a pre-settlement baseline, the second conveyed the current landscape and associated land use practices, and the third and fourth communicated the future scenarios.

4.6.1 Pre-Settlement Baseline

A baseline map for the study area was established by estimating pre-settlement land cover. Pre-settlement land cover was estimated based on soil data obtained from the Canada Land Inventory (Agriculture and Agri-Food Canada 1998). Gleysolic soils were associated with former wetlands, dark brown chernozemic soils were associated with native grasslands, and regosolic soils associated with deciduous forest cover (see Table 4.1 and Fig. 4.5). This process and similar associations were used by Voora and Venema (2008).

Ecological service values were then calculated by area per land cover type as per David Suzuki Foundation (2008). Only three land cover types, deciduous forest, native grasslands and wetlands, would have been found in this pre-settlement landscape.

The visualizations include a 3D bird's-eye view of the study area done in ArcScene, a 2D photomontage of an upland area from the river, and pie graphs that represent a breakdown of land cover by area versus land cover by associated ecological service value. There is additionally a comparative component that shows proportional relationships between all four landscape scenarious: pre-settlement, current, "do nothing" future, and "efficient development" future. Perspective views, especially three dimensional, have been shown to elicit greater recall and understanding amongst audience members in previous examples (e.g. Sheppard 2008; Sheppard et al. 2010).

True north was kept to the right of the image, and project north faced true east in attempts to better convey the entire study landscape in a more easily comprehensible manner. Attention was paid to colour legibility and applicability in the southern Saskatchewan context; however, this selection was ultimately subjective.

	PRE-SETTLEMENT			
LAND COVER	ha.	% total area	$ ESV	% total ESV
FOREST	380	10	$1,703,920	9
GRASSLANDS	2,349	65	$3,772,494	21
WETLANDS	901	25	$12,837,448	70
AGRICULTURAL LANDS	0		$0	
SHELTERBELTS	0		$0	
RIPARIAN BUFFERS	-		-	
ROADS	0		$0	
FARM YARDS	0		$0	
TOTAL	3,630	100	**$18,313,862**	
			baseline	

Table 4.2 Pre-Settlement Landscape Baseline ESV by Land Cover

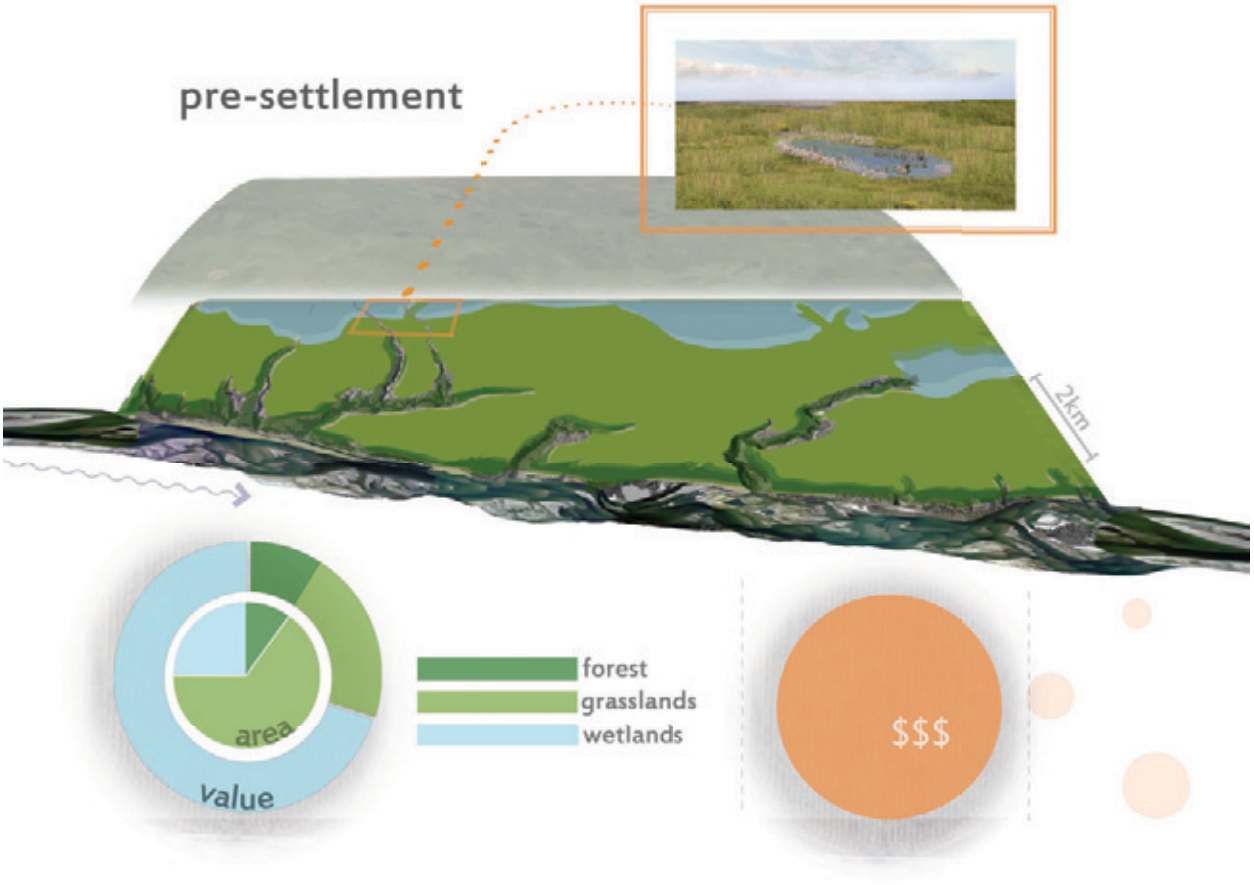

Figure 4.5 Pre-Settlement Landscape Scenario

The pie graphs represent the percentages shown in the columns in Table 4.1.

