Resident Participation in Watershed Management: Preference for Riparian Landscapes, Attitudes, and Behaviors

Case Study of Cedar River Watershed, Washington

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1. Introduction

The Lower Cedar River Basin in King County, Washington is an urban watershed that faces many of the same challenges as other riparian ecosystems in the Pacific Northwest urban areas. These include flood damage mitigation, fish and wildlife habitat conservation, invasive plants eradication, and water quality maintenance. A critical factor in restoration and conservation of urban streams and their catchments is the role human populations play (Walsh et al., 2005; Booth, 2005). Effective management of urban streams requires a broader perspective than traditional river ecology, one that includes social, economic, and political dimensions. Engaging the local communities in urban areas to achieve a shared understanding of what is achievable and desirable for their local streams has been one of the main challenges for riparian ecologists and policy makers (Walsh et al., 2005).

Along with local government agencies, non-profits such as Forterra can play an important role in inviting community residents to river restoration projects improving riparian ecological health and preventing flood damage. Restoration along the Lower Cedar River is a shared responsibility of King County, Seattle Public Utilities (SPU), Forterra, and Friends of the Cedar River (Figure 1). Public landownership mainly belongs to King County and Seattle Public Utilities. While King County does restoration in County natural areas and parks, Seattle Public Utilities has contracted the non-profit Forterra to design and implement restoration projects in the lower watershed since 2003. These projects mitigate the effects of deforestation, invasive plant infestations, and polluted stormwater runoff. In collaboration with Friends of the Cedar River Watershed, Forterra also engages the surrounding community in the stewardship of the shared riparian resources along the river (Blanco, 2011).

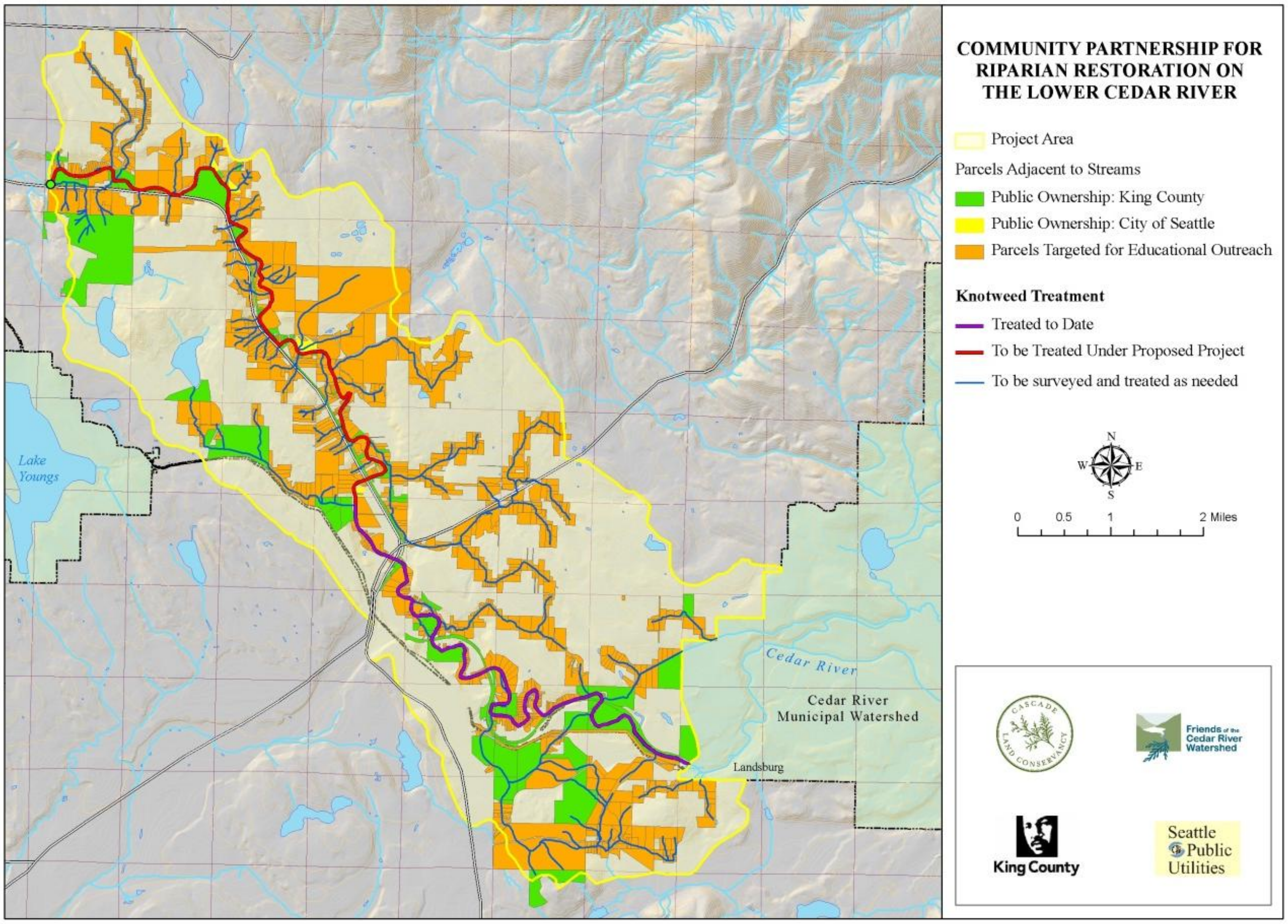

Figure 1. Community Partnership for Riparian Restoration on the Lower Cedar River (Forterra, 2010)

In 2010, the partnership of SPU and Forterra initiated the Cedar River Restoration Stewardship in Action Program (SiA), a comprehensive, landscape-scale approach to restoration. Through the SiA, invasive plant abatement, native plant installations on public and private lands along the river, and outreach and education are the shared responsibilities of Forterra, SPU, Friends of the Cedar River Watershed and King County Noxious Weed Control Program. The SiA aims to collaborate directly with local residents to design and install planting projects that restore native plant communities to private riverfront parcels. In return, the river residents become representative stewards, sharing their experience with the community, occasionally inviting tours to their property, or speaking publically on behalf of the program (Blanco, 2011).

Community residents are essential to the long term success of SiA and other partnerships working to restore the ecological health of the Cedar River Basin, which depends on diverse stakeholder groups within the partnership. While finding common ground in restoration goals and objectives is important, involvement of diverse stakeholders creates more opportunity to generate or sustain interest and funding for future management (Blanco, 2011). Therefore, it is important to know if residents' perspectives on watershed management are consistent with those of river managers from agencies and non-profits. For example, riparian characteristics with limited ecological values, such as mowed grass zones or paved riverside paths may be attractive for some urban communities (Walsh et al., 2005).

One way to gain an understanding of how people may value a river corridor is by asking them to indicate their preference for different river corridor management approaches. Photographs have been used as a tool in environmental psychology to examine landscape preference: the types of landscapes that people prefer and reasons for their preference (Fitzjohn, 2007). Landscape perception is a function of the interaction between people and the landscape (Kearney et al., 2008; Zube et al., 1982), and preference is an indication of perception.

The properties of the landscape itself are what affect preferences and aesthetic judgments. A landscape's physical characteristics and pattern yield a wealth of knowledge about people's reactions to the visual aspects of a landscape (Bradley and Kearney, 2007). Also important are people's attitudes and demographic characteristics (Bradley and Kearney, 2007). The understanding of attitudes, demographics, and their relationship with preference will structure the overall environmental perception of perceivers.

To assist Forterra to develop effective collaborative program with local residents in the Lower Cedar River Basin, the research goal for this study is to understand riverside residents through1) exploring their landscape preferences, 2) explaining preferences with demographics and attitudes, 3) explaining behavior with preference sand attitudes, and 4) explaining attitude differences with demographics. By examining the relationships among preference, attitudes, behaviors, and demographics, the study aims at a deep understanding of the residents' perspectives on riparian landscape.

The study is organized in the following order. Chapter 2, a literature review covers literatures on river restoration and landscape preference. The purpose of the review is to set the study of landscape preference in the context of river restoration, which is based on river ecology. In addition, an understanding of the local ecosystem, land-use, and restoration on the Cedar River delimits the study in this particular geographical setting. Chapter 3 is the objective statement of the study: I state the specific questions that stem from the four main study goals. In, chapter 4, I present the study methods, including data collection and analysis. A Survey is the major tool used in the study to collect landscape preference data. Finally, data analysis results are presented in Chapter 5 to answer the specific questions stemming from my study objectives. Discussion in Chapter 6 places the findings in the context of managerial implications. To provide more specific managerial suggestions, recommendation for watershed management is outlined at the end of discussion.

2. Literature Review

The purpose of the review is to set the study of landscape preference in the context of river restoration. There are two parts in the chapter. The first addresses river restoration, which includes river ecology and the ecology of the riparian landscape, impacts of urbanization, restoration in the Pacific Northwest, and landuse on the Cedar River. Understanding of the local ecosystem, landuse, and restoration situates the study in this particular geographical setting.

The second part of the review chapter deals with landscape preference, which includes reviews of studies on landscape elements and preference, the relationship between preference and demographic, preference and attitudes, and finally, landscape perception and environmental behaviors. By examining the previous studies on landscape preference and how demographic, attitude, and behavior variables relate to preference, the review guides the development of study objectives in the next chapter.

2.1 River Restoration

2.1.1 River Ecology and Riparian Landscape

<u>River Ecology</u>

Rivers are among the most complex ecosystems on Earth. They act as integrators of broader environmental conditions and centers of organization within the landscape. Activities within a watershed, whether natural or anthropogenic, influence riparian habitat distributions, trophic structure, physical, chemical and biological processes, and demography of the biological communities (Naiman & Bilby, 1998).

River channels are important as avenues of sediment transport that deliver eroded material from continents to the oceans. Channel morphology is influenced by both local and systematic downstream variation in sediment input from upslope sources (sediment supply), the ability of the channel to transmit theses loads to downslope reaches (transport capacity), and the effects of vegetation on channel processes (Naiman & Bilby, 1998).

Stream flow is an essential variable in our understanding of the functioning of watersheds and associated ecosystems because it supplies the primary source and medium of energy for the movement of water, sediment, organic material, nutrients, and thermal energy. The variation of flow during and between seasons is a key selective pressure on aquatic and riparian organisms and a primary control on channel form and process. In the Pacific coastal eco-region, the timing and extent of fish spawning runs depend on flows high enough to allow fish to enter and penetrate the channel network. Annual floods distribute sediment and organic debris through the system, scour the bed, and remove newly established vegetation in the active channel. Extreme flood events create new streambed surfaces by erosion and deposition, and renew dynamic processes in aquatic and riparian ecosystems (Naiman & Bilby, 1998).

External influences on channel response include factors such as confinement, riparian vegetation, and in-channel large woody debris. Channel confinement strongly influences channel response. Unconfined channels possess extensive floodplains across which over-bank flows spread, and this limits the effect of peak discharges on channel morphology. In contrast, confined channels efficiently translate high flows into increased basal shear stress (Naiman & Bilby, 1998).

Riparian forests in the Pacific coastal eco-region are floristically and structurally the most diverse vegetation of the region, in terms of species richness, plant biomass, and structural complexity. Riparian vegetation influences channel morphology by providing root strength that contributes to bank stability, especially in relatively non-cohesive alluvial deposits. Riparian vegetation is also an important source of roughness that can mitigate the erosive action of high discharges (Naiman & Bilby, 1998).

Large woody debris (LWD) provides significant control on the formation and physical characteristics of pools, bars, and steps, and thereby influences channel type and the potential for change in sediment storage and bedform roughness. The influence of wood on the structural and functional characteristics of streams affects the biological community including dynamics of riparian forest succession, and habitat provision for fish and wildlife. Fish, particularly salmonids in Pacific Northwest streams, prefer the pool habitat created by LWD because they require a minimum of effort to maintain their position in faster water, yet they have access to the abundance of food items carried by the current around LWD (Naiman & Bilby, 1998).

Riparian Landscape

The idea of considering riparian areas as landscapes is comprehensively captured in Malanson's (1993) book, *Riparian Landscape*. Besides indicating that the river corridor is a landscape in and of itself, the title implies that the riparian zone is a functionally dominant feature which contains and connects elements. In a landscape which is made up of a number of ecosystems, the flows of energy, matter, and species are determined to some extent by the spatial configuration of the elements (Malanson, 1993). If we consider riparian areas as landscapes, we consider them as ecological as well as cultural entities, and this leads to potentially better management (Décamps, 2001).

Landscape ecology is a discipline that deals with the influence of spatial patterns on ecological processes. It considers the ecological consequences of where things are located in space, where they are relative to other things, and how these relationships and their consequences are contingent on the characteristics of the surrounding landscape mosaic at multiple scales of time and space. Despite their traditional focus on "land", landscape ecologists have considered rivers in one (or more) of three ways, viewing riparian landscapes with a gradient of increasing sensitivity to detail: 1) river as an element of a landscape mosaic. 2) rivers linked with their surroundings by boundary dynamics, i.e. exchanges of materials, organisms, energy, or information across boundaries between adjacent landscape elements (Hansen & di Castri, 1992; Wiens, 2002). ; and 3) rivers as internally heterogeneous landscapes, with an internal structure of their own, whether it is the pattern of pools and riffles of a small tributary stream, the channels and vegetated islands of a braided river in a floodplain, or the main stems, backwaters, and oxbows of a large river (Wiens, 2002).

An accurate comprehension of spatiotemporal heterogeneity is a crucial component of a holistic understanding of the structure and function of river ecosystems and of successful protection and restoration (Ward et al., 2002). The largest temporal and spatial scale is that of the river catchment (10-10 years, km) and the smallest is the particle scale (<10years, >10^{-8} m^2) (Table 1). The scales within the river catchment include valley and channel reaches which in turn contain smaller sized riparian and channel habitats. Riparian, channel, and floodplain habitats lie within river and tributary valleys whose channel widths range from narrow (constrained reaches) to wide (unconstrained reaches), depending on the bedrock geology and geomorphological features. Changes in these physical features, and the structure and function of the riparian system, commonly depend on hydrological regimes, sediment routing dynamics, natural disturbances such as floods and fires, and anthropogenic modification (Tabacchi et al., 1998).

Table 1. Spatial and Temporal Scales Associated with a River Catchment (Tabacchi et al., 1998)

Geomorphic structure	Geomorphic function	Temporal scale (years)	Spatial scale (m)
River basin network	Water and sediment transfer	10^1–10^6	> 10^4
Valley floor	Water and sediment storage	10^2–10^4	10^3–10^4
Floodplain	Water and sediment storage	10^1–10^3	10^2–10^3
Riparian corridor	Water and sediment storage, wildlife habitat	10^0–10^3	10^1–10^2
Channel meander	Water and sediment transfer+storage	10^1– 10^2	10^1–10^2
Pools and riffles	Water and sediment transfer+storage	10^1–10^2	10^1–10^2
Depositional bars	Sediment transfer	10^0–10^2	10^0–10^2
Dunes and ripples	Water and sediment storage	<1	<1
Particles	Erosion product	<10	1–10^2

Both the riparian and channel areas can contain a wide variety of wildlife and aquatic habitats, for example, forest canopies, floodplain ponds, side channels, pools, and riffles. The scale of these habitats and their diversity can be controlled by local factors such as channel geometry, discharge and edaphic conditions, subsurface flow systems or hyporheic zones. The smallest scale, which exists within local habitats, includes the boundary layer between water and substratum, fine particles and individual organisms (Tabacchi et al., 1998).

Spatial and temporal dimensions of riparian vegetation patches reflect the heterogeneity of geomorphic surfaces within the river valley. Riparian vegetation on surfaces closer to the active channel is characterized by younger stands, commonly composed of deciduous shrubs and trees. Floodplains farther from the active channel may contain older plant communities composed of either typical riparian species (e.g., alder, cottonwood, and willow) or upland species extending down onto the floodplain (Hawk & Zobel 1974; Gregory et al., 1991). Mosaics of landforms strongly influence spatial patterns of riparian plant communities, but riparian vegetation also influences the evolution of geomorphic surfaces. Root networks of riparian stands increase resistance to erosion. Aboveground stems of streamside vegetation increase channel roughness during overbank flow, thereby decreasing the erosive action of floods and retaining material in transport (Gregory et al., 1991).

Riparian plant communities also contribute large woody debris, a major geomorphic feature in streams and rivers, to channels (Bilby, 1981; Keller and Swanson, 1979; Swanson et al., 1976; Gregory et al., 1991). LWD may serve as nuclei for the development of vegetated islands (Abbe & Montgomery, 1996; Ward et al., 2002), the presence of which is believed to contribute directly and indirectly to landscape heterogeneity (Gurnell et al., 2001; Ward et al., 2000; Ward et al., 2002).

2.1.2 Urban Impacts on Riparian Ecosystems & Landscape

In urban ecological studies, the role of rivers in an urban setting can be conceived of as that of a native ecosystem impacted by urban development or as parts of the urban ecosystem itself. In the dynamics of urban ecosystems, streams feature strongly as 1) habitats for a potentially diverse and productive biota, 2) carriers of water and processors of the materials in that water, and 3) important social and cultural foci for the human inhabitants of their catchments. The position of urban streams in the landscape makes these ecosystems particularly vulnerable to impacts associated with landcover change (Walsh et al., 2005).

It is worth noting that urban development does not itself cause stream ecological degradation, but inflicts stresses on river biota by altering the landscape. Human activity in urban development is multidimensional; it can entail industrial, retail, housing, or road networks development, with alterations of topography, soils, vegetation, and channel network of various levels (Booth et al., 2004). In the conceptual framework offered by Booth et al. (2004), the human actions collectively termed "urbanization" are explicitly linked with biological condition, the primary endpoint of concern, with altered landscapes as transitions (Figure 2).