4.6.2 Current Landscape

Land Cover vector data circa 2000 (Natural Resources Canada 2009) was used in ArcGIS to establish a visualization of current land cover types and associated ecological service values by land cover area (see Table 4.2).

The same birds-eye perspective view used in the baseline visualization was used to convey current land use in the study area, and a perspective “snapshot” from the same area as the baseline visualization was used to highlight the land use changes from pre-settlement times

to the current period (see Fig.4.6). The heuristic principle in using the same views was that of consistency, while at the same time relying on contrast due to the different elements contained in the drawings. For example, the pre-settlement drawing involves only three land cover types, while the current landscape includes an additional four land cover types (croplands, roads, farmyards and shelterbelts) that would have been added post-settlement.

Since the audience would be expected to be quite accustomed with this particular landscape, as it is representative of its current state, there is no argument being made here either explicitly or otherwise. What is different in this visualization is the breakdown of ESV by land cover type. Agricultural lands are now the predominant land cover type while wetland cover, for example, has decreased by 92% from the pre-settlement baseline. It is clear from the pie graphs, however, that even having been decreased so substantially, wetlands are still an ecological powerhouse punching well above their per-hectare weight. The orange-circle graphic in the bottom right corner represents the proportional difference between the (larger) pre-settlement ESV circle and the current ESV circle (a decrease of 79%).

	CURRENT				
LAND COVER	ha.	% total area	% change (from baseline)	$ ESV	% total ESV
FOREST	110	3	-70%	$493,240	13
GRASSLANDS	397	11	-83%	$637,582	17
WETLANDS	87	2	-92%	$1,235,587	32
AGRICULTURAL LANDS	2858	79		$1,363,266	35
SHELTERBELTS	78	2		$131,040	3
RIPARIAN BUFFERS	-			-	
ROADS	61	2		$0	
FARM YARDS	39	1		$0	
TOTAL	3630	100		**$3,860,715**	
		(from baseline)		-79%	

Table 4.3 Current Landscape ESV by Land Cover

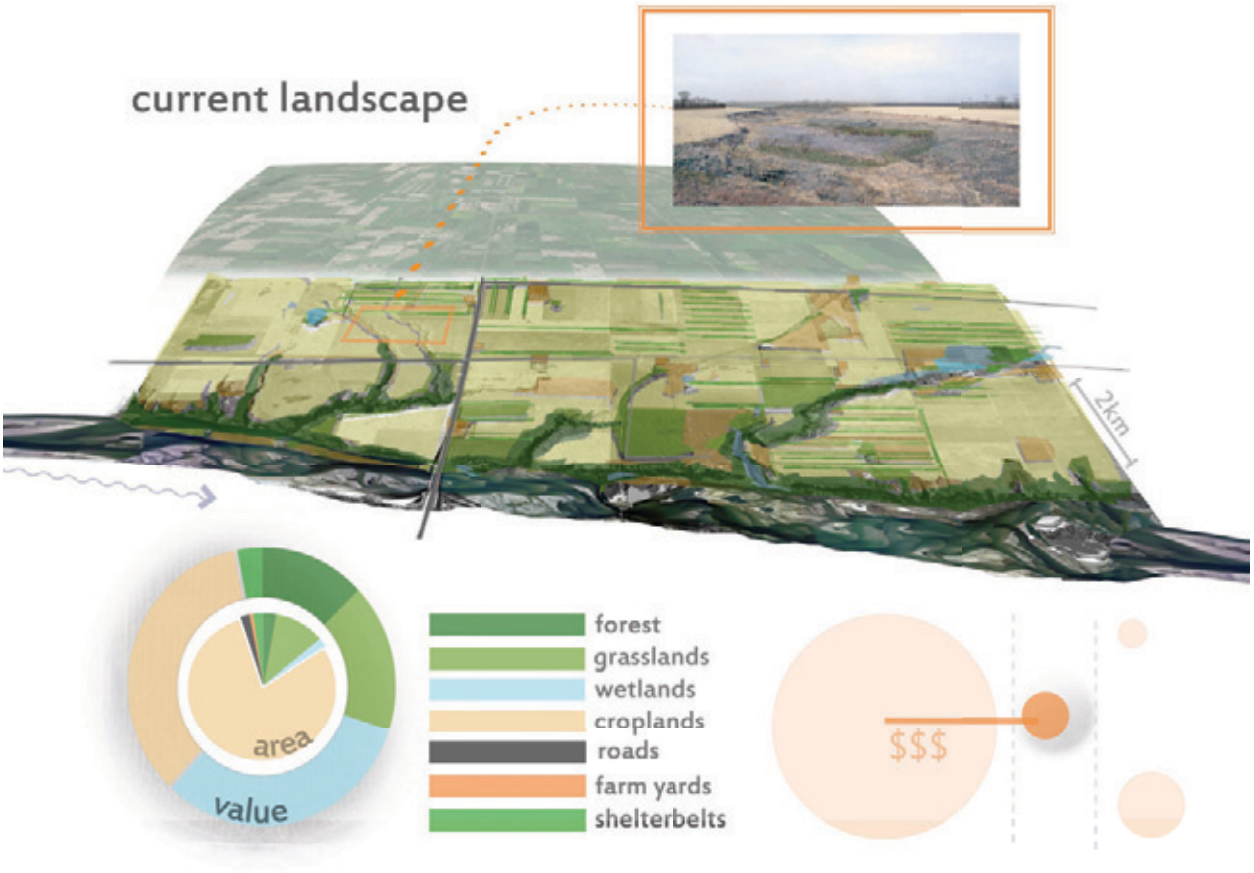

Figure 4.6 Current Landscape

4.6.3 Future A2 - "Do Nothing"

Future 'A2' incorporated socioeconomic trends derived from agricultural census data (Statistics Canada 2006; 2011), such as increasing farm size, removal of shelterbelts, and the implementation of 50m riparian buffers along all stream courses (see Fig.4.7). The number of farms in this scenario decreased to nine from thirteen in the current scenario, or by 31%. The breakdown of area per land cover type for future "Do Nothing" scenario is in Table 4.3.

	Future A2				
LAND COVER	ha.	% total area	% change (from baseline)	$ ESV	% total ESV
FOREST	65	2	-80%	$291,460	12
GRASSLANDS	95	3	-95%	$152,570	6
WETLANDS	24	0.5	-98%	$341,952	14
AGRICULTURAL LANDS	3333	91	13%	$1,589,841	66
SHELTERBELTS	17	0.5	-75%	$28,560	1
RIPARIAN BUFFERS	13	0.5		$20,878	1
ROADS	61	2		$0	
FARM YARDS	22	0.5		$0	
TOTAL	3630	100		**$2,425,261**	
		from baseline from current		-87% -37%	

Table 4.4 Future Scenario A2 – "Do Nothing" ESV by Land Cover

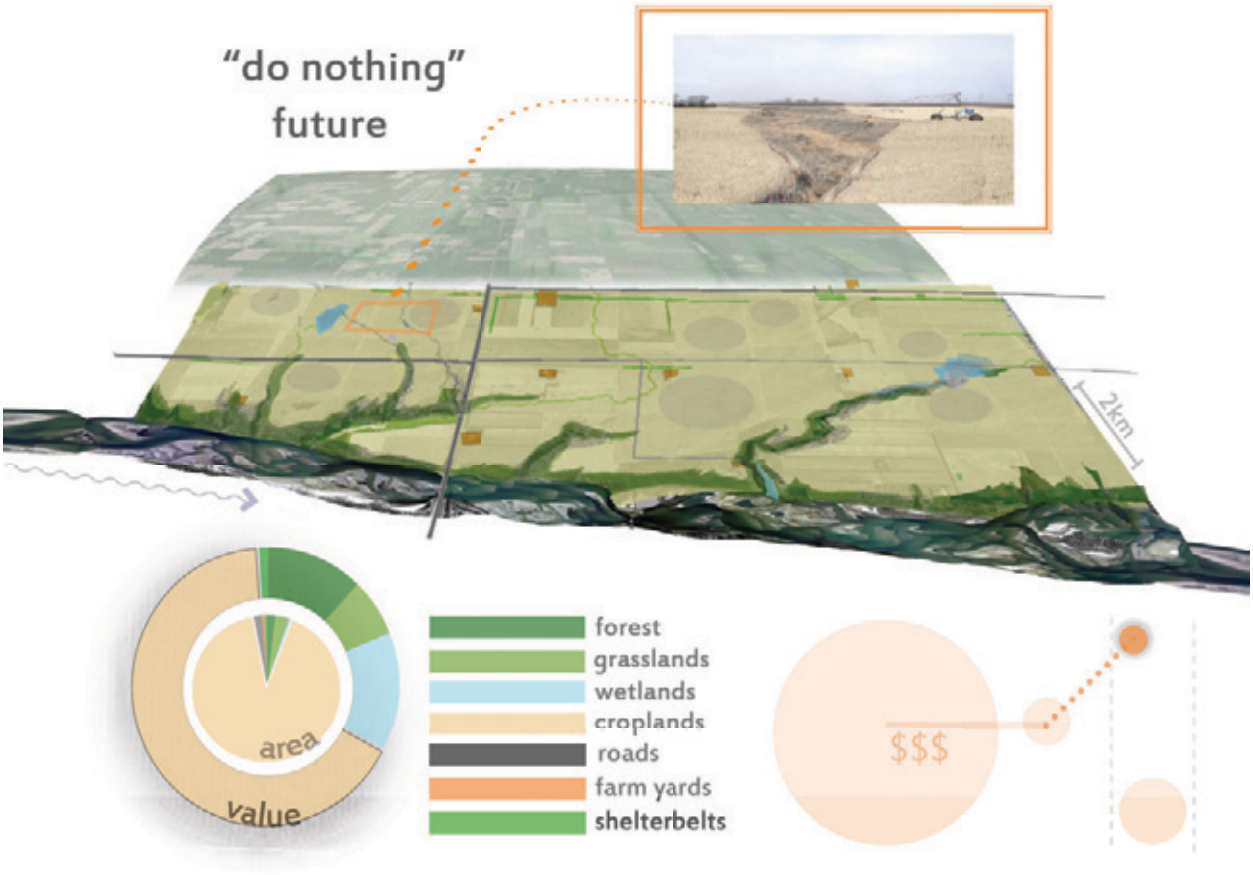

Figure 4.7 "Do Nothing" Future Landscape Scenario

In this future, agricultural profit is the primary driver, and not much changes from the current trajectory. Trends gleaned from the Agricultural Census of 2011 (Statistics Canada), such as fewer shelterbelts, were visualized as seen in Fig.4.7. The same birds-eye and perspective views utilized in previous scenarios were used to readily convey these differences in land use practices. The pie graphs quickly convey that croplands are far more dominant by land area, but that other land cover types such as forest, grasslands, and wetlands still have a much higher ESV, even though they have been decreased by 80%, 95%, and 98% from the baseline, respectively. The orange-circle graphic shows that this scenario's total ESV is proportionally much less than the pre-settlement baseline, an 87% decrease overall.