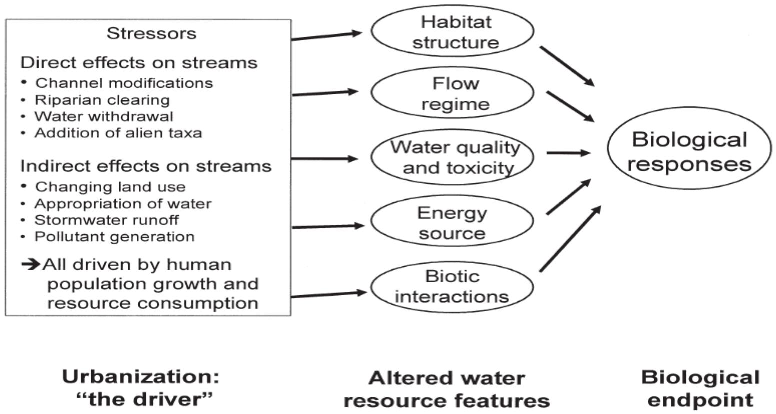

Figure 2. Conceptual Model of the Varied Stressors Resulting From Human Actions That Alter Stream Biological Condition (Booth et al., 2004)

Major impact of urbanization on streams include increases in the amounts and variety of pollutants in runoff, more erratic hydrology owing to increased impervious surface area and runoff conveyance, increased water temperatures due to loss of riparian vegetation and warming of surface runoff on exposed surfaces, and reduction in channel and habitat structure as a result of sediment inputs, bank destabilization, channelization, and restricted interactions between the river and its land margin (Paul & Meyer, 2001; Allan, 2004).

Enhanced runoff from impervious surfaces and stormwater conveyance systems can degrade rivers and displace organisms with greater frequency and intensity of floods, erosion of riverbeds, and displacement of sediments (Lenat & Crawford, 1994; Allan, 2004). Incision is especially marked in watersheds with old and/or stable urban landuse, where there are few sources of sediment to replace material scoured by high flows during floods. Channel incision, in combination with reduced infiltration in impervious urban uplands, can reduce riparian groundwater levels, which can have dramatic effects on soil, plants, and microbial processes. As suggested by Groffman et al. (2003), riparian "hydrologic drought", caused by lowered water tables, is a general effect of urbanization that occurs in many cities.

Given that the regeneration and growth of riparian vegetation is adapted to water table levels and the flooding regime of the adjacent stream, the hydrologic and soil changes associated with urbanization should have dramatic effects on riparian vegetation. The impacts on vegetation can in turn influence other ecosystem functions, due to the critical roles vegetation plays in riparian zones, including maintenance of river temperature, provision of woody debris to create stream habitat, and uptake of nitrate from shallow groundwater (Sweeney, 1992; Tabacchi et al., 2002; Groffman et al., 2003).

The vegetation analysis done by Groffman et al. (2003) at Gwynns Falls watershed, Baltimore clearly shows the effect of riparian hydrologic drought induced by urbanization. The riparian zone is becoming drier throughout the Gwynns Falls watershed, with the lower urbanized watershed created drier, more favorable habitats for the germination and growth of upland species. In the lower, more urbanized section of the watershed, wetland tree species are either absent or occur as small stems, while upland species are abundant and occur in mixed sizes. Such a shift could have dramatic effects on ecosystem services provided by vegetation in the riparian system (Groffman et al., 2003).

Many other studies have shown that wetland vegetation responds rapidly to hydrologic changes. Alterations in riparian vegetation induced by urban hydrologic drought are a particularly important type of wetland vegetation effect, because of the functional importance of riparian zones in watersheds. For example, such change has been identified as a key factor in stream degradation in the Puget Sound/Seattle metropolitan area of Washington State. In a survey of 45 sites along second- and third-order streams, measures of stream biotic integrity declined strongly with the percentage of urban land cover in the riparian zone (Booth et al. 2001; Groffman et al., 2003).

Other major effects of riparian vegetation degradation associated with clearing and canopy opening include reduced shading, causing increases in stream temperatures, light penetration, and plant growth; decreased bank stability; reduced inputs of litter and wood that decrease nutrients and contaminant retention; reduced sediment trapping and increased bank and channel erosion; altered quantity and character of dissolved organic matter owing to loss of direct input and retention structures; and altered trophic structure (Allan, 2004).

Loss of large woody debris in riparian zones also has impacts on stream ecosystems, such as reduction of substrate for feeding, attachment, and cover; loss of sediment and organic material storage; reduced energy dissipation; altered flow hydraulics and, therefore, habitat distribution; reduced bank stability; and alteration of invertebrate and fish diversity and community function (Allan, 2004).

There is no single change that defines urbanization; instead, the cumulative effect of the variety of human activities in urban basins profoundly influences urban streams and their biota. Because of this complexity, successful rehabilitation must combine knowledge of the biophysical processes and conditions that sustain a specific stream system with knowledge of the drivers of degradation in that system (Booth et al., 2004).

Summary

River ecologists point out the importance of river systems in terms of sediment transportation, seasonal variation of flow, unconfined channel processes, riparian forest functioning, and large woody debris maintenance. The ecological functions of these stream elements are entailed in the riverine landscape, which can be shaped and managed by human populations. Identifying important riparian landscape features and their ecological functions allows us to understand how converting a natural river through urban development can degrade ecological functions of river systems.

Key riparian landscape features include: forest canopies, floodplain ponds, side channels, pools, rifles, and large woody debris. By altering the landscape, impacts of urbanization such as enhanced runoff from impervious surface, vegetation shift and degradation, loss of large woody debris, and confinement of river channel inflict stresses on stream biota. River morphological and biological responses to urbanization such as increased risk of flood hazards and stormwater pollution often in turn have negative impacts on human health and quality of life. When this degradation occurs, ecological landscape restoration can reconstitute riparian natural features and thus their ecological functions.

2.1.3 Riparian Restoration in the Pacific Northwest

Ecological restoration is the reestablishment of processes, functions, and related biological, chemical, and physical linkages between the aquatic and associated riparian ecosystems; it is the repairing of damage caused by human activities. Since Euro-American settlement in the western United States, the riparian zones have been extensively altered as a result of channelization, road construction, timber harvesting, livestock grazing, mining, and water diversion. Degradation of riparian zones and streams diminishes their capacity to provide critical ecosystem functions, including the cycling and chemical transformation of nutrients, purification of water, attenuation of floods, maintenance of stream flows and stream temperatures, recharging of groundwater, and establishment and maintenance of habitats for fish and wildlife (Kauffman et al., 1997). Thus, the goal of restoration projects is to ensure that the dynamics of natural ecosystem processes are again operating efficiently so that both ecosystem structure and function can be recovered (National Research Council, 1992; Kauffman et al., 1997).

Catchments in the Puget Sound region of western Washington share relatively uniform soil, climate, and topography. The region is characterized by temperate, humid-region lowland streams where urban or suburban development is the primary human disturbance. The climate is maritime and mild, with 75% of the annual rainfall (1000mm) falling in autumn and winter. Bethel and Neal (2003) noted the two prevailing goals for stream-enhancement projects in the Puget Sound region: "1. to establish the channel morphology appropriate to the topographic, geologic, and hydrologic setting, and 2. to establish the channel and riparian habitat that support a diverse native plant and animal community appropriate to the setting" (Booth, 2005).

This perspective was affirmed by most stream enhancement projects in the Puget Sound region during the 1990s (CUWRM, 1998; Booth, 2005). Of the nearly 400 stream enhancement projects reviewed in CUWRM (1998), 90% fell into 4 broad categories involving physical rehabilitation: riparian enhancement (planting and fencing; 35% of all projects), in-stream habitat augmentation (large woody debris [LWD] installation, gravel placement, and large rocks; 22%), bank stabilization and grade control (18%), and fish passage enhancement (15%) (Booth, 2005). Each of these project categories typically affected only a few tens to, at most, hundreds of meters of stream channel. The common theme of these and other stream restoration projects is their narrow symptomatic focus (e.g., bank erosion or lack of pools or LWD at a site) in response to an underlying disturbance at a much larger, typically catchment scale (e.g., logging or urbanization).

While scientists strongly recognize the need to restore or conserve native fish throughout the Pacific Northwest, less appreciation exists for how local geomorphic settings and natural hydrologic disturbance regimes interact with native riparian plant communities to create sustainable habitats (Kauffman et al., 1997). For example, fish habitat in Pacific Northwest streams includes such elements as LWD, pools, riparian and in-stream cover, gravel deposits, floodplains, and riparian vegetation. Each of these habitat elements can be built on-site, but neither their longevity (Frissell and Nawa ,1992; Booth, 2005) nor their biological effectiveness (Larson et al. 2001; Booth, 2005) have been documented (Booth, 2005).

Ecological restoration should be a holistic approach not achieved through isolated manipulations of individual elements but through approaches ensuring the occurrence of natural ecological processes (Kauffman et al., 1997). As the movement to restore urban streams grows, urban stream ecologists will be challenged to identify the primary mechanisms of degradation, the best management actions to reverse those mechanisms, and attainable goals for restoration (Hobbs and Norton 1996, Booth 2005). Further challenges involve engaging the human communities of urban areas to achieve a shared understanding of what is achievable and desirable to communities for their local streams (Walsh et al., 2005), especially in the Pacific Northwest where most urban streams flow across private properties and thus lie beyond the jurisdiction of public agencies (Schauman, 2000; Booth, 2005). For example, urban riparian attributes with limited ecological values, such as mowed grass zones or paved streamside paths, may have amenity values for some urban communities (e.g., Tunstall et al. 2000; Walsh et al., 2005). Community actions guided by public education to maintain sustainable and ecological streams and to enhance degraded streams is therefore important (Purcell et al. 2002; Booth, 2005), particularly for which restoration is justified in terms of quality of life or by their value as a public amenity (Booth, 2005).

2.1.4 Landuse and Restoration on the Cedar River

The Cedar River is about 45 miles (72 km) long, originating in the Cascade Range near Abiel Peak, flowing generally west and northwest, and empty into the southern end of Lake Washington (FCRW, 2012). The hydrology and landcover of the Cedar River basin have been altered from natural conditions in the past century (King County, 2010).

The upper watershed is a protected area known as the Cedar River Municipal Watershed. About 90,000 acres, or 143 square miles, is owned by the Seattle Public Utilities and managed as an ecological preserve to provide drinking water for about one million King County residents (FCRW, 2012). Landuse in the upper Cedar River basin is dominated by forest use (60.6 percent of the basin), with three dams designed for municipal water supply and hydropower purposes: the Masonry Dam, the reconstructed Crib Dam or Overflow Dike, and the Landsburg Diversion (King County, 2010).

The lower Cedar River Basin is home to over 60,000 people, including communities of Maple Valley, Ravensdale, and Renton (FCRW, 2012). The lowest mile of the river was rerouted by the U.S. Army Corps of Engineers in 1914 in order to provide additional water for operation of the locks between Lake Washington and Puget Sound. The mouth of the Cedar River, which previously drained to the Black River and subsequently the Green River and into Puget Sound, was diverted into Lake Washington through a straightened, dredged channel with rock-stabilized banks (King County, 2010).

Historical aerial photographs increasing residential development over 60 years (Figure 3.). Now the main uses in the lower basin are residential; 21.3 percent can be classified as low-density development, 7.7 percent as medium-density development and 0.9 percent as high-density development. High-density development is located primarily in the Cities of Renton and Maple Valley (King County, 2010).

Figure 3. Historical Aerial Photographs of Fairwood in 1936, 1970, 1996, Southeast of Renton, Washington (King County, 2009)

Human residence on floodplain creates problems including flood hazards and declining salmon and steelhead runs in the Lower Cedar River Basin. During major storms, over 300 homes along the Cedar River are exposed to mainstream flooding. More than 100 of these homes are subject to life-threatening flood flows and evacuation routes for many other homes are impassable (King County, 2010). Natural runs of Lake Washington sockeye, coho, and chinook salmon and steelhead trout have been severely depressed in recent years. The reasons for the declines are not fully understood and vary by species, but the protection and restoration of the Cedar's aquatic habitat are identified in King County’s Lower Cedar River Basin Plan (2010) as a key element in both the recovery and the long term sustainability of salmon and steelhead runs in the larger Lake Washington system (King County, 2010).

Therefore, while allowing for urban development and support for industry and recreation, the Lower Cedar River Basin Plan addresses flood mitigation, habitat, and water quality concerns. Partnerships among interest groups- King County, Seattle Public Utilities (SPU), Forterra, and Friends of the Cedar River- as well as local businesses, landowners, schools and other local government have evolved from stewardship and volunteer projects as a way to protect and restore key areas of the Cedar River (King County, 2010). To restore habitat and reverse declines in the salmon runs, King County has spent or leveraged more than $19,250,000 over the last 12 years to acquire priority habitat totaling more than 1,053 acres. Restoration projects to plant trees and remove invasive plant species have been coordinated by the Friends of the Cedar River through volunteering events and stewardship programs (FCRW, 2012).

However, the projects done by the County on the Cedar River are mostly of “narrow symptomatic focus” (Booth et al., 2004). They either address flood mitigation with levee construction and bank stabilization, or salmon run recovery with salmon spawning channel construction and parcel-scale tree planting. Successful stream rehabilitation requires a shift from narrow analysis and management to integrated understanding of the links between human actions and degrading river health. Because one single change is inadequate to generalize impacts of urbanization, knowledge of the biophysical processes and conditions that sustain a specific stream system must be combined with knowledge of the drivers of degradation in that system to achieve the overall goal of river health (Booth et al., 2004).

Figure 1 shows the community partnership in the Cedar River restoration projects. The land ownerships of the lower Cedar Basin primarily include King County, Seattle Public Utilities (SPU), and private property owners. Therefore, to achieve comprehensive restoration goal, all stakeholders must be involved. While the County is focusing on restoring parcels in designated natural areas and parks, and Forterra is contracted to work on SPU lands, private property owners, especially riverside residents, are in need of support in terms of education and restoration resource provision to implement restoration. Primary restoration in the basin is the control of invasive knotweeds- *Polygonum bohemicum* (Bohemian knotweed), *P. cuspidatum* (Japanese knotweed), P. *sachalinense* (giant knotweed), *P. polystachyum* (Himalayan knotweed) (King County, 2008), and the installation of native vegetation.

In the Stewardship in Action Program (SiA), Friends of the Cedar River Watershed and Forterra are working in partnership with SPU and King County Noxious Weed Control program to provide free knotweed control services to private property owners who live along the mainstream or major tributaries of the Cedar River in Renton and Maple Valley (FCRW, 2012). Through native planting design and installation, SiA aims to improve the ecological health of the river and ensure a stable riverbank.

2.2 Landscape Preference

To understand landscape preference and underlying perception of the residents in the Lower Cedar River Basin, I will break down landscape preference in four parts: 1) landscape elements and preference, 2) variations among demographic groups in preference, 3) variations among people with different attitudes toward watershed issues in preference, and 4) how preference, as a perception of landscape affects individual environmental behavior. The following sessions review previous studies on the above topics of landscape preference.

2.2.1 Landscape Elements and Preference

Empirical studies on landscape preference use photographs of real environments and ask people to rate on a Likert-point scale of how much they like each of the scenes. Preference ratings generate diverse information. The ratings can be examined in terms of how much various scenes are liked or disliked by computing the average rating for each scene. The pattern of the ratings and their relationship to each other can also be examined. For example, landscapes that contain similar elements may be rated in the same way by the same individuals. Based on the rating patterns, factor analysis generates various landscape categories, within which same landscape elements are identified as underlying perception factors that determine perceiver responses.

Landscape categories can thus help us understand the underlying perceptions that structure preference. To come up with landscape categories, empirical studies used different categorization techniques, including explicitly collecting ratings on specific landscape elements in each scene (Chin et al. 2008; Nassauer, 1993), implicitly pre-assigning categories and using factor analysis or complementary questions to generate new categories from participant ratings (Kenwick et al., 2009; Williams and Cary, 2002), and exclusively using factor analysis to yield new categories from respondent ratings (Ryan, 1998; Salisbury, 1997).

To explore preference for scenes with a range of ecological values, William and Cary (2002) and Nassauer (1993) both found that naturalness, aesthetic value, neatness and orderliness all account for preference. Nassauer (1993) concluded that a landscape is more likely to be attractive if it is neat and well cared for, regardless of naturalness. This is demonstrated by William and Cary (2002), given that scenes with moderate ecological quality but which are dry or dead-looking due to the existence of oak trees and signs of fire are least preferred, but other “natural” scenes with openness and maintenance such as grassy and grazed woodlands are the most preferred.

Preferences for riparian landscapes and buffers were explored by Ryan (1998), Kenwick et al. (2009), and Salisbury (1997). These studies showed that aesthetics, ecological benefits, and maintenance are the most important concerns of a riparian buffer treatment. This again illustrates the important balance between "naturalness" and "neatness" in riparian landscape restoration. River scenes were the favorite among all four categories of river, woods and grassland, farm field, and backyard in Ryan (1998). However, a narrow and overgrown stream scene received a far lower rating, illustrating that while water may be an indicator of preference, people tend to prefer more open streams (Kaplan, 1977; Ryan, 1998). Preference for riparian vegetation buffer showed a strong inclination toward "tree buffer," as opposed to "grass buffer," and "no buffer" in Kenwick et al. (2009). Similarly, across different bank treatments in Salisbury (1997), a "natural" scene with a log jam is the most preferred, while the scene containing unvegetated riprap was the least preferred.

In summary, empirical studies show that people have a preference for natural-looking and neat landscapes. Attractiveness of a landscape arises when the landscape is consistently natural and yet well maintained to provide a view or allow access. Preference for different categories of landscaping is not necessarily sequential from the most natural to the most developed. Instead, it is an incorporation of the idea of naturalness into what people consider to be aesthetically pleasing. Therefore, recognizing the difference between perceived ecological value and aesthetic value of a landscape is important to ecological landscape restoration. When we frame "messy" ecosystems in an ordered manner which fits the cultural context of the place (Nassauer, 1995), we are more likely to achieve overall ecological health along a river corridor.

2.2.2 Landscape Preference and Demographics

This section compiles studies that explored effects of demographic factors on landscape preference. Studies suggest that people relate differently to settings with which they have direct experience. The environment near one's home, for example, holds some special significance that is reflected in preference judgments. People tend to prefer the scenes that they are familiar with (Kaplan & Kaplan, 1989). The effect of residential location on landscape preference is examined by Ryan (1998) in terms of township, distance to the river, and surrounding landscape type. Residents appear to have a greater preference for their surrounding landscape. In addition, those in closest proximity to the river expressed the most concern about water quality. Township location, on the other hand, was significantly related to participants' perceptions of flooding and insect problems.