4.6.4 Future B1 - "Efficient Development"

Future scenario 'B1' emphasized shelterbelts and riparian buffers of 300m, as per best management practices published by Agriculture and Agri-Food Canada (2010). The same birds-eye and perspective views were used as in the previous visualizations for reliable consistency and to allow for contrast between them. Pie graph information conveys the same types of relationships within the data, namely land cover area and ESV by land cover. The orange-circle graph shows the total ESV compared proportionally to the pre-settlement and current totals, in this case -70% and +30% respectively (see Table 4.4).

Future B1

LAND COVER	ha.	% total area	% change (from baseline)	$ ESV	% total ESV
FOREST	110	3	-70%	$493,240	9
GRASSLANDS	497	14	-69%	$798,182	15
WETLANDS	160	4	-82%	$2,279,680	41
AGRICULTURAL LANDS	2,232	61		$1,064,664	19
SHELTERBELTS	134	4		$225,120	4
RIPARIAN BUFFERS	397	11		$637,582	12
ROADS	61	2		$0	
FARM YARDS	39	1		$0	
TOTAL	3630	100		**$5,498,468**	
		from baseline from current		-70% 30%	

Table 4.5 Future B1 "Efficient Development" ESV by Land Cover

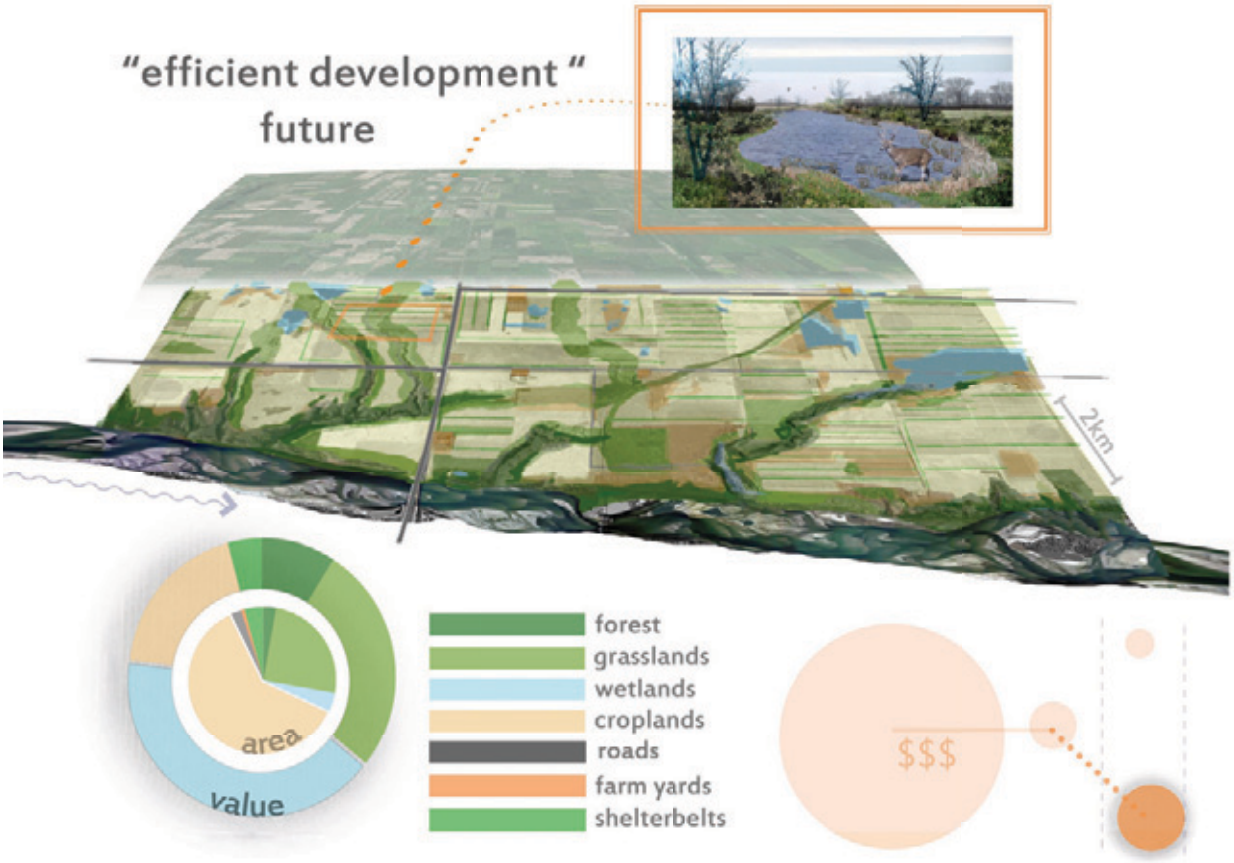

Figure 4.8 "Efficient Development" Future Landscape Scenario

4.7 Visualization Evaluation

Audience beliefs were addressed through the images in that they were framed in non-market economic terms using land cover is a readily understood common denominator. The message was constructed to address these beliefs using clear graphic communication that avoided statistical evidence, instead distilling complex information into single-frame graphics. Disclosure was implied by the presentation of data, which, if taken to the next iteration at the community workshop level, would be supplied as a shared dataset package. This dataset supports the defensibility of the visualizations. The visualizations were assumed to include dramatic effects given the contrast between them and the implications of each scenario. Further testing would be required to gauge actual dramatic effect.

The visualizations utilized several different communication strategies from both the shallow and deep processing modes.

4.6.1 Shallow Processing Strategies

The contrast principle was used in showing what this landscape may have been, what it is, and two different versions of what it could be. Reciprocity in that the landscape provides life-support services that need to be better respected and properly managed. Reciprocity was implied, in that the landscape provides services that must be recognized, respected, and preserved. This latter part was implied only. Balance was attempted by offering two contrasting future outcomes that stress different economic, social and environmental values. Conclusions were not explicitly drawn and leading titles for the scenarios, if they were to be taken to the public, would be avoided so as to engage deeper processing on the part of the audience and to allow individual conclusions to be drawn. Similarly, both gain-and-loss framing were implied to some degree.

4.7.2 Deep processing strategies

Strategies from the deep processing side of the influential communication flowchart (see Fig.4.1) included clear presentation of available evidence, the use of temporal narrative, and visualization. The emphasis in this case was in making apparent the big differences that can be made by small changes in land use. Audience engagement was intended by using “their” landscape and their associated beliefs. Emotion was not necessarily represented in the images/maps themselves, but assumed to be part of the audience reaction to them. Further testing would be required to know if any of the above strategies had or would have their intended effect.

4.8 Summary

Communication flow-charts were produced within the framework of grounded theory. The principles within these flowcharts were then used to construct a series of four landscape visualizations, including two future scenarios based on downscaled global climate models. The visualizations were framed in non-market economic terms to address audience beliefs and behaviours that were deemed to be most relevant. The four visualizations were then analyzed

against communication principles and strategies derived from the literature. A more thorough discussion of these comparisons is found in the next chapter.

CHAPTER FIVE: DISCUSSION

5.0 Overview

This chapter reflects on the major findings of the study. In then highlights the importance of the results, reflects on the research process, and relates the findings to the scope of landscape architecture.

5.1 Major Findings

The major findings from the literature review and resultant substantive theory of this study are that, as an adaptive mechanism, current land use communication tactics are not meeting the mark, as evidenced by ongoing environmental inaction at all levels and ecological crises that are complicated by future uncertainty. In the Canadian Prairies, for example, the declining health of Lake Winnipeg, which, as a receptor of runoff from all three prairie provinces, speaks to the damaging land use implications of the entire ecozone. It is perhaps only when the situation begins to show signs of reversal that we may know that the message of the need for proactive adaptive measures is being received, understood, and affecting change.

When devising such communication strategies, attention must be paid to audience beliefs and behaviours, to the message, and to how the message may be processed by the audience in the context of their beliefs and behaviours. Landscape problems need to be addressed and made relevant at the community level, and these problems must be re-framed according to audience beliefs. Particular attention must be paid to accurately discerning those beliefs so that appropriate evidence-based design solutions may address them as needed. Ideally this strategy is achieved through participatory planning processes. When time or resources do not allow for these inclusive measures, available data must be sought out and maximally utilized. For example, in the context of this study, it was determined that barriers to adaptive change are economic in nature. This determination guided the creation of land use scenarios that re-framed the economics from traditional market values to life-supporting ecological service values. While data to determine these barriers could not be obtained directly from the land-user audience in question, audience beliefs and behaviours were inferred from other resources such as census data and previous assessments undertaken by other researchers.

Most importantly, using landscape to frame both environmental issues and possible

solutions can enhance communication of such issues. The experiential, analytical, and visual qualities of the landscape are accessible to all. By repositioning our collective focus on landscape, vital issues such as land use, food production, biodiversity, water quality and climate change can be communicated to a wider audience. Greater engagement at all levels is needed as solutions to increasingly complex problems demand more collaborative and integrative solutions. Since many of these problems ultimately manifest in the landscape, it is there with the landscape that both the problems and potential solutions must be visualized.

These visualizations need to go beyond the typical urban or forestry settings in which they are most commonly practiced, and must also emphasize our rural landscapes. This emphasis becomes especially important when these landscapes have been almost completely altered from their native pre-settlement state, and the impacts of how they are managed are felt locally, downstream and globally. Some research is being done in this regard, but the majority of this work has focused on 2D mapping. Therefore a need exists for more in-depth examination of possible rural land use outcomes with emphasis on 3D and perspective visualizations. If there had been more time allotted for this project, greater emphasis would have been placed on providing such detailed 3D analysis.

Finally, attention must be paid to the emotional aspects of shared landscape experience, as these are what bind us communally and to the land. Emotional appeals, such as those implicating fear responses, have been shown to be effective in influential communications, but these persuasive strategies should perhaps instead focus on the positive experiential qualities, the shared landscape pleasure, joy, or even overcoming hardship. The landscape provides an ideal platform on which to present even statistical data in an emotionally engaging way.

5.2 Reflections on the Literature

Since the landscape scenario visualizations were intended for the audience living in or near that landscape, and since the scenario implications have a direct or indirect impact on the agricultural livelihoods of those living in that landscape, it was assumed that the audience would be ‘involved’ in scenario outcomes and their implications. It was also assumed that this audience would be able to cognitively process the information contained within the scenario visualizations. Care was taken to distill complex information into simple graphics to aid the ability to easily understand the information.