Length of residency is a spatial-temporal factor in landscape preference. Past studies (McCool & Martin , 1994; Vaske et al., 2001) have found that as length of residency decreases, individuals are more preservation focused, rather than anti-preservation (Vaske et al., 2001). This is demonstrated in Ryan

(1998): the shorter the residency, the more the residents preferred the river photo category, whereas long-time residents (over 25 years) had a relatively higher preference for domestic landscapes in the backyard photo than those in the short and mid-range of residency. Newer residents also appreciated the natural areas along the river, such as woods, wildlife and quiet locations more than long-time residents.

It was implied that people who share the same cultural backgrounds, system of thought, or language would experience the environment similarly and would have some common preferences (Kaplan & Kaplan, 1989). Virden and Walker (1999) explored how ethnicity/race influences human-natural environment relationships among white, black, and Latino college students in the western United States. White participants perceived a forest environment to be a safer and more pleasing place than either black or Latino participants. For preferred environmental settings, black participants exhibited a higher preference for visible management and law enforcement than either white or Latino participants. While white or Latino participants favored more remote natural settings, black participants preferred an environmental setting developed more towards visitor convenience.

Variations are not only likely to exist in one's cultural/ethnic background (Virden & Walker, 1999), but also within subculture groups such as age, gender, religion, political affiliation, and socioeconomic groups such as education, income, and occupation. The relationship between age and landscape preference has shown significant differences between children and adults (Howley, 2011). Additionally, elderly people have been found to display relatively low preferences for wild natural landscapes. It is hypothesized that their greater physical and psychological vulnerability may make them more at risk from the dangers of wilderness areas (Van den Berg & Koole, 2006, Howley, 2011).

Studies using gender as a predictor for environmental value orientations show a mixed pattern of findings. While the available empirical evidence is inconclusive, most authors conclude that females are more environmentally oriented than males, especially when the focus is on local natural resource issues (Mohai, 1992; Vaske et al., 2001). On the other hand, the effect of gender on human-natural environment relationships in Virden and Walker (1999) showed that female participants perceived a forest environment to be more mysterious, less safe, and more awe-inspiring than males. More males than females preferred less visible evidence of management and law enforcement was preferred by males than females. The same was true for a preference for a remote natural setting over a visitor convenience setting.

Few studies have consistent results on the influence of religious variables on the environment and why. Despite the growing diversity of religions in the US, studies have focused on the broader Christian community. Judeo-Christians are generally found more committed to a mastery-over-nature orientation than non-Judeo-Christians, though religious commitment varied considerably across individuals (Guth et al., 1995). Lynn White's (1967) classic assertion that a Judeo-Christian mastery perspective on nature retarded environmental sensitivities and encouraged exploitation of natural resources is supported by Hand & Van Liere's (1984) study of Washington-state residents.

Political affiliation has been found to relate to environmental concerns. Since the late 1970s, Democrats tend to have the strongest environmental sympathies (Pollock, Vittes, & Lilie, 1992; Peterson, Kowalewski, & Porter, 1993; Guth et al., 1995). Research examining the relationship between education and environmental value orientation shows a mixed pattern of findings. Steel et al. (1994) found that those with more education were more ecological-oriented among Oregon participants (Vaske et al., 2001). Most other studies also demonstrated the result of positive association between education and ecological-oriented environmental value (Howell and Laska, 1992; Inglehart, 1990; Milbrath, 1984; Nelson, 1999, Vaske et al., 2001).

Income, though correlated with education, has not been associated with an individual's environmental values. Very high income individuals have traditionally been employed in businesses that value economic rewards more than environmental preservation (Nelson, 1999; Vaske et al., 2001). Similarly, people of lower income rate economic values higher than environment ones because they depend on the economy to survive. People in middle-income categories have sufficient resources to live beyond subsistence and often have the formal education needed to be aware of human impact on environmental consequences (Vaske et al., 2001). Occupation is found to be related to environmental concerns in past analyses. Professional and managerial classes, not blue-collar workers, form the core of environmental enthusiasts, although this may be partly an artifact of education (Guth et al., 1995).

Nevertheless, the effects of different demographic variables on landscape preferences are often found to be highly variable across different landscape categories (Kaltenborn & Bjerke, 2002; Howley, 2011; Howley et al., 2012; Salisbury, 1997).There is no consistency across the landscape types in terms of the direction of the effects of demographic variables (Howley, 2011). Despite some findings of significant relevance between landscape preference and demographics, the overall relationship between the two has been relatively weak (Stamps, 1999; Bradley & Kearney, 2009).

2.2.3 Landscape Preference and Attitudes

The effects of attitudes on landscape preference have been explored in a number of studies. When individual or inter-group differences in landscape appraisals are found, they may be closely related to underlying differences in values toward environmental issues. Our basic beliefs about a more restricted part of the environment, such as our evaluation of environmental issues, are our environmental value orientations (Kaltenborn & Bjerke, 2002).

Classification of environmental values orientation may be general or specific, according to the study purpose. For example, Kaltenborn and Bjerke (2002) used a scale originally developed by Thomson and Barton (1994). The scale contains three subscales; ecocentrism, anthropocentrism, and environmental apathy. While ecocentrism attitudes emphasize that nature has intrinsic rights which are independent of human interest, anthropocentrism values argue for avoiding damage to the environment for human interest. Generally negative attitudes towards the environment are classified as environmental apathy.

Howley (2011) and Howley et al. (2012) examined preference for rural landscape and traditional farmland landscape respectively, and thus have identified distinct classes of environmental values as: "multifunctionality", "agricultural productionist", and "environmental apathy". The statements relating to "multifunctionality" in both Howley (2011) and Howley et al. (2012) are attitudes on the environment as a provider of a range of public goods and services as well as its overall intrinsic value. The "agricultural productionist" statements refer to a more functional view of the landscape- one that emphasizes the importance of using the landscape for food production.

To address public land management issues, Ribe's (2002) study of the relationship among attitudes, preference for and acceptability of landscapes grouped the participants into three sets: resource productionist, resource protectionist, and other nonaligned people with moderate views about environmental issues. More specifically, Bradley and Kearney's (2009) study on forest scenes examined the attitude items including the necessity of forest management and timber harvesting, the use of specific management prescriptions, and various management objectives.

The preference for natural landscapes is more often associated with ecocentrist attitudes. On the other hand, preference for landscapes with human intervention is often found to be associated with anthropocentric values. Kaltenborn and Bjerke (2002) found a significant positive relationship between ecocentric values and a preference for wildlands with water. They also found a significant positive correlation between anthropocentric value orientation and modern farm environments. Those who were relatively indifferent to environmental issues (environmental apathy) were found to be less likely to prefer "wild nature scenes" and "water related landscapes". In Howley's (2012) farmland study, individuals that were indifferent to environmental issues were found to be less likely to prefer traditional farm landscapes as opposed to modern farm landscapes.

Ribe's (2002) study of the relationships among attitudes, preference, and acceptability found that resource protectionists had higher standards for both scenic beauty and acceptability; they only perceived scenes as acceptable if they were also beautiful. In contrast, participants who favored resource production had lower standards for both scenic beauty and acceptability, and perceived some scenes rated low in scenic beauty as acceptable.

Attitude was found to be a significant factor in explaining preference in Bradley and Kearney's (2009) forest scene preference study. In particular, having a utilitarian/commodity perspective regarding forest management increased one's preference for forest scenes depicting at least some active forest management. However, as opposed to Kaltenborn and Bjerke (2002), Howley (2011), Howley (2012), and Ribe (2002), an ecosystem/amenities perspective was not found to be associated with a decrease in preference for managed scenes, and no in`crease in preference for natural-appearing scenes was found to be associated with increased endorsement of an ecosystem/amenities perspective in Bradley and Kearney (2009).

2.2.4 Landscape Perception and Environmental Behavior

Few studies address the relationship between landscape preference and environmental behavior. The existing literature describes the mutual interaction between landscape perception and environment behavior as transactional in that human and the environment define and transform each other over time (Gobster et al., 2007). Gobster et al. (2007) provided a conceptual model of human–environmental interactions in the landscape. The model portrays humans and the environment as discrete but interacting sets. Through perception of the environment (landscape perception) process, aesthetic experiences drive actions toward landscapes, which affect landscape patterns and hence ecological functions (Figure 4).

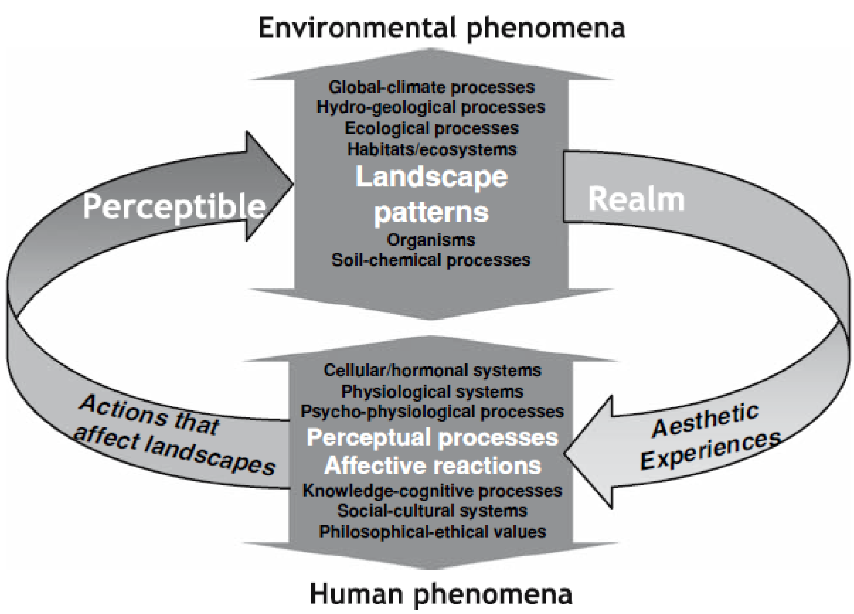

Figure 4. Model of Human–Environmental Interactions in the Landscape (Gobster et al., 2007)

Although environmental behavior and landscape preference are interactive in a way that either one may be explained by the other, it is more intuitive to consider landscape preference as a human perceptual process, and hence leads to behaviors that affects ecological functions. Williams and Cary (2002) explored the effects of landscape preference on human behaviors that affect environmental quality. Landholders who report higher preference for vegetation types with moderate to high ecological quality also report undertaking a higher number of behaviors that will preserve the ecological quality of these ecosystems. In contrast, there is no association between protection behavior and preference for vegetation that is low in ecological quality.

Limitations of Literature Review

Despite the huge volume of landscape preference studies and research on the social dimensions of restoration , riparian landscape preference is not as widely examined in terms of ecological restoration. The background of the study is to address a real-time problem in a highly local context. This study could draw from previous research to a certain extent. In addition, studies on the effects of atitudes and demographics on preference are highly variable in terms of the results. There are very few studies on associating environmental behavior with preference. Therefore, the study referred less to previous studies but drew more from an empirical need to set the stage for objective formation.

3. Objectives

I designed the study to inform Forterra and other restoration stewardship program partners about the riverside neighborhood residents' perspectives, including their preference for riparian landscapes, environmental behaviors, attitudes toward watershed issues, and demographic characteristics. An understanding of the residents' perspectives would help these agents to engage of riverside residents in riparian restoration. The collaboration of private landowners and Forterra in restoration projects will not only improve stream ecological health but also mitigate flood damage.

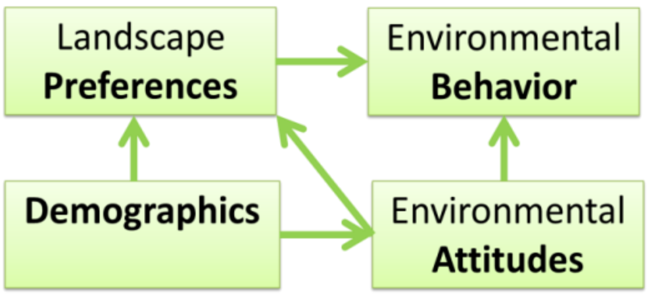

Figure 5. The variables and their interactions examined in the study (arrows pointing to dependent variables).

Specifically, the objective of the study is to understand riverside residents through1) exploring their landscape preferences, 2) explaining preferences with demographics and attitudes, 3) explaining behavior with preferencesand attitudes, and 4) explaining attitude differences with demographics (Figure 5.). To meet the objectives, I asked the following research questions:

- Landscape Preference
    - What are the common themes that emerge from the scenes of different landscape types?
    - What are the participants' descriptions for each landscape types?
    - What are the participants' preference ratings for each landscape type?
- Explaining preference with demographics and attitudes
    - How do residents' landscape preferences differ among demographic groups, including residential proximity to the river, riverfront or non-riverfront residence, residential jurisdiction before annex, length of residency, age, gender, religion, political affiliation, education, income, and occupation?
    - How do residents' attitudes (awareness, importance, and preparedness) toward environmental hazards (earthquake, flood, erosion) relate to their landscape preferences?
    - How do residents' awareness, approval, and participation in watershed management plans and regulations relate to their landscape preferences?

    - How do residents attitudes toward watershed management issues (resident participation, private right protection by regulatory systems, government role, and management objectives) relate to their landscape preferences?
    - How do residents' attitudes toward human-nature relationship (human dominance and pro-environment statements) relate to their landscape preferences?
- Explaining behavior with preference and attitudes
    - How do residents' landscape preferences relate to their behaviors that affect environmental quality?
    - How do residents' attitudes toward environmental hazards relate to their behaviors that affect environmental quality?
    - How do residents' awareness of, approval for, and participation in watershed management plans and regulations relate to their behaviors that affect environmental quality?
    - How do residents' attitudes toward watershed management issues relate to their behaviors that affect environmental quality?
    - How do the residents' attitudes toward human-nature relationship relate to their behaviors that affect environmental quality?
- Explaining Attitudes with Demographics
    - How do residents' attitudes toward environmental hazards differ among demographic groups, including residential proximity to the river, riverfront or non-riverfront residence, residential jurisdiction before annex, length of residency, age, gender, religion, political affiliation, education, income, and occupation?
    - How do residents' awareness of, approval for, and participation in watershed management plans and regulations differ among demographic groups, including residential proximity to the river, riverfront or non-riverfront residence, residential jurisdiction before annex, length of residency, age, gender, religion, political affiliation, education, income, and occupation?
    - How do residents' attitudes toward watershed management issues differ among demographic groups, including residential proximity to the river, riverfront or non-riverfront residence, residential jurisdiction before annex, length of residency, age, gender, religion, political affiliation, education, income, and occupation?
    - How do residents' attitudes toward human-nature relationship differ among demographic groups, including residential proximity to the river, riverfront or non-riverfront residence, residential jurisdiction before annex, length of residency, age, gender, religion, political affiliation, education, income, and occupation?

4. Methods

The study site is the Lower Cedar River Basin, where photos were taken to be included in a survey questionnaire. Participants are residents of Maplewood Neighborhood, Renton, Washington. Four interviews with Maplewood residents served as the pilot study to gather information for survey development. A questionnaire was then designed to achieve study objectives-understanding of landscape preference, attitudes toward watershed issues, environmental behaviors, and demogrpahics (Appendix I). Survey questionnaires were hand-delievered to all the other residents in Maplewood.

I used SPSS as the statistical tool for data analysis. Factor analysis was used to identify underlying dimensions of preference and attitudes and reduce the variables to a smaller number of factors. Statistical models were developed to examine the relationships among preference, attitudes, behaviors, and demographics. Specifically, one-way analysis of vairance (ANOVA) was used to examine the difference in preference and attitudes among demographic groups. Bivaritae correlation was used to examine the relationship between preference and attitudes. Behavior was tested with regard to preference and attitudes using logistic regression.

4.1 Site and Participants

Site Description

The natural areas in the Lower Cedar River Basin are mostly managed by King County Natural Areas or County Parks. Other natural areas are managed by Seattle Public Utilities (SPU), but restored and maintained by Forterra. On the land that belongs to private ownership, the riparian landscapes are usually lawns or gardens, except for those under conservation easement or restored by Forterra. The river is more channelized as it flows downstream into ciy of Renton. There are modified sidewalks along the city park riverfront. Levees were built to protect shorelines near public facilities such as Renton City Hall and Boeing fields at the mouth of the Cedar River.

Participants

Participants in the study are residents of Maplewood Neighborhood, Renton, Washington. The participant neighborhood was chosen in response to Forterra's request for reaching out to downstream riverside communities. The neighborhood sits on a patch of right convex bank of the Cedar River. Before the jurisdictional annex in 2008, the neiborhood was divided into two part; the east half part of the neighborhood was an unincorporated urban area in King County, while the west part was in Renton (Figure 6). There are 163 households in the neighborhood, with 43 on the riverfront.

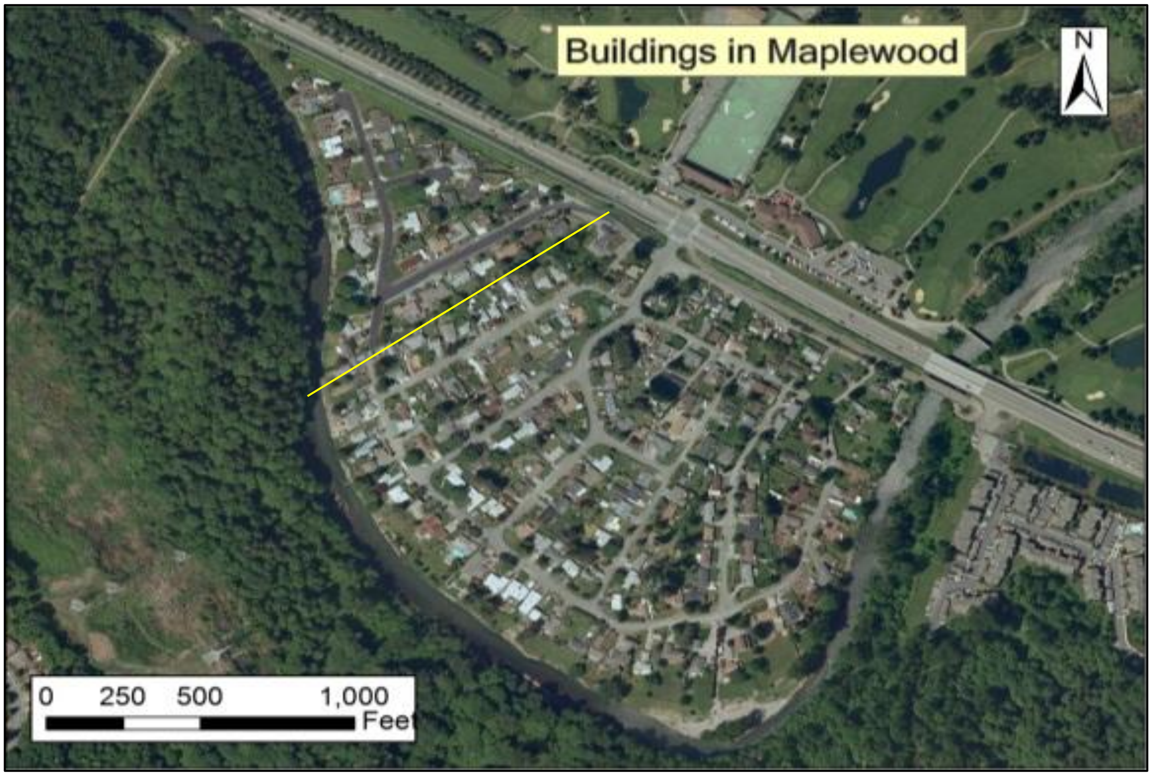

Figure 6. Maplewood Neighborhood and Renton/King County Jurisdiction boundary before Annex

As study participants, residents in a neighborhood are viewed as a “loose collectivity”, a collection of people in touch with one another but not as closely linked as those in an organization (Weiss, 1994). It may be possible to find someone who is central and knowledgable; however, any member may provide entry-level information (Weiss, 1994). Key informants who are knowledgable and central to the neighborhood were first identified and interviewed to provide information for the development of survey, which is aimed at the overall population in the neighborhood. Participants in interviews were chosen based on “convenienve sampling” (Weiss, 1994); they are two contact residents introduced by Forterra. More interviewees were recruited by “snowball sampling” (Weiss, 1994); three other interviewees were recurited through the first interviewee’s referral.

The goal of the study is to understand the neighborhood comprehensively. Due to the small size of neighborhood population, all the other 159 households in the neighborhood were visited for survey participation. This is to increase the representation of participants of the entire neighborhood (Weiss, 1994). Recruting as much participants as possible might also display a better variation in the larger population. 121 surveys were sucessfully delievered, and 91 were returned. Thus, the total number of survey participants in the study is 91. There are more than 60 respondents in the study. This sample size is likely to be a fairly good representation of the population in the sense that every important characteristic of the population is likely to have one or more representatives in the study (Weiss, 1994).

4.2 Survey Development & Design

Photo Preparation

Photographs have been used as a tool in environmental psychology to examine landscape preference: the types of landscapes that people prefer and reasons for their preference (Fitzjohn, 2007). The pictures were taken on the Cedar River itself. It was a clear sunny day in May, 2011, with few clouds in the sky. The water was clear and scenes were bright. Scenes were focused on riparian landscape treatment. Buildings and vehicles were removed from scenes to avoid distraction. The 32 riparian scenes include 8 themes: lawns, sand bar, forest, hard bank, rip-rap, cobbles, log jams, pavement. I spanned the range of preferences availabe in each theme, avoiding using only the more aesthetically pleasing scenes that might bias the ratings on the theme (Kaplan & Kaplan, 1989). Each theme has four pictures. If the study were to include two or three examples of riparian scenes, it would be difficult to ascertain whether the preferences were affected by some idiosyncratic aspect of these scenes – for example, the cloud cover or the water texture (Kaplan & Kaplan, 1989).

Studies show that four pages of photographs, with eight scenes on each page, to be a comfortable number to include in a photo-questionnaire (Kaplan & Kaplan, 1989). This study put six images on a page, and a total of six pages were shown to the participants. The 32 phtographs that made up the photo portion of the survey were randomly ordered so that participants' ratings would not be biased by themes assigned by the researcher.

For each photo, participants were asked to indicate how much they liked each scene from 1(not at all) to 5(very much). In asking about preference, the importantance of different domains of preference is very little. The domain of preference includes: how much they likem the scene, how pretty they think it is, how would they judge its scenic quality, how much they would like to go to such a setting, wether they would like to own the picture, and so on. Although the responses to these different domains of preference may be somewhat different, the pattern of responses will be very similar. A scene one likes more will be considered more beautiful and higher in scenic quality (Kaplan & Kaplan, 1989). The number of scale positions was found to be felxbile; however, a five-point scale worked well in Kaplan & Kaplan's (1989) studies. For the last eight photos, each representing a theme pre-assigned by the researcher, participants were asked to briefly explain why they rated the scene the way they did.

Pilot Study-Interview

Research interview is based on the conversations of everyday life and is a professional conversation. They are conversations with structure and purpose that are defined and controlled by the researcher (Kvale, 1996). To obtain description of the interviewee with respect to interpreting the meaning of the described phenomena-riparian landscape and watershed management issues, four semi-structured interviews were conducted in Maplewood. The purpose of the interviews is to facilitate the design of survey questions. Because interviews allow people to convey to others a situation from their own perspective and in their own words (Kvale, 1996), the development of survey questions depend on information gathered from the interviews to be more relevant to the residents. The interview included both open-ended and closed-ended questions. They were conducted in May, 2011 at the interviewee's houses in the neighborhood. Each interview was approximately one and a half hours long.

To start with, a photo preference exercise was used to "warm up" and familiarize the interviewee with the main concern of the study ─ river issues. Scenes were obvious for the interviewees to distinguish from one theme to another and evoked different responses. A concern was raised by the interviewees about what it means to like a scene. It was unclear whether they should assess the scene from an aesthetic, functional, or other point of view. The researcher then emphasized to "simply" rate how much you like a scene in the survey to acquire an intuitive scenic preference from the participants.

To understand what is considered as a "healthy" and an "unhealthy" riparian scene by the residents, the researcher asked open-ended questions during interviews. Scenes with large woody debris were considered the healthiest by the interviewees, due to its ecological function of providing fish spawning habitat and representing a natural flood regime. Sidewalk and a lawn backyard were both seen as "structured" landscapes that "contain" the river and impede "free-flow," making them unhealthy. Gravel banks were considered unhealthy because they are "bare". Thus, descriptions derived from interviews that were then used in the survey for a healthy riparian scene are: vegetation, fish & wildlife habitat, no human disturbance, free-flow of the river, flood & debris. For an unhealthy riparian scene, descriptions include: no vegetation & bare, not a good habitat, structured with human disturbance, containing river channel and not allowing free-flow.

Recreational activity is one human use of river resources. The activities people do on the river serve as one of the indications of how they relate to the river. I asked pilot interviewees questions about recreational activities in their backyard and use of parks and trails in order to develop close-ended options in the survey. In the residents' backyards, recreational activities include: wildlife watching, fishing, swimming, floating, gardening, picnicking, badminton and bocce ball or other sports or games. For those who visit parks along the Cedar River, major activities include: wildlife watching, fishing, swimming, floating, picnicking, off-leash dog-walking, and sports. Lastly, on the Cedar River Trail, located on the north boundary of the neighborhood along highway 169, activities include walking, running, biking, dog-walking, and skateboarding or roller-skating.

Once the interviewees were more comfortable with river issues, the interview progressed to attitudes and behaviors questions. First of all, attitudes toward environmental hazards of earthquake, flooding, and erosion were asked. Three of the interviewees live on the riverfront, and they all have experienced flood and erosion damages on their property. As for earthquake, three interviewees who have lived in the neighborhood for over ten years share a particularly vivid memory of the 2001 Nisqually Earthquake, which "stopped" the water flow due to a landslide that occurred about 1 mile upstream of Maplewood. The interviewees provided mitigation strategies that were incorporated into the survey as close-ended options. For flood and erosion mitigation, hard-banking and tree-planting were mentioned. In addition, flood insurance is required by King County for floodplain residence and thus is also included in one of the damage mitigation methods. To mitigate earthquake damage, having a preparedness kit, furniture bolted to the wall, and shake-resisting building design are strategies mentioned by interviewees.

To gauge residents' attitudes toward watershed management plans and regulations, I ascertained what plans and regulations that familiar to them during the interviews. The knowledge of management plans and regulations varied among the interviewees with different levels and types of their participation and concerns regarding public affairs. The interviewee who serves on the Maplewood Neighborhood Association committee was more familiar with management plans. Another interviewee, a newer resident in the neighborhood, had a good grasp of regulations that they had to follow when they built their riverfront house four years ago. Plans mentioned in the interviews were: plans of the Neighborhood Association; nearby natural area; park, and trail maintenance; and restoration plan of Friends of the Cedar River Watershed. All of the above are local plans, closely related to the neighborhood instead of the watershed. Building and landscaping regulations were the most familiar to the interviewee who was the newer resident, while fishing regulations were familiar to all the riverfront interviewees.

I subsequently inquired about attitudes toward plans and regulations, watershed management objectives, and the human-nature relationship by soliciting agreement with statements. The interviewees were asked to rate how much they agree with each statement from 1 to 5. The interviewee's response helped me to decide whether a statement was clear and necessary to put in the survey. The statements used in interviews that were too vague, confusing, or redundant were deleted or reworded in the survey.

Environmental behaviors were asked at the end of the interview, to avoid biasing the perspectives of participants in answering landscape and attitude questions. Behavior questions were answered with yes or no in order to not overloading the interviewees with open-ended questions that they have to elaborate. There was only a slight change in behavior questions from interview to survey.

Finally, demographic information was acquired from the interviewees. Their willingness to disclose their age, occupation, education level, religious affiliation, and political affiliation were obtained before the questions were asked. The diversity of demographic characteristics is one of the key factors to examine how people have different landscape preferences and attitudes. Hence, their willingness to share the above private questions encouraged the researcher to include these questions in the survey.

Overall the interviewees were content with their quality of life and opportunities to enjoy nature in the neighborhood. While a love for nature was shared by the interviewees, opinions on how the environment should be taken care of varied from one to another. The subsequent survey was aimed to understand and detail the variations among all the residents in the neighborhood.

Survey Structure

The typical central features of a survey include: the use of a fixed, quantitative design; the collection of a small amount of data in standardized form from a relatively large number of individuals; and the selection of representative samples of individuals from known populations (Robson, 2002). This section introduces the design of a standardized form included in a questionnaire aiming for Maplewood residents. As described previously, all households in the neighborhood were visited to maximize survey participants. The selection of a representative from each household is described in the next section-survey delivery.

Slight modifications were made from the interview to the survey. Open-ended questions in the interview were converted to close-ended questions through the addition of check-boxes in the survey. The sequence of the questions follow the interview to guide participants progressively deeper into the subject of river issues, from the inviting photo preference exercise and recreational activities to the more sensitive attitude and behavior questions of environmental concern. Finally, demographic questions are asked in the end of the questionnaire and a blank space was provided for participants to give additional comments.

The survey was then color-printed in an 8 by 11 inch format (Appendix I). A cover page and an explanatory page explained the purpose of the research and assured the participant of confidentiality, along with providing the researcher's contact information and a check-box of whether the respondent would like to have a summary of the survey result. An envelope was provided for the participants to put the questionnaire in and leave it at their front porch for the researcher to collect a week later.

For the photo exercise, no modifications were made due to its efficacy presenting different themes and evoking different responses in interviews. Following the photo portion of the survey, the participants were asked to indicate the two healthiest and the two unhealthiest scenes with check-boxes and to select rationales from a list. Participants were also asked to select their preferred recreational activities around the Cedar River from a list of options.

The following five pages of questions addressed attitudes toward watershed issues, environmental behaviors, and demographic information. All attitude questions were designed to be answered on a scale of 1 (not at all) to 5 (very much). For attitudes toward environmental hazards including earthquake, flooding, and erosion, participants were asked to rate their awareness, the importance of the hazard, and their degree of preparedness. Additionally, mitigations strategies were provided as check-box options. Management plans and regulations were listed in tables. Plans of agencies or organizations included the neighborhood, the local (County/City), and the regional (State) level and were rated from 1-5 in terms of the participants' awareness, approval, and participation level.

Regulations include building regulations, landscaping regulations on the floodplain, and fishing regulations on the river, and were rated in terms of the participants' awareness, approval, and the impact of the regulation on them. Next, four general attitude statements toward plans and regulations were asked in terms of participants' agreement on a scale from 1 to 5, along with attitudes toward four aspects or watershed management objectives, and ten statements regarding the human-nature relationship.

Nine questions about behaviors that would affect environmental quality were asked following the attitudes section. These behaviors included general environmental behaviors such as recycling and composting, to restoration activities such as planting native plants and removing non-native plants, and behaviors that would affect water quality such as storm drains maintenance and use of pesticide/herbicide. Answers were collected in binary check-boxes of "yes" or "no".

Lastly, ten demographic questions were asked with check-box options. The questionnaire was designed to be filled out by only one individual, thus there were multiple choices with only one answer for each question. Specifically, the questions included the participants' length of residency, age, gender, ethnicity, religion, occupation, education, political affiliation, income, and housing proximity to the river. For income and housing proximity to the river, supplimentary information of home value and satellite image were collected by the researcher with the respondent's address.

Survey Delivery

After receiving exempt status approval through University of Washington Human Subjects Division (application # 41286), 121 surveys were delivered by the researcher in person in August, 2011. A satellite map of all the houses was used for the researcher to navigate through the neighborhood and record the participants' location (Figure 6). Four visits were made to maximize participation of

Maplewood residents, and three visits were made to collect the questionnaires. A total of 91 surveys were returned; the return rate is 75%.

Only one representative of a household was asked to fill out the survey questionniare. The representatives were the head of the household, and s/he was asked to fill out the survey independently of others' involvement. Confidentiality was guaranteed in terms of anonymity. The purpose of the study was briefly explained with an emphasis on academic purposes. An introduction to the photo preference exercise was provided to raise the residents' interest in participation. Participants were asked to leave the survey on their porch after completion to be collected by the researcher a week later.

4.3 Data Analysis

SPSS (Version 19) was used for data analysis. Factor analysis was used to identify underlying dimensions of preference and attitudes and reduce the items to a smaller number of variables (Hinton et al., 2004). Correlation was performed to test the degree to which the variation in the scores on attitude variables results in a corresponding variation in the scores on preference variables (Hinton et al., 2004). Analysis of variance was used to compare preference scores among demographic groups, and attitude scores among demographic groups. Logistic regression was used to predict the dichotomous behavior variable from a set of predictor variables (Ho, 2006), including preference and attitude variables (Table 2). Detail descriptions of each data analysis method listed in table 2 is provided in the following sections.

Table 2. Overview of Statistic Models in the Study

Variables	Variables	Models
Preference		Factor Analysis
Preference	Attitudes	Bivariate Correlation
	Demographics	One-Way ANOVA
Behavior	Preference	Logistic Regression
	Attitudes	Logistic Regression
Attitudes	Demographics	One-Way ANOVA

<u>Preference Factor Analysis</u>

The Likert-type scale ratings for 32 scenes were subjected to exploratory factor analysis in order to identify underlying dimensions and reduce the items to a smaller number of variables. Regardless of the eight themes pre-assigned by the researcher, factor analysis was used to discover the categorization of participants' preference of landscape. Principal components analysis (PCA) with varimax rotation was used. PCA analyzes the total variance and attempts to explain the maximum amount of variance by the minimum number of underlying factor (Hinton et al., 2004). It is appropriate because the purpose of performing this analysis is mainly to "reduce data" to obtain the minimum number of factors needed to represent the original set of data (Ho, 2006). The rotation phase in factor analysis serves to "sharpen" the factors by identifying those variables that load on one factor and not on another. Varimax is an orthogonal rotation method that seems to give the clearest separation of factors (Ho, 2006). It does this by producing the maximum possible simplification of the columns (factor) within the factor matrix (Ho, 2006).

The method of factor extraction was eigenvalues greater than 1.0. The rationale for using the eigenvalue criterion is that the amount of common variance explained by an extracted factor should be at least equal to the variance explained by a single variable (unique variance) if that factor is to be retained for interpretation. An eigenvalue greater than 1.0 indicates that more common variance than unique variance is explained by the factor (Ho, 2006). An item-loading cut-off value of .50 was used to determine which items to include on each new factor. That is, if an item cannot explain as much as this it is not worth including as an important underlying item. The value of .5 is stricter than a usual cut-off point of .3 or .4 (Hinton et al., 2004), to reduce items and ensure the accountability of the items included in a factor. These final factors were then subjected to Cronbach's internal consistency estimate of reliability, alpha, which was .70 or greater. Cronbachs alpha depend to a certain extent on the number of items in the test and the number of participants, but .7-.8 is generally a sensible range of value to take as the benchmark (Hinton et al., 2004).

The study conducted a total of four factor analyses for landscape preference. The first one generated 8 factors; however, three of the factors did not pass Cronbach's internal consistency test. The second analysis was modified to specifically generate seven factors (all eigenvalues are greater than 1). One of these factors did not pass Cronbach's test. This factor consisted of only two variables so neither of them could be eliminated to form a factor. The third analysis was modified to generate six factors, and only "forested bank" did not have a Cronbach's alpha greater than .70. By taking out photo#19 from "forested bank", the alpha for the remaining four variables was increased from 0.672 to 0.815.

After eliminating photo#19 from "forested bank", all the six new factors each comprised four variables except for "gravel bank", which included ten variables. The ten variables were thus subjected to another factor analysis to reveal possible underlying dimensions. Principal components analysis with varimax rotation was used. Factors with eigenvalues over 1.0 and an item-loading cut-off of .50 were used to determine items to include on new factors. Two factors were generated: seven variables fell under a new category of "rip-raps", with the other three remained under the original category "gravel bank". Both new factors passed Cronbach's internal consistency test of an alpha value over .70.