Relevance of the subject matter to the audience was also assumed, given the implications of the landscape scenarios on the livelihoods of those living in and working on that

landscape. Because certain landscape interventions - such as preserving or restoring wetlands, preserving existing shelterbelts or planting new ones, or establishing riparian buffers of various dimensions - directly impact the agricultural productivity of that landscape, it was assumed that those involved directly with that landscape would regard the landscape scenarios as particularly relevant to their ongoing land management practices.

Landscape scenario visualizations were intentionally left as inexplicit as possible in the sense that no distinct conclusions were made. For the purposes of this thesis, the future scenarios were titled “do nothing” and “efficient development” to allow for easier differentiation between them, although it is noted that both terms carry with them certain connotations. Such connotations, whether negative or positive, may lead an audience to believe that they are being manipulated, thereby potentially decreasing source credibility and overall message persuasiveness. If this project were to be taken to the next iteration at the community level, such as a participatory community workshop, care would have to be taken to ensure that scenario titles were communicative without being overly leading or explicit.

Using the same land cover categories and visualization format across scenarios, as applicable, helped to ensure that the only differences among the scenarios had to do with the proportion of land cover and corresponding ESV totals.

In order for ESV data to be considered and accepted as evidence, some understanding of the associated ecological processes must be assumed on the part of the audience. Farmers, working directly with their land, likely have a good understanding of the immediate functions and benefits of shelterbelts and riparian buffers, since a reduction in soil erosion, for example, is readily apparent on the landscape. Knowledge regarding certain functions and benefits of wetlands, however, may not be as common among the farming audience, since many of these benefits involve less visible outcomes such as water regulation and social well-being or filtration of chemical inputs. However, this information and related evidence is becoming increasingly widespread, so some familiarity with these less visible ecological processes was assumed on the part of the farming audience.

Because they were intentionally left inexplicit, the landscape scenario visualizations do not directly address any ‘sides’ of an argument. Taken collectively, however, the implicit ‘argument’ becomes clear: our land use decisions have direct consequences on the amount of ecological services that are possible within a given landscape. The two future scenarios may be interpreted as two-sided refutational, assuming that the necessary conclusions are drawn by the audience. In order for the two scenarios to be deemed ‘refutational,’ one scenario must be regarded as better than the other, and reasons for this differentiation must be made apparent.

Similar to the discussions of explicitness and sidedness, framing was left vague in terms of scenario gains versus losses. Because of this intentionally implicit nature, conclusions would have to be drawn by the audience, and further testing would be required to know what those conclusions were, and whether they were influenced by the visualized scenarios. These issues regarding land use decisions and their associated ecological service value outcomes were ultimately framed in economic terms, which implies a tendency towards maximizing gains and minimizing losses. However, these gains and these losses were re-framed from the perspective of ESV, possibly allowing new landscape associations to be made.

It is unknown whether the presentation of such landscape scenarios, framed in terms of ESV, would be novel to the audience or not. If so, overall persuasive effect may be enhanced; if not, the mere exposure effect may enable increased exposure to the concepts of land use decisions and ecological service values to result in the intended belief, attitude, and perhaps behavioural change. Further testing of these outcomes would be required to determine any correlation.

It was assumed that the audience would find the landscape scenarios relevant due to their involvement in that landscape. The scenarios may be perceived to be incongruent with the land use status quo in that landscape, since economic profit is assumed to be the current motivator in land use decisions in the study area. Similarly, cause is likely understood by the audience, although this is tempered by the lack of actual financial control on the part of the audience in changing the status quo.

The two future landscape scenarios each included a corresponding narrative and guiding set of assumptions. These narratives were kept intentionally brief, which may not have allowed for sufficient development of the required storyline in order to minimize counterarguing. Viewed sequentially, the scenario visualizations also reveal a collective narrative, from the pre-settlement baseline through time to the current landscape, which serves as a departure point to the two future scenarios. This collective narrative, including two alternate ‘endings’, leaves the final outcome up to the audience.

Overall, the four visualizations were intended to be easily understood and remembered, given the commonalities across the individual scenarios. The larger-scale birds-eye view of the entire study landscape may have been too coarse to increase presence and vividness to the desired effect, although the perspective views helped to bring the scale back down to the ground level, thereby aiding in the establishment of ‘presence’ and vividness.

The four scenario visualizations capitalize on the experiential qualities of the landscape, which enables the landscape to be the communicative medium and speculative method for the

discussion of land use practices and potential outcomes. For those with actual experience in this particular landscape, the emotive outcomes may be heightened across the four different scenarios, as land use decisions carry with them different ecological outcomes. For those who are not familiar with this landscape, there is still an experiential component implied across the four visualizations, as it becomes evident that the impacts of our land use decisions are real regardless of location.

5.3 Reflections on the Research Process

Grounded theory was an appropriate framework with which to approach the vast topic of communication, but it was not without its challenges. The project would have benefited from closer monitoring of progress within the conceptual emergence process. This could have taken the form of ongoing journaling to supplement ordered searches of papers and dated notations. As an exploratory inductive theory-building exercise, however, the emergence of themes can be deemed to be successful.

5.4 Reflections on the Mapping and Visualization Process

A combination of 2D and 3D mapping tools and visualization software was used to provide comprehensive landscape scenario views. 2D software included ArcMap and Photoshop, and 3D software included ArcScene. Some effect was perhaps lost due to the relatively coarse scale of the full-landscape 3D birds-eye views, although this limitation could potentially be mitigated if the maps were reproduced on a larger sheet size. The 2D ground-level perspective views, used for the same location in all scenarios, were included in attempts to mitigate the lack of detail posed in the birds-eye views.