Attitudes Factor Analysis

The Likert-type scale ratings for different categories of attitudes were subjected to separate exploratory factor analysis in order to identify underlying dimensions and reduce items to a smaller number of variables. The different categories of attitudes were: environmental hazards, management plans, management regulations, and attitude statements. Principal components analysis with varimax rotation was used. The method of factor extraction was eigenvalues greater than 1.0. An item-loading cut-off of .50 was used to determine which items to include on each new factor. These final factors were then subjected to Cronbach's internal consistency estimate of reliability, alpha, which would be .70 or greater.

Factor analyses for attitudes serve as a reference in the categorization of attitude items. The purpose of factor analyses in the case of attitudes is mainly to reduce items, rather than identifying the categorization of respondent ratings. After the analyses were performed I made the final categorization of items, to ensure that the nature of questions remained unchanged with new categories. Still, items included in the same factor were subjected to Cronbach's internal consistency test to ensure a justifiable clustering.

Explaining Preferences

Correlation was performed to test the degree to which the variation in the scores on attitude variables (Appendix II) results in a corresponding variation in the scores on preference variables (Appendix III) (Hinton et al., 2004). Each of the eleven attitude variables was correlated to each of the seven preference variables. A total of 77 models were performed. Scatterplots were used to see the patterns of correlations. It was a suitable method because both preference and attitudes were rated on an order from 1-5. One preference variable was correlated to one attitude variable at a time, since they can be treated as related pairs of scores (Ho, 2006). Pearson correlation coefficient (r) was used to measure the linear association between individual attitude and preference variables (SPSS, 2010). Pearson correlation coefficient is typically employed with interval or ratio scaled variables (Ho, 2006). Thus, it is an appropriate measure of how much the scores of preference and attitude variable vary together and then contrasts this with how much they vary on their own (Hinton et al., 2004). A significant 0.05 level of p was examined to determine whether the correlation was significant.

One-way analysis of variance (ANOVA) was used to test the whether the demographic (Appendix IV) group means of preference ratings are equal. One demographic variable at a time served as the independent variable to examine its effect on a set of seven landscape preference variables. I ran a total of 15 models with each of the 15 demographic variables. The dependent variable-preference was rated on an interval-level, and there were one or more categories in each of the demographic variables to define the groups (SPSS, 2010). A *p*-value of .05 was used to determine significance. Following Bradley and Kearney (2007), the test statistic was Wilk's Lambda, which is the preferred statistic when one has a larger number of groups formed by independent variables. However, when the analysis did not pass the Levene's Test of Homogeneity of Variance at $p< .05$, Welch statistics were used. This is an approximate test for equality of means without the homogeneous variance assumption (SPSS, 2010).

<u>Explaining Behaviors</u>

Behavior data (Appendix V) were collected in a dichotomous manner. A logistic regression model is the most suitable to examine the probability that a particular subject is in one of two dichotomous categories (Wuensch, 2011). The set of seven preference variables (Appendix III) were entered simultaneously as independent variables to predict each of the nine behavior variables, and so were the set of eleven attitude variables (Appendix II). Nine models were performed to examine the effects of preference variables on behaviors, and another nine models were performed to examine the effects of attitude variables on behaviors.

Logistic regression is similar to a linear regression model. Logistic regression coefficients could be used to estimate odds ratios for each of the independent variables in the model (SPSS, 2010). Independent variables can be of categorical or interval level, which is the case for all preference and attitude variables. "Enter" was chosen as the procedure for variable selection in which all variables in a block were entered in a single step. The procedure produced significant values which were based on fitting a single model (SPSS, 2010). The test statistic was the Wald Chi-Square statistic, which tests the unique contribution of each predictor in the context of other predictors. The study examined the significance value of less than .05 to determine significant preference and attitude predictors on each dichotomous behavior variable.

<u>Explaining Attitudes</u>

One-way analysis of variance (ANOVA) was used to test the whether the demographic group means of attitude ratings were equal. Demographic variables (Appendix IV) served individually as factors explaining the set of eleven attitude variables (Appendix II). A total of 15 models were performed with respect to each of the 15 demographic variables. The dependent variable-attitude was rated on an interval level, and there were one or more categorical variables in demographics to define the groups (SPSS, 2010). A *p*-value of .05 was used to determine significance. The test statistic was Wilk's Lambda, but when the analysis did not pass the Levene's Test of Homogeneity of Variance, Welch statistics were used.

5. Results

In this chapter, participant demographics and attitudes are presented to set stage for the following analysis. Elucidation of demographics and attitudes is not the goal of the study, but is essential for further analysis. The demographic section lays out basic demographic information of the participants. The attitude section shows the result of attitude factor analysis, which clustered attitude variables into categories that were used in further analysis.

The rest of the chapter presents the findings of study objectives. Section 5.1 describes landscape elements and preference as established by preference factors from factor analysis and used in further analysis. Section 5.2 explains preference with attidude variables and demographic variables respectively. Section 5.3 explains behavior with preference and attitude variables separately. Section 5.4 explains attitudes with demographic variables.

Participant Demographics

A total of 91 surveys were returned. A 75% return rate was received. Of those who returned the survey, about 40% are newer residents that have lived in the neighborhood for less than ten years. Approximately 60% of the participants are female. 50% range from 50-70 years old, and about 30% of the repondents are retired. In terms of ethnicity, 70% are white. 66% noted Christian as their religious affiliation. 40% of the participants are not politically affiliated; 32% are Democrats and 17% are Republicans. In terms of education, 44% are high school graduates, 17% have an Associate's degree, 31% have a Bachelor's degree, and 7% have a Master's. 50% of the participants are skilled workers, and 28% are unskilled, 22% are professionals. Income data was collected from part of the survey participants, and home values were obtained from an online real estate market price estimating website - Zillow, with all surevy participants included. Participant's addresses were inputed into Zillow to generate estimates of their home value, which serve as a proxy for income due to a low response rate of exposing one's income level.

Overall, the respodent demographics are of a variety of ethnic, cultural, and socio-economic backgrounds. There is also a combination of riverfront and non-riverfront residence. About 30% of the participants live within 200 feet from the river, and about 50% live within the range of 200-500 feet from the river.

Participant Attitudes

The final attitude factors are listed below in Table 3.

Table 3. Factor Analyses & Categorization Results for Attitudes[a]

Attitudes	Factors	Items	M[b]	SD	Factor 's alpha
Hazards	Flood	Awareness, importance, preparedness for Flood	4.25	0.98	1.00
	Erosion	Awareness, importance, preparedness for Erosion	3.57	1.33	1.00
Plans	Plan #1-3	Awareness, Approval, and Participation of 1) Maplewood Neighborhood Association- Public River Access Maintenance Plan, 2) Forterra - Cedar River Restoration Plan, 3) Friends of the Cedar River Watershed, Stewardship in Action	2.01	1.12	0.91
Regulations	Awareness	Awareness of landscape, building, & fishing regulations	2.13	1.34	0.87
Statements	Participation	Residents' participation in watershed management is important.	4.19	0.90	
	Private rights	A major consideration of any good regulatory system is the protection of private property rights.	4.11	0.93	
	Gov. role	The best government is the one that governs the least.	3.27	1.24	
	Religious role	River/water/floods is important to my spiritual or religious life.	2.26	1.59	
	Pro-environment	* Environmental protection plans should be implemented even though the monetary cost might exceed the benefit. * The River should be managed for clean streams, lakes, and wetlands. * The River should be managed for fish and wildlife habitat. * When humans change the natural environment, it often produces disastrous results. * If a development would result in a loss or degradation of fish & wildlife habitat, the development should stop. * I do what is right for the environment, even when it costs more money or takes up more time. * Humans need to adapt to the natural environment because we cannot change it to suit our needs. * We are harming the environment when we do normal things, like driving & using chemicals to do cleaning. * I am likely to do something for the environment even if others do not do the same.	3.68	0.75	0.85
	Human-oriented management	*The River should be managed for flood mitigation. *The River should be managed for public use and enjoyment.	4.19	0.82	0.62
	Human dominance	*Plants and animals exist primarily to be used by humans. *Humans should dominate natures.	1.90	1.05	0.73

a. Extraction method was Principal Component Analysis with eigenvalues greater than 1.0; Rotation method was Varimax with Kaiser normalization.
b. On a 5-point scale with 5 indicating strongest agreement. Means were weighted by factor loadings.

With regard to environmental hazards, factor analysis generated two categories of "flood" and "erosion," each comprising three items of awareness, importance, and preparedness. "Earthquake" did not come up as an internally consistent category (alpha lower than .70). Given that earthquake is a relatively insignificant hazard in the neighborhood, it was not incorporated in the subsequent analyses in relation to preference, behaviors, and demographics.

With regard to management plans, participants are generally unfamiliar with local and regional plans (plan #4-12). The only plan variable that is taken into account in further analyses is neighborhood-level plans, which include the awareness, approval, and participation for plan #1-3.

Awareness is the only regulation variable that remained for further analyses, due to a larger number of data (N=72) compared to two other factors generated for regulations. The number of data for approval (N=54) and impact (N=57) of regulations are too small to be taken into further analysis.

Attitude statements were categorized with several experimental combinations of items to generate the most reasonable and justifiable clustering. The statement items representing the importance of public participation, private rights protection, the government's role, and the religious/spiritual role of river were kept as individual categories themselves because they each serve different purposes that should remain distinct from others. These items were not subject to factor analysis.

For the rest of the statements, could be categorized as management objectives, pro-environment, and human-dominance. Management objectives can also be generalized as either nature-oriented or human-oriented. Nature-oriented management objectives were combined with pro-environment statements, which generated a Cronbach's alpha of 0.852. Human-oriented management objectives, on the other hand, were separated as an individual group since they were not in agreement with human dominance over nature. However, the combination of the two human-oriented management objectives did not pass Cronbach's internal consistency test, which indicated a discrepancy between agreement on management objectives for public use & enjoyment and flood mitigation. The inconsistency was not adjusted to create a distinction between the two. Human dominance included two items that were consistent in both their purposes and ratings.

5.1 Landscape Elements and Preference

Factor analyses were performed to generate preference factors that cluster scenes with similar perceived elements in categories. The study conducted a total of four factor analyses for landscape preference. Seven factors were generated from the final two analyses. Final factors are shown in table 4.

Table 4. Factor Analysis Results for Riparian Scenes[a]

Factors & Items[b]	Item Loadings	M[c]	SD	Factor's alpha	Descriptions
Forested Bank		3.80	0.97	0.82	natural, vegetation
#27 Forested	0.89	3.77	1.17		
#11 Forested	0.83	3.55	1.34		
#3 Forested	0.65	4.05	1.15		
#18 Sand Bar	0.52	3.91	1.01		
Gravel Bank		3.59	0.90	0.75	natural
#10 Sand Bar	0.91	3.75	1.05		
#2 Sand Bar	0.73	3.32	1.16		
#26 Sand Bar	0.71	3.73	1.08		
Public Access		3.38	1.02	0.87	access, unnatural, aesthetics, recreation, management
#16 Public Access	0.85	3.34	1.21		
#8 Public Access	0.82	3.49	1.27		
#32 Public Access	0.82	3.39	1.21		
#24 Public Access	0.77	3.29	1.09		
Lawn		3.18	0.81	0.71	aesthetics, access
#17 Lawn	0.76	3.35	1.13		
#1 Lawn	0.71	3.23	1.15		
#5 Rip-rap	0.61	2.42	1.08		
#25 Lawn	0.56	3.74	1.05		
Log Jam		3.17	1.19	0.90	natural, log jam, debris
#15 Log Jam	0.85	2.97	1.38		
#23 Log Jam	0.80	3.09	1.32		
#7 Log Jam	0.74	3.41	1.32		
#31 Log Jam	0.70	3.24	1.43		
Rip-rap		2.68	0.78	0.85	natural, ugly, associated with flood
#30 Cobbles	0.76	2.72	0.98		
#22 Cobbles	0.73	2.16	1.07		
#29 Rip-raps	0.73	3.18	1.02		
#21 Rip-raps	0.69	2.56	1.10		
#14 Cobbles	0.68	2.59	1.18		
#6 Cobbles	0.63	2.31	1.09		
#13 Rip-raps	0.59	3.21	1.03		
Hard Bank		2.63	0.84	0.75	unnatural, ugly
#28 Hard Bank	0.75	2.58	1.07		
#4 Hard bank	0.67	2.41	1.14		
#20 Hard Bank	0.65	2.36	1.00		
#9 Hard Bank	0.54	3.31	1.17		

a. Extraction method was Principal Component Analysis with eigenvalues greater than 1.0; Rotation method was Varimax with Kaiser normalization.
b. Photo ordering in the table is based on the factor analysis results and not the order in which photos appeared in the survey.
c. On a 5-point scale with 5 indicating highest preference. Means were weighted by factor loadings.

The seven final factors include five from the third analysis which generated six factors, and two others from the ten variables loaded on factor #1 in the third analysis. New variables were created for each factor such that an individual's factor score was a weighted average (weighted by item loading) of the scores on the individual variables comprising the factor; in this way, component variables with higher item loadings will be weighted more heavily in the overall factor score.

The final seven factors yielded from the 32 riparian scenes is the result of two factor analyses. The factors were also provided by the participants with verbal descriptions, which were summarized and presented in Table 4. *Forested bank Scenes* includes three forested bank scenes and one sand bar scene with forest in the background. *Gravel bank* includes three natural sand bar scenes. *Public access* includes all scenes with pavements or artificial walkways. *Lawn* includes three private lawn scenes and a scene with rip-rap armoring and a thin lawn surface. *Log jam* includes scenes with large woody debris in the waterway or on the river bank. *Rip-rap* comprises of three natural cobble banks scenes and three artificial rip-rap scenes. Finally, *hard bank* comprises of scenes with artificial wall or levee structure.

Figure 7 depicts representative scenes from each of the seven factors. Descriptions provided for the last eight scenes were re-organized into each of the new seven landscape factors. A summary of the descriptions provided insights in the preference factor analysis results. *Forested bank* scene was considered as natural and having lush vegetation. *Gravel bank* was considered as natural as well. *Public access* scene was described as accessible, pretty, recreational, managed, but unnatural. *Lawn* was described as pretty and accessible. *Log jam* was natural, and described as having log jams and debris. *Rip-rap* scene was also described as natural, but ugly and associated with floods. Lastly, *hard bank* was unnatural and ugly.

Forested bank, mean= 3.80, S.D.= 0.97

Gravel bank, mean= 3.59, S.D.= 0.90

Public access, mean= 3.38, S.D.= 1.02

Lawn, mean= 3.18, S.D.= 0.81

Log jam, mean= 3.17, S.D.= 1.19

Rip-rap, mean= 2.68, S.D.=0.78

Hard bank, mean= 2.63, S.D.= 0.84

Figure 7. Example Scenes from each of the Seven Riparian Landscape Factors

The overall mean preference ratings for each riparian landscape factor are shown in Figure 8 and the ratings for individual scenes in each factor are shown in Figure 11. While the most preferred scenes of forested bank (M=3.8, SD=.97) and gravel bank (M=3.59, SD=0.9) indicate “naturalness,” the unnatural but aesthetic and accessible (M=3.38, SD=1.02) and lawn (M=3.18, SD=0.81) scenes come the next in the rank. Log jams (M=3.17, SD=1.19) and rip-raps (M=2.68, SD=0.78), though considered natural, they are less preferred possibly due to a lack of aesthetic and access values. Lastly, the group considered unnatural and ugly, hard bank (M=2.63, SD=0.84) is the least preferred landscape type. However, as Figure 9 shows, there was a great variability in preference for the individual scenes comprising each factor.