The visualizations were done in an attempt to appeal to a wide land-user audience. They involved communication of the science associated with land cover and corresponding ecological systems so that audience members might understand varying levels of information, depending on their ability and motivation to do so. For example, a first glance of the birds-eye and perspective views show readily apparent differences in land cover and associated land use. These differences would presumably be apparent even to children, or perhaps those with little-to-no familiarity with this landscape. Upon further evaluation, however, these differences are represented proportionally by the corresponding pie charts, which would likely only have

meaning to those with a greater understanding of this landscape or its associated landscape systems. Efforts were ultimately made to merge typical landscape planning imagery (i.e. production processes and software) with a broader communication-theory base in order to reach a broader audience.

5.5 Landscape Visualization and Accuracy

Given the speculative nature of the future scenarios, this project challenges the notion of 'accuracy' regarding visualization, especially given that metaphor, narrative and visual representations are already detached representations of reality. Taken collectively, these visualizations are limited by the bounds of language, knowledge, and technology. The multitude of available media, whether digital or tactile and regardless of the number of 'dimensions' involved, add weight to the arguments on both sides of this debate. In order to effectively communicate a message and ultimately persuade an audience, 'accuracy' is a term that might be better substituted with 'plausibility'. Both terms – accuracy and plausibility – are closely connected to the concept of relevance.

Accuracy comes into play with regard to the evidence portrayed, which in this case involve ESV figures that were adapted from one context to another. The aim of the project must be taken into account here, since the goal was ultimately to communicate evidence according to principles derived from the literature. Viewed this way, the project was successful. However, room for argument against the validity of the evidence communicated has certainly been made. Evidence could have taken several forms. For example, carbon storage or sequestration could have been analyzed, or WATFLOOD or other models could have been used to quantify things like soil erosion and water quality. However, project limitations did not allow this inquiry to occur, although such data could very well help to make a stronger, more persuasive argument.

5.6 Importance of Results

As discussed in the literature review, adaptive processes such as communication are often best suited to past conditions, and may therefore not sufficiently address current demands and challenges. These processes are in a sense constantly playing catch-up as new challenges and uncertainties arise for which previous adaptive measures are no longer fully

appropriate. It is therefore imperative to become proactive in our adaptive measures, to anticipate problems rather than simply reacting to them as the consequences are increasingly dire. This proactive measure takes on even greater importance in the context of land use behaviours and the implications under global climate change.

The communication strategies listed in this study may not be entirely new, but revisiting them in light of recent theory reminds us to continually evaluate our communication practices to ensure ongoing fluency and influence. When discussing issues that play out on the landscape, enhanced communication can be achieved by framing the problem and possible solutions within the landscape itself. By relying on its experiential, analytical, and visual qualities, using visualization scenarios of the landscape can help to vivify the interconnected ecological and socioeconomic systems that support life as we know it. The use of visualization scenarios can help to demonstrate possible outcomes of land use choices, potentially leading to serendipitous innovation. At the local level, the landscape synthesizes various systems in a meaningful and relevant way, and so we must harness the powerful implications of our shared experience upon the landscape, and use this commonality as a foundation when discussing our shared future. In the end the results are about relationships more than exact figures, leaving the audience to draw its own conclusions. The results are ultimately about balance, and how emphasizing how small landscape interventions, whether ‘positive’ or ‘negative’, can have large future impacts.

5.7 Implications for Landscape Architecture

If landscape architects are indeed stewards of the land, then this responsibility takes on greater importance amidst mounting future uncertainty and increasing competition for landscape resources. Not only must landscape architects design on the landscape, but we must channel the communal power of all the systems that play out on the landscape to collectively guide our collective future. We must continue to develop our visualization skillset, but not necessarily in the top-down dogmatic style that has become the norm. Instead, we must listen to the audience for whom and with whom we are proposing landscape changes, incorporating a collective base of knowledge and experience. In this way, increasingly complex landscape problems can be met with appropriate solutions. Landscape architects have a special opportunity to utilize more carefully considered communication techniques, thereby improving our landscape fluency with an audience beyond professionalism. Regardless of objective or scope, of utmost importance is the ongoing evaluation and improvement of our communication practices to reach a broader, more inclusive audience and to enable positive landscape change.

5.8 Summary

This chapter provided a discussion of the major findings from this study as they relate to the literature on which the study was based. Reflections on the overall research process are provided; commentary on the mapping and visualization process is also provided. The concept of 'accuracy' is revisited with regard to landscape visualizations and their importance and implications within the field of landscape architecture. This discussion is continued and concluded in the following chapter, which suggests areas for future research in light of the limitations of the present study.

CHAPTER SIX: CONCLUSIONS

6.0 Overview

> "We must create in every region people who will be accustomed, from school onward, to humanist attitudes, co-operative methods, rational controls. These people will know in detail where they live and how they live; they will be united in a common feeling for their landscape, their literature and language, their local ways, and out of their own self-respect they will have a sympathetic understanding with other regions and different local peculiarities.
> (Lewis Mumford 1938, cited in Hamin and Marcucci 2008)

It is with the above quote in mind that we revisit the concepts of vulnerability, adaptation, communication, and rural land use. These concepts take on a particular importance when placed in the context of the semi-arid landscape of southwestern Saskatchewan, a landscape characterized by moisture variability and the cultural adaptations to such fluctuations, and one that most climate projections have poised in a particularly precarious place. The above quote succinctly captures the need for a balance between rational and emotional evaluation, a sentiment echoed by others in the assertion that the experiential and analytical qualities of landscape are what make it an ideal communicative medium. The landscape can provide this commonality, through feeling, language, and shared productivity, which leads to a landscape fluency shaped by co-operative methods, rational controls, and empathy. We must place greater emphasis on recognizing this common ground, in both the literal sense and figurative sense, and prioritize it as such.