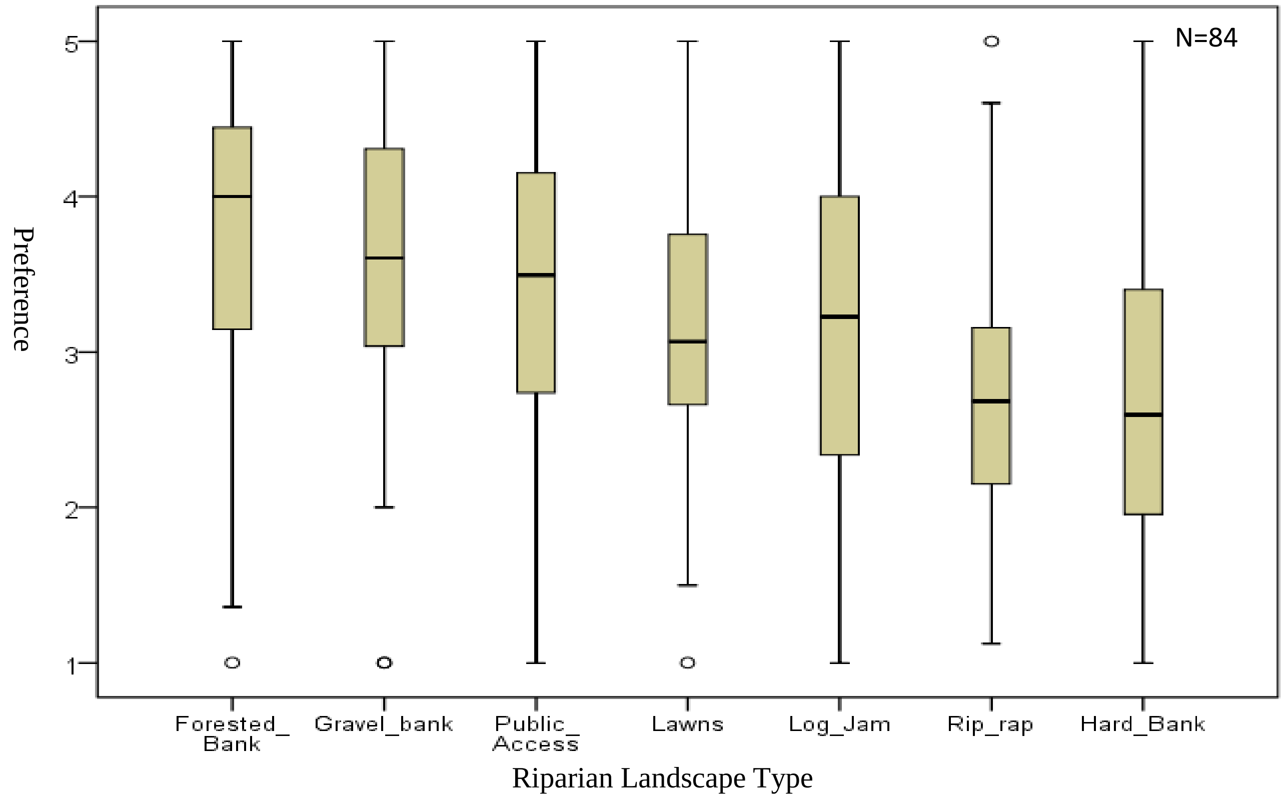

Figure 8. Boxplots of Preference Ratings for the Seven Riparian Landscape Factors

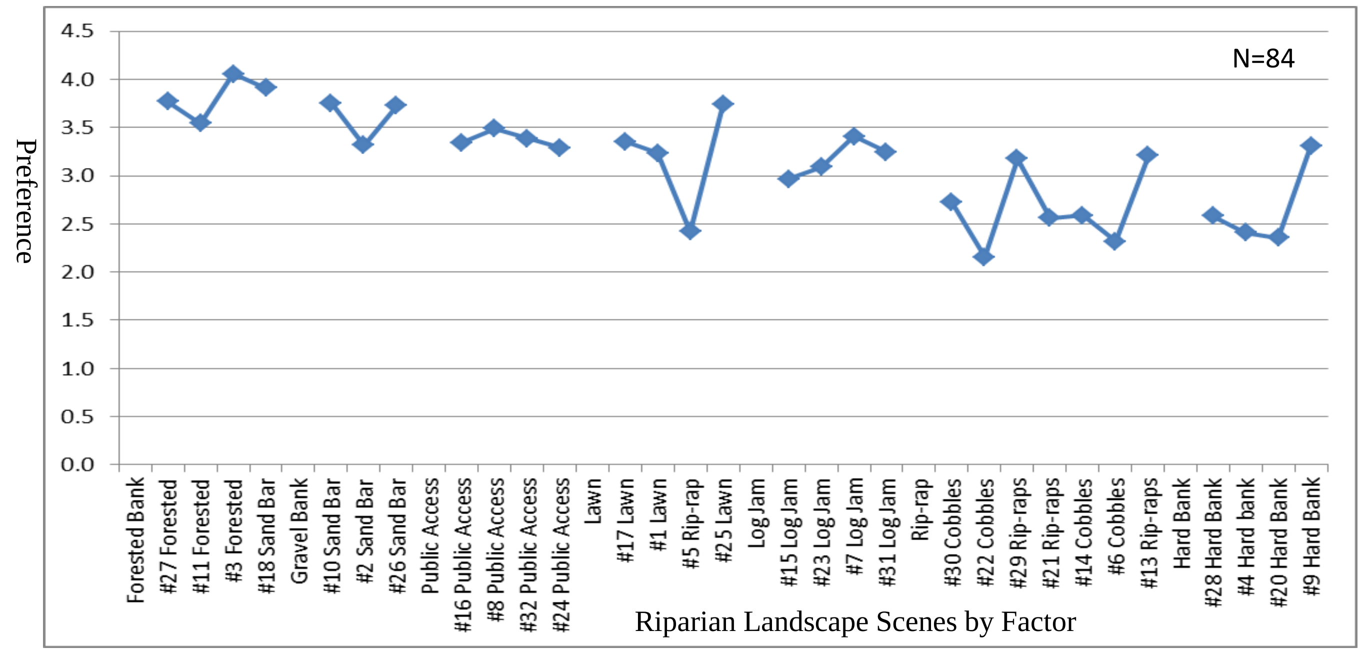

Figure 9. Average preference Ratings for Individual Scenes in each Factor
Note: Factors and individual scenes within each factor are shown in descending order of overall mean preference.

5.2 Explaining Preference

Demographics & Preference

Preference for certain landscape types varied across only two demographic variables: gender and the physical proximity of residence to the river (Appendix VI). In both cases, ANOVA's assumption of homogeneity of variance was not met, so Welch statistics were used to test for significant effects. Gender was significantly related to public access (p=.014, W (1, 69) = 6.42), lawns (p=.043, W (1, 78) = 4.23), hard bank (p=.016, W (1, 77) = 6.04), and rip-rap (p=.012, W (1, 72) = 6.66). Differences between males and females are shown in Table 5.

Table 5. Differences between Gender Groups in Landscape Preference

	Public access		Lawns		Rip-rap		Hard bank	
	N=80		N=80		N=76		N=80	
	M	SD	M	SD	M	SD	M	SD
Male	2.99	0.97	2.93	0.64	2.40	0.56	2.35	0.65
Female	3.56	1.01	3.28	0.91	2.80	0.77	2.77	0.89

Physical proximity was significantly related to preference for hard bank (p =.001, W (8, 14) = 6.97). Figure 10 shows that the farther away one lives from the river, the less likely they would prefer hard bank scenes.

No other demographic variables were found to be significantly related to preference ratings. Those variables include: length of residency, age, ethnicity, religion, occupation, education, political affiliation, income, home value, and respondent-reported housing proximity to the river (as opposed to physical proximity to the river, which was measured by Google Earth).

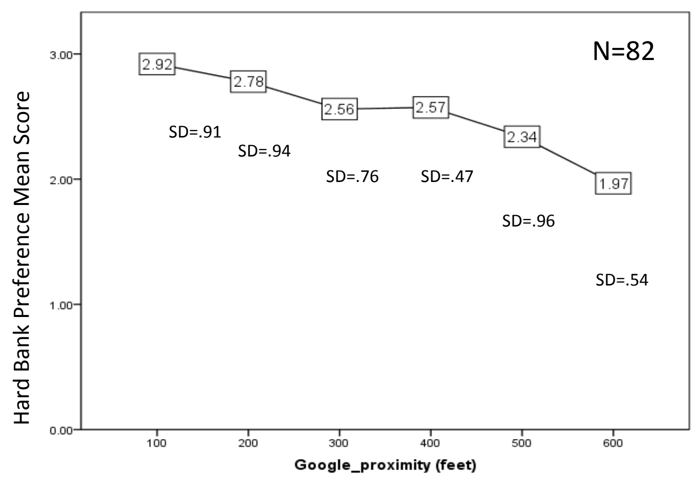

Figure 10. Mean scores for hard bank in relation to residence proximity to the river

Attitudes & Preference

A total of twelve significant correlations were found between attitude and preference variables (Appendix VII). The importance of public participation in watershed management was positively related to preference for gravel bank scenes (p =.031, Pearson Correlation Coefficient r=.253), a landscape considered as "natural".

Approval of private right protection (p =.002, r=.357) and small government (p =.043, r=.236) were positively related to preference for lawn scenes, which were described as accessible and pretty.

The importance of religious or spiritual role of the river was positively related to preference for gravel bank (p =.018, r=.283) and negatively related to log jam (p =.024, r=.-267) scenes.

Attitude toward human-oriented management objectives, including approval of the river to be managed for public use and enjoyment and flood mitigation, was positively related to forested bank (p =.007, r=.308), gravel banks (p =.017, r=.277), rip-raps (p =.013, r=.289), and log jams (p =.000, r=.465), all of which are scenes considered as "natural".

Lastly, awareness, importance and preparedness for flood (p =.017, r=.283) and erosion (p =.024, r=.270) were both positively related to preference for gravel bank. In addition, attitudes toward erosion was positively related to preference for forested bank scenes (p =.019, r=.274).

Public access and hard bank scenes were not found to be related to any attitude variables. Attitudes toward neighborhood-level management plans, awareness of regulations, approval of pro-environment statements and human-dominance statements were not found to correlate to any preference factors.

5.3 Explaining Behavior

Only two behaviors: removing invasive knotweed or other non-native plants and planting native plants on their property were related to a sum of two attitude and one preference variables (Appendix VIII). I compared the significant differences in attitudes and preferences between "yes" and "no" in behaviors from logistic regression results in table 6.

Removing knotweed was positively associated with attitudes toward pro-environment statements (p =.018, Wald χ^2 =5.586) and awareness of regulations (p =.032, Wald χ^2 =4.588), but negatively associated with preference for public access scenes (p =.018, Wald χ^2=5.586).

Planting native plants was also negatively associated with preference for public access (p =.006, Wald χ^2 =7.564). Univariate ANOVA analyses show the differences in attitude and preference factors between participants who answered yes and no to a behavior.

Table 6. Differences in Attitude & Preference between "Yes" & "No" to a Behavior

Behavior \ Attitudes & Preference		Pro-environment		Awareness of regulations		Public access scenes	
		M	SD	M	SD	M	SD
Removing knotweed		N=74		N=67		N=77	
	Y	3.75	0.76	2.33	1.34	3.21	0.98
	N	3.54	0.69	1.61	0.98	3.48	1.03
Planting natives						N=78	
	Y					3.17	1.03
	N					3.57	1.02

Note: The Significant Differences are results from separate logistic regression models.

5.4 Explaining Attitudes

Gender, ethnicity, religion, education, political affiliation, riverfront/non-riverfront residence, and residential jurisdiction before annex had significant effects on different attitude variables (Appendix IX).

Gender was significantly associated with approval of human-oriented management statements (p =.007, F (1, 70) = 7.60). Among 72 participants, female (M=4.40, SD=.77) participants had a higher rating than males (M=3.88, SD=.83).

Ethnicity was significantly associated with awareness of, importance to, and preparedness for flood hazard (p =.011, F (3,61)=4.01). Among 65 participants, white (M=4.36, SD=.89) people showed a higher rating than Asian (M=3.33, SD=1.15), Pacific Islander (M=3.5, SD=2.12), and other/mix (M=2.5, SD=.71) ethnicities.

Religion was significantly associated with attitudes toward human-dominance statements (p =.007, W (3,9) =7.68) and neighborhood-level plans (p =.027, W(3,8)=5.29). Figure 11 shows the difference in religious groups' attitude ratings. Christian participants had a higher rating for human dominance over nature statements.

Education was significantly associated with attitudes toward private right protection (p=.042, $W(3,19)=3.31$) and the religious/spiritual role of a river (p=.01, $W(3,15)=5.352$). Figure 12 shows that the higher the education level, the less one would agree on private right protection, and the more one considered the river important in their religious/spiritual life.

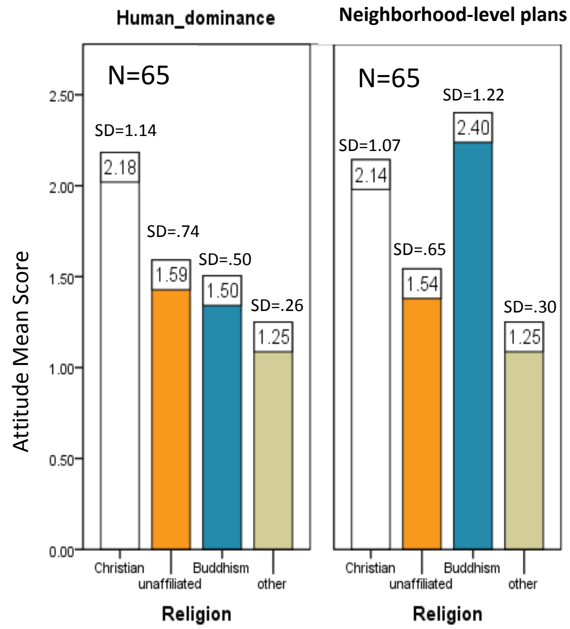

Figure 11. Differences in Mean Scores for Attitudes toward Human Dominance Statements & Neighborhood-level Plans among Religious Groups

Political affiliation was significantly associated with attitudes toward public participation in watershed management (p =.047, $F(3,58)=2.81$) and preference for small government (p =.01, $F(3,58)=4.04$). Figure 13 depicts the differences among various political affiliated groups in attitude mean scores. Participants who self-identified as politically affiliated tended to value higher public participation in watershed management. Republicans had a higher rating for small government than democrats.

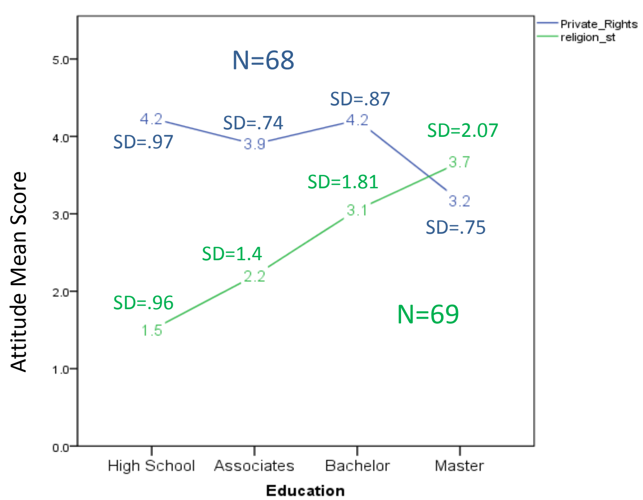

Figure 12. Differences in Mean Scores for Attitudes toward Private Right Protection & Religious/Spiritual Role of the river among Education groups

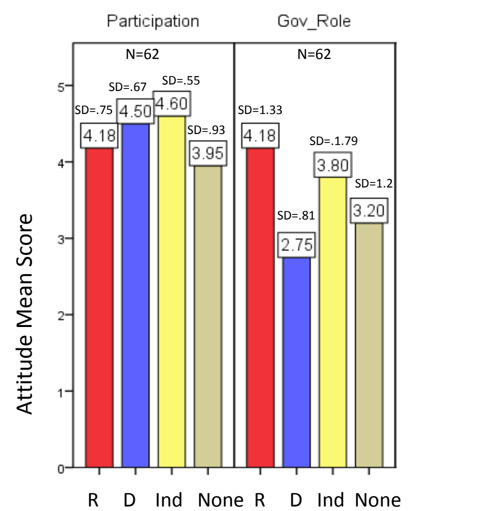

Figure 13. Differences among Political Affiliated Groups in attitudes toward Public Participation, small government

Riverfront and non-riverfront participants had significant difference in attitudes toward public participation in watershed management (*p* =.01. *W*(1,40)=7.352), private right protection (*p* =.009, *W*(1,44)=7.41), the religious/spiritual role of the river (*p* =.026, *W*(1,24)=5.66), neighborhood-level plans (*p* =.023, *W*(1,33)=5.708), and awareness of regulations (*p* =.029, *W*(1,36)=5.145). Figure 14 shows the difference between riverfront and non-riverfront resident participants in attitudes. Riverfront residents had higher ratings for religious/spiritual life (religion_st), public participation, private right protection, neighborhood-level plans (All1_3), and awareness of regulations (Reg_AW).

Residential jurisdiction before annex also had effects on attitudes toward small government (*p* =.005, *F* (1,73)=8.532) and human dominance over nature (*p* =.01, *F*(1,72)=7.002). Figure 15 shows that former Renton resident participants had higher ratings for small government & human dominance over nature statements, compared to former King County resident participants.

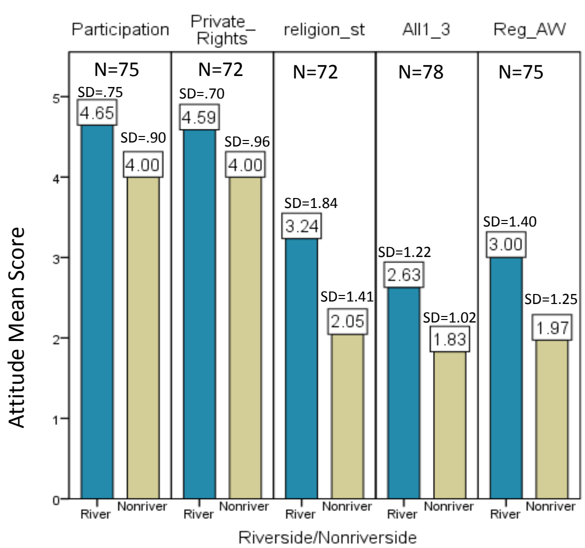

Figure 14. Differences between riverfront and non-riverfront resident participants in attitudes toward religious/spiritual life (religion_st), public participation, private right protection, neighborhood-level plans (All1_3), and awareness of regulations (Reg_AW)

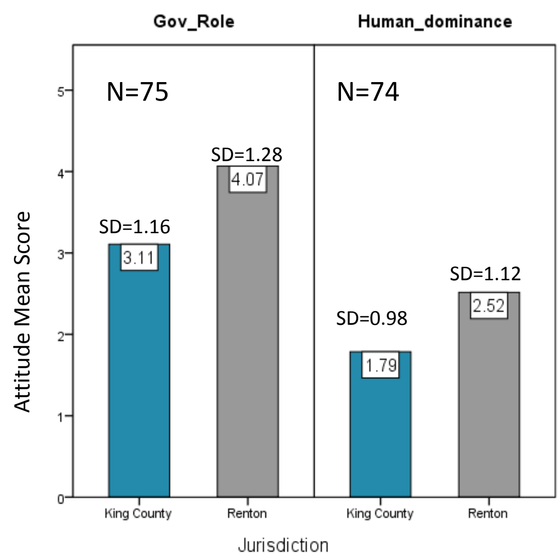

Figure 15. Differences between former King County & Renton resident participants in attitudes toward small government and human dominance over nature

6. Discussion & Recommendation

Landscape Preference: Incorporating Naturalness, Aesthectis, and Access in Landscape Restoration

The most preferred riparian landscapes are forested bank and gravel bank, which both contain the element of naturalness. Also considered natural are log jams and rip-raps; however they are two of the least preferred landscapes. In the middle of the pack are aesthetic and accessible public access and lawn scenes, which imply human maintanance. Lastly, hard banking was rated lowest and described as ugly and unnatural. This is consisent with William and Cary (2002) and Nassauer (1993) who both found that naturalness, aesthetic value, neatness and orderliness all account for landscape preference. It also coincides with riparian buffer studies, which showed that aesthetics, ecological benefits, and maintenance are the most important concerns (Ryan,1998; Kenwick et al.,2009; Salisbury, 1997).

Understanding general landscape preference of the neighborhood presents an opportunity to take the whole nieighborhood into account in riparian restoration. The ideal of restoration is to consider the whole watershed as a restoration unit, given that the river is a system of its own. However, due to the complexity in landownership and constraints in budget, current restoration practice on private properties along the Cedar River is at the household level rather than on the watershed level.

It is important to see that naturalness was valued by the participants. But in addition to naturalness, aesthetics and access were also valued by the river residents. Incorporating elements of naturalness, aesthetics, and access, the study suggest a landscape model (Figure 16) as a possible riparian landscape design for a riverside community. Nassauer (1995) suggested that landscape restoration frame "messy" ecosystems in an ordered manner which fits the cultural context of the place. Weaving ecological concerns into this particular social context, we could suggest that native shrubs, grasses, and some trees be planted on the riverfront gravel bank, and have the upland neighborhood forested with riparian trees. Thus, naturalness could be achieved while meeting aesthetic and access concerns.

Figure 16. A Landscape Model for Riverside Community

Understanding attitudes toward watershed management also points out two main concerns: public use and enjoyment, and flood mitigation. While the elements of naturalness, aesthectis, and access allow for public use and enjoyment, how a flood can be mitigated by having native plants and large woody debris on the riverfront should be communicated to the residents. Log jams and rip-raps could serve as natural armors that protect river bank from erosion. To be more socially acceptable, the installation of plants and large woody debris during restoration should incorporate aestheticity and accessibility.

Explaining Preference: Communicate the Real "Nature"

Understanding how demographics and attitudes relate to preference illuminates those of the participants' values that structure landscape preferences. While the results point out facts about the participants, they also offer opportunities for value change through education and information sharing.

Female participants might be more concerned about human care of the landscape than males. Female participants were found to have higher perference for public access, lawn, rip-raps, and hard bank landscapes. Women also had higher ratings for human-oriented management objectvies of public use and enjoyment, and flood mitigation. While public access and lawn scenes could be associated with providing public use and enjoyment, rip-raps and hard bank were those associated with flood control. Similar results are also shown in the study of Virden and Walker (1999) that female participants perceived a forest environment to be less safe than males, and more males than females preferred less visible evidence of management.

Riverfront participants often considered the river important in their sipritual life and agreed on the importance of public participation in watershed management. This could be associated with Kaplan & Kaplan (1989) that the environment near one's home holds special significance that is reflected in preference judgments. People tend to prefer the scenes that they are familiar with. Given that the above attitudes were related to preference for gravel bank scenes, gravel bank might be the riverfront participants' favortie landscape. This would serve as a perfect social context to install gravel bank on riverfront properties, as suggested by the study in Figure 16.

To communicate with residents that preferred lawns, it is important to emphasize that landscape restoration could serve the purposes of aesthetic value and accessibility while being ecologically healthy. It could also be emphasized to these residents that it is not a requirement of any agencies to do restoration, but that they are encouraged to make their own residence a more enjoyable place for both humans and wildlife. The participants that preferred lawn and had a higher agreement on private property right protection and small government could be less willing to change their values of controlling the landscapes.

Education addressing the ecological values of large woody debris is necessary for the riverfront residents. Hard banking is traditionally considered as the way to avoid flood damage, which could also be mitigated with natural armors such as large wood. The river would also be more accessible with natural armors that do not create a barrier like hard banking. The fact that those who live farther from the river tended to dislike hard bank more than riverfront residents could be related to their need for flood control. They might also like access to the river given that almost all the riverfront in the neighborhood is occupied by private residence.

Values attached to natural scenes shed light on the opportunity for education in terms of reinforcing the ecological view of naturalness. How native plant root systems secure the river bank could be reinforced in people's minds, given that awareness of and preparedness for erosion is associated with the preference for forested bank. Improving residents' understanding of the ecological view of naturalness could potentially drive change in their environmental perception and behavior. Those who valued human-oriented management objectives of public use and enjoyment, and flood mitigation, also showed a higher preference for natural scenes of forested bank, gravel banks, rip-raps, and log jams.

Explaining Behaviors: Who are the Stewards?

The residents who encourage other residents in landscape restoration are those that already remove invasive knotweed and install native plants. These potential stewards are also less likely to prefer public access scenes. It is encouraging to know that these participants were taking an ecological view in landscaping. They were also more aware of landscape, building, and fishing regulations that would avoid human disturbance to the environment.

Explaining Attitudes: Demographic Matters

Cultural background explains some of the attitudes people carry toward river issues. White people tended to be more aware of and prepared for flood. Christians tended to have more agreement on human dominance over nature. This is consistent with Guth et al. (1995) that Judeo-Christians are generally found more committed to a mastery-over-nature orientation than non-Judeo-Christians. However, It would have been more feasible to compare attitude differences if there were an equal distribution of people in each cultural groups. In Maplewood, white (86%) and Christian (66%) participants accounted for most of the population in the neighborhood.

When it comes to natural resource protection, communicating to people who are more educated could be easier. It is also easier to engage politically affiliated residents who valued public participation in watershed management. Education played a role in how people agreed with private right protection and the importance of the river in their spiritual life. With higher education, people tended to appreciate nature spiritually and be less likely to agree with private property right protection.

It is possible that those riverfront residents who are able to enjoy the river spiritually in their backyard but face a higher risk of flood an erosion damage would be more likely to participate in watershed management projects and pay attention to regulations. Riverfront reisdents had higher ratings for religious/spiritual life, public participation, private right protection, neighborhood-level plans, and awareness of regulations.

When trying to engage the neighborhood in restoration as a whole unit, it could be noteworthy that people who used to live in different municipal jurisdictions in the neighborhood- former Renton residents and former King County residents- could have different attitudes. The previous Renton residents on the west side of the neighborhood tended to prefer small government and agreed more on human dominance over nature.

Recommendation

Managerial implications of the study are as follows:

- Landscape Restoration:

- Incorporate preferred landscape elements in landscape restoration: **naturalness**, **access**, and **aesthetics.**
- Frame restoration goal in the context of human-oriented management objectives: **flood mitigation**, **public use and enjoyment.**
- Understand general landscape preference of the neighborhood and consider the **whole neighborhood** as a landscape restoration design unit.
- Generate a holistic picture of riparian landscape design, given that a **gravel bank** scene with forests in the background is the most preferred landscape. The riverfront of the neighborhood can be installed with woody debris, gravel bank, and flood-tolerant plants. The upland residence could be vegetated with riparian forests, with access that links the upland neighbors to the riverside residence.

- Communication:

- Communicate the ecological and erosion mitigation values of **large woody debris** to the residents. Emphasize that logs can serve as natural armors and replace the hard bank that is traditionally recognized as flood control treatment.
- Communicate to residents who preferred lawn that landscape restoration could serve the purposes of aesthetics and accessibility while achieving ecological health.
- Improve residents' understanding that the ecological view of nature could potentially drive change in their environmental perception and behavior.

- Engagement Strategy:

- Recognize residents with ecological landscape values and select them as stewards for riparian landscape restoration.
- Engage those with a higher educational level and those that self-identified as politically affiliated, because they who agreed more on resident participation in watershed management.
- Treat riverfront residents who tended to be more willing to participate in watershed management due to a need for flood mitigation, as priority subjects to engage in riparian restoration.

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Appendix I: Survey Questionnaire

UNIVERSITY *of* WASHINGTON COLLEGE *of the* ENVIRONMENT
School of Forest Resources

Master of Science Thesis Study
Investigator: Yu-Chi Huang

Your Favorite Riverside Landscape!

Your Favorite Riverside Landscape!

Please share your views.

As a graduate student at the School of Forest Resources, University of Washington, and an intern with the Cascade Land Conservancy, I am studying residents' use and recreational activities related to the Cedar River, their preference for riverside landscapes, , and their attitudes about watershed issues. This information will hopefully enable watershed managers to work more effectively with landowners on river restoration projects.

Time.

Completing the survey takes about 20-30 minutes.

Anonymity.

Your responses will be anonymous. The ID label in the back of this survey is for tracking purpose only and will be removed and discarded as soon as your survey is received and noted that someone from this address has responded. Under no circumstances will individual responses be reported.

Findings.

A summary of my findings will be available this winter.

Would you like to receive the Neighborhood's summary results?

☐ **yes** ☐ **no**

Questions?

Please contact Yu-Chi Huang with any questions or concerns about this survey. Thank you for your opinions.

Email: kellytofly@gmail.com

Mailbox: Box 352100 Seattle, WA 98195-2100

I Photo Preference Exercise

1. Following are 32 photos of river scenes. Please look at each riverside scene, and simply rate how much you like the scene. Rate the scene from 1~5, with 1 = not at all, 2 = a little, 3 = somewhat, 4 = quite a bit, and 5 = very much. For each scene, circle one number.

(1) 1 2 3 4 5

(2) 1 2 3 4 5

(3) 1 2 3 4 5

(4) 1 2 3 4 5

(5) 1 2 3 4 5

(6) 1 2 3 4 5

(7) 1 2 3 4 5

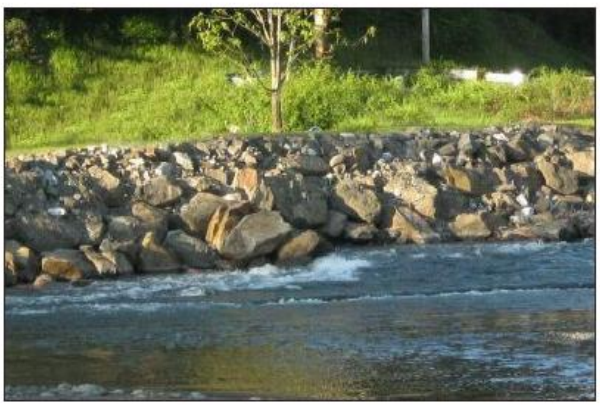
(8) 1 2 3 4 5

(9) 1 2 3 4 5

(10) 1 2 3 4 5

(11) 1 2 3 4 5

(12) 1 2 3 4 5



(13) 1 2 3 4 5

(14) 1 2 3 4 5

(15) 1 2 3 4 5

(16) 1 2 3 4 5

(17) 1 2 3 4 5

(18) 1 2 3 4 5

(19) 1 2 3 4 5

(20) 1 2 3 4 5

(21) 1 2 3 4 5

(22) 1 2 3 4 5

(23) 1 2 3 4 5

(24) 1 2 3 4 5

(25) 1 2 3 4 5

(26) 1 2 3 4 5

(27) 1 2 3 4 5

(28) 1 2 3 4 5

(29) 1 2 3 4 5

(30) 1 2 3 4 5

(31) 1 2 3 4 5

(32) 1 2 3 4 5

Now that you have rated the 32 photos, please review the last 8 photos (25~32), and briefly note why you rated the scene the way you did.

Photo (25): ____

Photo (26): ____

Photo (27): ____

Photo (28): ____

Photo (29): ____

Photo (30): ____

Photo (31): ____

Photo (32): ____

2. Looking back at the 32 photos, identify the two that you feel are most representative of a **healthy** riverside design. Check below on the reasons that support your choice.

   Photo#___, because of ☐ Vegetation ☐ Fish & wildlife Habitat
   ☐ Erosion & flood control ☐ Clean & clarity ☐ No human disturbance
   ☐ Maintenance ☐ Free-flow of the river ☐ Floods & debris ☐ Shades
   ☐ Other, _______________

   Photo#___, because of ☐ Vegetation ☐ Fish & wildlife Habitat
   ☐ Erosion & flood control ☐ Clean & clarity ☐ No human disturbance
   ☐ Maintenance ☐ Free-flow of the river ☐ Floods & debris ☐ Shades
   ☐ Other, _______________

3. Looking back at the 32 photos, identify the two that you feel are most representative of a **unhealthy** riverside design. Check below on the reasons that support your choice.

   Photo#___, because of ☐ No vegetation, bare ☐ Not a good habitat
   ☐ Over-grown with vegetation ☐ Shade & dark ☐ Structured, human disturbance
   ☐ Lack of maintenance ☐ Contained river channel, not allowing free-flow
   ☐ Floods & debris ☐ Open & no shading ☐ Other, _____________

   Photo#___, because of ☐ No vegetation, bare ☐ Not a good habitat
   ☐ Over-grown with vegetation ☐ Shade & dark ☐ Structured, human disturbance
   ☐ Lack of maintenance ☐ Contained river channel, not allowing free-flow
   ☐ Floods & debris ☐ Open & no shading ☐ Other, _____________

II Recreational Activities

1. How do you spend your leisure time in your backyard or in and around the Cedar River corridor?

   ☐ Wildlife watching ☐ Fishing ☐ Swimming ☐ Floating ☐ Gardening ☐ Picnic

   ☐ Badminton, bocce ball, or other sports activities. ☐ Other: _______________

2. Do you go to parks on the Cedar River? ☐ no. ☐ yes, and what activities do you do in the park?

   ☐ Wildlife watching ☐ Fishing ☐ Swimming ☐ Floating ☐ Picnic ☐ Dog-loose

   ☐ Badminton, bocce ball, or other sports activities. ☐ Other: _______________

3. Do you use trails on the Cedar River? ☐ no. ☐ yes, and what activities do you do on the trail?
   ☐ Walking ☐ Running ☐ Biking ☐ Dog-walking ☐ Skateboarding or roller-skating
   ☐ Other:_______________

III Environmental Hazard

I am interested in knowing your concerns about environmental hazards in the Cedar River Watershed. Please let me know:

Are you **aware** of any environmental hazards?

How **important** are the hazards to you or your living?

How **prepared** are you against the hazards?

Please fill in the blanks with a range of degree from 1~5, with 1 = not at all, 2 = a little, 3 = somewhat, 4 = quite a bit, and 5 = very much.

Hazard	Awareness	Importance	Preparedness
Earthquake			
Flood			
River erosion			

What have you done to mitigate the hazards? Please check the following options.

Earthquake: ☐ Preparedness kit ☐ Furniture bolted to the wall ☐ Shake-resisting building design ☐ Other: _______________

Flood: ☐ Hard-banking ☐ Tree-planting ☐ Flood insurance ☐ Other: _____________

Erosion: ☐ Hard-banking ☐ Tree-planting

IV Management Plans & Regulations

1. Management Plans

Are you **aware** of any Cedar River management plans?

Do you **approve of** the plans?

How much have you **participated** in plan development?

Please fill in the blanks with a range of degree from 1~5, with 1 = not at all, 2 = a little, 3 = somewhat, 4 = quite a bit, and 5 = very much.

Plans	Awareness	Approval	Participation
Maplewood Neighborhood Association, Public river access maintenance plan			
Cascade Land Conservancy, Cedar River Restoration Plan (knotweed removal & native plants planting)			
Friends of the Cedar River Watershed, Stewardship in Action (knotweed removal)			
Cedar River Council meetings			

Seattle Public Utilities, Cedar River Watershed Education Center Institute programs			
Seattle Public Utilities, Habitat Conservation Plan, Sockeye Hatchery Project			
City of Renton Parks Planning & Natural Resource, Soos Creek Park & Trail plans			
City of Renton Parks Planning & Natural Resource, Cedar River Trail plans			
City of Renton Parks Planning & Natural Resource, Cedar River Natural Zone City Preserve plans			
King County Flood Control District, Maplewood Land Acquisition & Levee Setback Capital Improvement Project			
Lake Washington/Cedar/Sammamish Watershed, Salmon Conservation & Restoration plans			
Lake Washington/Cedar/Sammamish Watershed, Greening Shorelines plan			
Other:______________________________			
Other:______________________________			

2. Regulations

Are you **aware** of any Cedar River management regulations?
Do you **approve of** the regulations?
How much **impact** do the regulations have on you and your property?

Please fill in the blanks with a range of degree from 1~5, with 1 = not at all, 2 = a little, 3 = somewhat, 4 = quite a bit, and 5 = very much.

Regulations	Awareness	Approval	Impact
Building & Development Regulations due to floodplain			
Landscaping Regulations due to floodplain			
Fishing Regulations			
Other:______________________________			
Other:______________________________			

3. Attitudes toward Plans & Regulations

Indicate the extent to which you agree with the following statements?

Please circle from 1~5, with 1 = not at all, 2 = a little, 3 = somewhat, 4 = quite a bit, and 5 = very much.

a. Residents' participation in watershed management is important.	1 2 3 4 5
b. A major consideration of any good regulatory system is the protection of private property rights.	1 2 3 4 5
c. The best government is the one that governs the least.	1 2 3 4 5
d. Environmental protection plans should be implemented even though the monetary cost might exceed the benefit.	1 2 3 4 5

4. Management Objectives of the River

a. The River should be managed for clean streams, lakes, and wetlands.	1 2 3 4 5
b. The River should be managed for fish and wildlife habitat.	1 2 3 4 5
c. The River should be managed for flood mitigation.	1 2 3 4 5
d. The River should be managed for public use and enjoyment.	1 2 3 4 5

V Human-Nature Relationships

1. River/water/floods is important to my spiritual or religious life. If yes, please specify your religion________________________	1 2 3 4 5
2. When humans change the natural environment, it often produces disastrous results.	1 2 3 4 5
3. Humans are part of natural environment; therefore some human-caused disturbance of species and habitats should be expected.	1 2 3 4 5
4. If a development would result in a loss or degradation of fish & wildlife habitat, the development should stop.	1 2 3 4 5
5. I do what is right for the environment, even when it costs more money or takes up more time.	1 2 3 4 5
6. Humans need to adapt to the natural environment because we cannot change it to suit our needs.	1 2 3 4 5
7. We are harming the environment when we do normal things, like driving & using chemicals to do cleaning.	1 2 3 4 5
8. I am likely to do something for the environment even if others do not do the same.	1 2 3 4 5
9. Plants and animals exist primarily to be used by humans.	1 2 3 4 5
10. Humans should dominate natures.	1 2 3 4 5

VI Behaviors related to nature & the river

Please check yes or no.

	Yes	No
a. Do you recycle?		
b. Do you compost leaves & grass clippings?		
c. Do you try to remove knotweed or other non-native plants in your backyard?		
d. Do you plant any native plants in your backyard?		
e. Do you clear your storm drains of leaves & other debris?		
f. Do you always pick up after you pet on walks and put in the trash?		
g. How do you use pesticides, herbicides, and fertilizer in your backyard?		
h. Do you use natural or non-toxic home cleaning products?		
i. Do you pour any liquids besides clean water into the storm drain?		