This project began as an exploration of the semi-arid landscape of the Palliser Triangle region of Saskatchewan and resulted in an exercise in landscape communication. From the outset, it was assumed that this project would deal with a particular place, complete with a special set of biophysical and socio-cultural attributes. A place well known for its wheat, its Depression, its drought. It was assumed that the South Saskatchewan River, a vital lifeline to that region would be central to this study, and in a way it still is. But it ultimately became clear that this distinction of place was unnecessary, since no region is an island, and through air, water, and nutrient cycles, each is somehow connected to every other. Separate regions are only pieces of a much larger network of similar systems in potentially dissimilar places, and every region faces vulnerabilities that can impact or be impacted by another. Drought in an agricultural region causes food prices to rise elsewhere, while runoff in previous years from those same fields in now suffocates a significant lake in another time zone.

The vulnerabilities of the Palliser Triangle speak to a heightened state of the ecological vulnerability shared worldwide. The waters of the SSR serve to remind us of the past, of how its waters formed the land through which it passes, and hint at a downstream future, temporally connecting time and place. Similar to how the flow of water shapes the land, and carries with it remnants of land use decisions from one region to another, so do the impacts of our communication choices have interregional consequences. Landscape, both in its local and continuous sense, must be looked to as a means of improving that communication, in an attempt to lessen or prevent said consequences.

6.1 Limitations

Reliance on secondary research is perhaps the most obvious limitation to this study. However, this limitation is arguably appropriate given the project's overall exploratory structure. Another key project limitation was the reliance on ecological service value estimations from a landscape and context that is different from the selected study area. These limitations resulted from the aggregation of values, with major differences in socioeconomic and biophyisical data. However, the resultant values represent a starting point, and make clear the reality of the value of ecosystem services in plain, capitalist language. Production of the landscape scenario visualizations was hindered by a shortage of base imagery material, and so digital drawing and photomontage techniques were relied upon. Further testing would be needed to verify the effectiveness of these techniques, and to determine where future improvements might be made. Similarly, the results from this project amount to the first stage in an iterative process. Without actual feedback from the target audience in question, which would typically be obtained through the next iterations in a participatory process, effectiveness of the scenario visualizations could only be estimated.

6.2 Suggestions for future research

Seventy-five years after Mumford made the above assertion we still have not got things right, and our lack of communication measures are partly to blame. 'Communication' is a vast subject implicated in most facets of human interaction. The resultant complexities, which are in a state of perpetual evolution as times and technologies change, leave many questions unanswered. At a fundamental level, there are no established guidelines concerning what makes information persuasive or not, and there is not yet any validated method for creating

strong arguments. Measuring the effectiveness of visual persuasiveness is also still in its infancy. With regard to emotion, it is not yet known if affective states are strong enough to impact evaluative beliefs, as this has not been systematically tested. Any research on the role of emotion and persuasion is sparse at present.

The hypothesis regarding an emotional connection between humans and landscape could be tested, perhaps using oxytocin as an indicator in a manner similar to how the presence of the hormone cortisol is used to test subject stress levels. Particular visualization components could be tested to determine what contributes to effective visualizations in terms of persuasiveness. Testing of particular influential communication components to determine what makes an effective message needs to be carried out to determine best-used strategies.

Contextualized ESV estimates for the rural Canadian Prairies, even though contested due to their overly simplified market analogy, would be beneficial in terms of providing 'evidence' in land use discussions for that region.

Regardless of context, the importance of effective communication seems self-evident at first glance, and yet it is clear that our current communication mechanisms are failing to convey the need to implement sustainable land use practices. This is due in part to the limitations imposed by the socio-cultural, linguistic, and technological systems in which our communications take place, and it is the reality of these limitations that leaves much room for further inquiry.

6.3 Final thoughts

Our communication techniques, like any other social adaptation, are in a constant state of flux as surrounding circumstances change. This point is particularly pertinent when conveying the need to adjust our beliefs and behaviours, especially when doing so is contrary to economic advancement in the current global structure. To address this apparent contradiction, we must regard the landscape in a manner beyond assumed resource, whether mineral or aesthetic, and look to it instead as a mirror reflecting our past, present, and possible futures. The landscape, our common ground, should be at the centre of our discussions of land use, food production, and economy, not for its immediate market value, but for its ongoing and ultimately invaluable life-supporting services. The shared experiential and visual qualities of landscape can extend its use beyond material resource, allowing speculations on our shared future to be visualized in a communally meaningful way. Our emotional responses to landscape must be given greater priority, and this relationship demands further investigation. These responses are not the fluffy, seemingly inconsequential sentimentalities often considered when

‘feelings’ are mentioned, but rather the deeply evaluative cognitive amplifiers that hint at our moral inclinations. Within the climate change discussion, emotions can serve two vital functions: they allow moral understanding of the future impacts of our current practices, thereby connecting us to future generations impacted by our decisions, and they can provide more reliable and balanced motivation than purely rational thought. Most importantly, landscape planners and designers need to remember their audience first and foremost, and standardized design language second. As reputed stewards of the land, our priority must be about connecting people with the landscape, increasing its relevance beyond intentionally and obviously planned instances, and connecting each piece of landscape and each other in more meaningful ways.

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