VII Demographic Questions

1. How long have you lived in Maplewood? __________years.
2. Gender: ☐ Female ☐ Male
3. Age: ☐ 18-25 ☐ 26-30 ☐ 31-40 ☐ 41-50 ☐ 51-60 ☐ 61-70 ☐ 71–80 ☐ 81 and up
4. Ethnicity: ☐ White ☐ African American ☐ Asian ☐ Native American ☐ Latino

   ☐ Pacific Islander ☐ Other/Mix
5. Religion: ☐ Christianity ☐ Unaffiliated ☐ Judaism ☐ Buddhism ☐ Islam

   ☐ Hinduism ☐ Other
6. Occupation: _______________.

   If retired, check here: ☐, and please note previous occupation:_________________.
7. Highest level of education:

   ☐ No high school diploma ☐ High School diploma ☐ Associates

   ☐ Bachelor's degree ☐ Master's degree ☐ Ph.D. degree
8. Which political party do you affiliate with?

   ☐ Republican ☐ Democratic ☐ Green ☐ Socialist ☐ Libertarian

   ☐ No party affiliation ☐ Reform ☐ Other:_________
9. What is the income level of your household? If retired, please state previous income.

   ☐ under $30,000 ☐ $30,000-49,999 ☐ $50,000-74,999 ☐ 75,000-99,999

   ☐ $100,000-149,999 ☐ 150,000-199,999 ☐ $200,000 and up

10. Housing Proximity to the River (feet): ☐ under 200 ☐ 200-300 ☐ 300-400

☐ 400-500 ☐ 500-600 ☐ 600-700 ☐ 700-800 ☐ 800-900 ☐ 900 and up

Thank you for your opinions! Your completion and return of the questionnaire is appreciated, I will come back to collect it!

If there are any other comments or suggestions you would like to share regarding your relationship or concern about the Cedar River Watershed, please note them in the space below:

Appendix II: Attitude Variables

	Public Participation	Private Property Rights	Government Role	Religious/Spiritual Role	Pro_Environment	Human_oriented_management	Human_dominance	Flood	Erosion	Neighborhood Plans	Regulation_Awareness
1	5.0		3.0		3.35	4.51	3.74	5.00	5.00	4.80	3.50
2			5.0		3.21	3.98	3.50			2.00	
3								5.00	5.00		
4	3.0	4.0	5.0		4.13	4.00	2.50	4.00	5.00	1.91	1.62
5	5.0	4.0	3.0	4.0	3.90	5.00	2.00	5.00	5.00	4.12	2.76
6	5.0	5.0	5.0	5.0	2.39	3.00	2.50	4.00	4.00	2.21	3.25
7	4.0	5.0	5.0	1.0	3.08	4.00	1.00	4.00	3.00	1.11	1.51
8	5.0	5.0	3.0	1.0	4.51	5.00	1.00	5.00	5.00	1.01	1.00
9										1.01	1.00
10	5.0		1.0	1.0	3.72	5.00	1.00	2.00	1.00	1.90	2.02
11	4.0	5.0	3.0	2.0	4.16	5.00	1.00	5.00	3.00	4.87	4.98
12	3.0	4.0	3.0	1.0	3.65	3.98	1.50	2.00	2.00	1.01	1.00
13	5.0	4.0	2.0	2.0	5.00	5.00	3.49	3.00	1.00	1.78	1.25
14								5.00	3.00	2.01	1.00
15	4.0	5.0	3.0	1.0	3.21	5.00	1.00	5.00	5.00	1.47	2.02
16	4.0	3.0	2.0	5.0	3.96	3.49	1.50	4.00	4.00	1.09	1.00
17	5.0	3.0	5.0	5.0	4.40	3.98	1.50	5.00	5.00	3.23	4.24
18											
19	4.0	3.0	3.0	2.0	4.05	3.49	1.00	4.00	3.00	1.01	1.51
20	3.0	3.0	5.0	4.0	2.80	3.00	2.50	5.00	5.00	1.09	1.51
21				4.0		3.00		5.00	2.00		
22	5.0	5.0	3.0	1.0	4.25	2.98	1.00	4.00	4.00		
23	5.0	4.0	5.0	2.0	2.88	5.00	4.50	5.00	3.50	3.33	1.25
24	3.0	2.0	3.0	1.0	3.94	4.00	2.49				
25	5.0	5.0	4.0	1.0	2.72	4.49	1.00	5.00	5.00	1.33	2.02
26	3.0	5.0	3.0	1.0	4.26	5.00	2.50	3.00	3.00	1.00	1.00
27										1.09	1.00
28								4.00	3.00	3.87	1.88
29	3.0	4.0	3.0	1.0	3.25	3.49	1.00			1.01	1.00
30	5.0	3.0	3.0	5.0	4.01	2.51	1.00	5.00	5.00	1.90	2.87
31	5.0	5.0	3.0	5.0	3.48	4.00	1.00	4.00	2.00	4.02	3.61
32	1.0	5.0	3.0	1.0	5.00	5.00	1.00	5.00	5.00	2.25	4.98
33	4.0	4.0	3.0	3.0	3.32	4.00	2.01	4.00	4.00	3.25	2.99
34	4.0				3.11		1.00	4.00	3.00	2.00	
35	5.0	4.0	4.0	3.0	4.92	5.00	5.00	5.00	5.00	3.34	1.00
36	4.0	3.0	2.0	1.0	3.42	3.49	1.00				
37	5.0	2.0	2.0	5.0	4.66	3.98	1.00	5.00	3.00	1.69	3.72
38				1.0	4.69		1.00	5.00	1.00	2.15	
39	5.0	5.0	1.0	5.0	3.94	3.04		5.00	5.00	1.92	2.39
40	5.0	5.0	1.0	1.0	3.70	5.00	1.00	3.00	3.00	1.01	1.00
41	5.0	5.0	3.0	1.0	3.38	5.00	3.01				
42	4.0	4.0	3.0	1.0	2.86	5.00	1.00	4.00	4.00	2.95	1.00
43	3.0	5.0	3.0	1.0	3.80	5.00	5.00	5.00	5.00	3.51	2.76
44	3.0	5.0	5.0	1.0	2.28	3.00	1.99	3.00	1.00	3.98	3.50
45	4.0	3.0	5.0	1.0	4.10	2.49	2.99	2.00	5.00	1.54	2.76
46	4.0	5.0	5.0	1.0	2.59	3.98	2.99	5.00	3.00	1.00	1.00
47	3.0	4.0	3.0	3.0	3.93	3.49	1.50	4.00	3.00	1.96	1.99
48	5.0	4.0	1.0	1.0	3.95	5.00	1.50	1.00	1.00	1.01	1.00
49	3.0	2.0	2.0	2.0	2.00	2.00	2.00	2.00	3.00	1.01	1.99
50	3.0	5.0	5.0	1.0	1.93	4.51	1.50	5.00	5.00	1.30	4.61
51	4.0	4.0	3.0	1.0	3.16	5.00					
52	4.0	4.0	4.0	1.0	4.00	5.00	1.00	4.00	3.00	1.11	1.00
53	3.0	4.0	3.0	5.0	4.57	5.00	1.00	5.00	4.00	4.21	3.99
54								4.00	3.00	1.00	1.00
55	5.0	5.0	3.0		4.69	5.00		3.00	2.00	1.01	1.00
56	4.0	4.0	3.0	1.0	3.83	4.49	1.50	5.00	5.00	2.49	1.99
57	5.0	4.0	3.0	5.0	4.27	5.00	2.00	4.00	2.00	2.82	2.13
58	5.0	5.0	5.0	3.0	3.42	4.49	1.50	4.00	4.00	4.00	4.61
59	5.0	5.0	5.0	1.0	4.67	3.98	1.00			1.00	4.98

Attitude Variables (cont.)

	Public Participation	Private Property Rights	Government Role	Religious/Spiritual Role	Pro_Environment	Human_oriented_management	Human_dominance	Flood	Erosion	Neighborhood Plans	Regulation_Awareness
60	4.0	2.0	5.0	3.0	3.61	5.00	1.00			1.00	3.25
61	5.0	5.0	1.0	3.0	5.00	3.00	1.00			2.00	1.00
63	5.0	4.0	3.0	1.0	2.57	4.00	1.00				
64	4.0	5.0	1.0	1.0	3.05	5.00	2.00	4.00	3.00	1.76	2.99
65								5.00	5.00		
66	5.0	5.0	5.0	4.0	4.51	5.00	1.00	5.00	5.00	2.24	1.00
67	4.0	5.0	5.0	1.0	2.24	4.00	3.50	5.00	1.00	1.46	1.00
68	4.0	5.0	3.0	5.0	4.36	3.00	1.00	4.00	2.00	1.90	1.36
69	3.0	3.0	3.0		3.69	3.49		5.00	4.00	1.01	1.00
70											
71	5.0	4.0	3.0	1.0	3.74	4.00	2.50	5.00	5.00	2.71	3.99
72	2.0	4.0	3.0	1.0	2.30	2.49	3.01			1.01	1.00
73								5.00	3.00	1.01	1.00
74	5.0	3.0	2.0	1.0	3.99	4.51	2.00	4.00	2.00	1.00	1.00
75	3.0	4.0	2.0	1.0	3.69	3.98	2.00	5.00	3.00	1.01	1.00
76	4.0	3.0	2.0	1.0	3.43	4.00	1.00	5.00	2.00	1.12	1.00
77	4.0	3.0	2.0	1.0	3.83	4.00	2.01	4.00	4.00	3.14	2.10
78	5.0	5.0	4.0	1.0	3.96	5.00	1.00			3.87	1.00
79	4.0	5.0	3.0	3.0	3.06	4.00	3.00	3.00	3.00	1.00	1.00
80											
81	5.0	3.0	2.0	5.0	4.39	5.00	2.00	4.00	3.00	1.43	1.73
82	5.0	5.0	5.0	3.0	3.13	3.53	1.50	5.00	5.00	4.68	4.98
83	5.0	5.0	3.0	4.0	4.40	5.00	3.02	5.00	5.00	1.01	1.00
84				1.0	4.45	5.00	1.00	5.00	5.00	1.80	3.50
85	5.0	5.0	1.0	1.0	3.37	5.00	3.50	5.00	5.00	1.96	1.00
86	5.0	5.0	5.0	5.0	2.54	5.00	1.99	5.00	5.00	1.82	4.98
87	3.0	3.0	4.0	5.0	4.79	5.00	1.00				
88	4.0	3.0	3.0	2.0	3.95	3.98	3.50	4.00	2.00	1.01	1.25
89	4.0	4.0	4.0	1.0	3.30	3.00	2.50	2.00	2.00	1.01	2.10
90											
91	5.0	4.0	3.0		3.41	5.00	1.00	5.00	5.00	1.00	1.51
92								3.00	3.00	1.90	1.00

Note: The final attitude variables are the results of attitude factor analysis. See table 3 for detail descriptions of each variable.

Appendix III: Preference Variables

	Forested_Bank	Public_Access	Log_Jam	Hard_Bank	Lawns	Gravel_bank	Rip_rap
1	4.71	4.00	5.00	2.00	2.97	5.00	
2	3.00	5.00	2.27	4.26	4.27	3.00	2.73
3	3.51	3.47	3.24	2.42	2.50	3.00	
4	2.34	3.27	1.23	2.22	3.71	4.00	2.17
5	4.71	2.48	2.47	1.88	3.77	3.61	1.68
6	4.29	1.75	2.97	1.96	3.27	3.00	1.73
7	4.26	4.49	4.50	3.92	3.96	2.99	3.44
8	3.49	3.28	3.45	1.50	4.02	4.39	3.03
9	4.82	2.47	4.53	2.33	3.06	3.69	2.57
10	2.42	4.50	1.00	3.45	3.77	3.07	1.40
11	4.42	4.75	3.86	2.70	1.94	4.53	2.43
12	4.28	2.51	1.00	3.46	2.23	1.00	1.98
13	3.95	3.50	4.73	2.13	4.54	5.00	2.71
14	2.36	3.28	2.24	1.31	3.48	3.77	2.08
15	3.52	4.00	4.73	2.42	2.98	3.69	3.66
16	2.87	2.24	3.74	2.42	2.98	3.31	2.41
17	4.71	2.00	5.00	2.00	2.27	4.38	2.71
18	4.10	4.00	3.74	3.70	4.56	4.70	3.84
19	4.00	4.00	3.24	3.25	3.77	3.69	2.83
20	3.71	2.74	3.26	2.46	2.77	2.99	2.15
21	2.42	3.00	2.47	1.95	3.04	3.00	1.57
22	4.32	2.24	4.24	2.93	4.27		2.85
23	3.40	4.53	4.00	2.88	3.29	3.31	2.29
24	1.49	2.24	1.00	1.74	2.21	2.99	2.15
25	4.22	4.51	3.76	3.42	4.25	3.99	3.89
26	5.00	4.06	5.00	2.90	5.00	4.69	4.40
27	3.22	2.24	3.76	3.03	2.75	3.70	3.43
28	1.36	4.27	1.00	2.26	3.25	3.01	2.25
29	3.78	5.00	4.23	3.43	2.92	3.07	3.33
30	4.82	1.24	5.00	1.21	1.50	3.38	1.30
31	4.53	2.00	3.71	3.63	2.79	3.39	2.85
32	4.19	3.03	1.98	3.84	1.63	3.37	2.98
33	3.57	3.75	2.26	3.75	2.48	3.69	2.27
34	4.60	3.69	4.24	1.54	2.21	4.69	2.29
35	5.00	2.01	3.42	1.50	1.56	5.00	3.39
36	4.33	4.25	2.48	2.90	3.77	3.46	2.69
37	4.02	3.50	4.47	1.70	2.84	4.00	2.60
38	4.51	3.50	3.55	1.67	2.79	3.32	
39	4.02	3.50	4.00	2.66	2.54	4.69	2.40
40	1.00	5.00	1.00	4.07	2.21	1.00	1.28
41	3.51	4.00	2.50	2.95	3.00	3.07	2.00
42	4.00	3.76	3.23	1.99	2.48	2.61	3.00
43	4.10	4.51	4.29	2.16	3.40	3.00	3.44
44	2.70	3.78	1.24	3.00	2.38	2.39	1.68
45	2.97	2.00	3.01	2.70	2.63	4.39	3.25

Preference Variables (cont.)

	Forested_Bank	Public_Access	Log_Jam	Hard_Bank	Lawns	Gravel_bank	Rip_rap
46	3.40	3.49	2.74	3.00	2.98	4.01	2.28
47	2.92	2.76	3.73	2.00	3.00	3.31	2.73
48	4.60	2.97	3.16	2.26	2.29	3.76	2.25
49	5.00	1.24	4.74	2.09	1.00	3.61	3.54
50	3.63	1.00	3.47	1.88	3.04	4.70	3.30
51	4.82	5.00	3.56	3.24	3.52	3.30	2.84
52	4.22	3.00	4.00	2.21	3.04	4.31	2.31
53	1.54	4.25	2.45	1.25	3.48	2.69	1.41
54	3.87	3.24	3.00	2.71	4.04	2.69	2.84
55	4.22	2.24	3.24	3.21	3.71	3.61	2.98
56	4.40	3.49	3.48	3.71	4.00	4.69	4.60
57	3.18	3.50	2.73	3.62	4.27	3.39	2.54
58	5.00	4.75	1.00	3.21	3.26	3.07	1.12
59	2.58	3.76	1.96	3.70	4.27	3.24	2.73
60	3.75	1.00	4.52	1.67	3.02	3.09	2.12
61	4.82	2.74	4.23	2.18	2.77	4.08	2.06
62	3.47	4.25	1.00	2.96	2.75	4.00	2.42
63	3.24	4.53	2.51	1.62	2.69	2.70	1.45
64	5.00	2.97	4.00	3.74	3.27	3.30	3.17
65	5.00	5.00	5.00	3.74	3.50	5.00	3.57
66	4.22	2.75	3.21	2.96	3.19	3.30	3.01
67	3.45	2.00	3.23	2.66	2.25	2.61	2.47
68	4.47	4.01	4.00	2.75	3.23	4.00	2.41
69	4.64	1.24	2.00	1.95	2.21	3.99	1.53
70	5.00	3.76	5.00	1.95	4.00	4.00	3.04
71	3.00	1.75	1.26	2.22	1.69	2.69	1.58
72	5.00	4.25	4.00	3.20	4.50		3.71
73	4.18	4.25	2.96	1.00	2.43	5.00	3.70
74	2.00	3.25	1.48	1.50	3.33	2.39	1.69
75	4.22	2.98	1.77	2.25	3.00	2.99	2.89
76	5.00	3.25	4.76	2.21	3.55	1.30	
77	2.89	3.49	4.23	3.66	4.29	3.68	3.15
78	3.76	2.50	2.76	3.47	3.54	2.00	2.45
79	3.45	4.00	2.00	2.49	2.85	3.61	3.25
80	5.00	5.00	1.00	3.50	4.21	5.00	3.13
81	3.40	4.00	3.73	3.21	3.50	3.30	3.42
82	2.94	3.24	2.95	2.50	4.79	3.30	2.13
83	5.00	3.24	2.36	3.50	3.59		2.94
84	4.82	4.76	2.92	3.74	3.64	4.69	3.84
85	1.97	5.00	1.00	5.00	4.43	5.00	5.00
86	1.76	2.78	4.47	1.50	2.27	4.69	3.57
87	4.24	3.51	3.02	1.29	2.79	4.30	2.68
88	4.00	4.00	3.61	3.39	3.75	2.30	1.69
89	3.12	3.75	2.50	2.54	3.08	3.39	3.00
90	4.40	3.00	2.40	1.74	3.28	5.00	2.28
91	4.47	3.00	5.00	1.70	4.50	5.00	2.83

Appendix IV: Demographic Variables

	Length_of_residency	Gender	Age	Ethnicity	Religion	Occupation	Retired_Status	Education	Political_Affiliation	Income	Proximity	Google_proximity	Home_value	Riverside	Jurisdiction
1	6	1		1			2	4	5	1	8	7	4	2	2
2	5	2	7	1	1		1	2			2	2	4	2	2
3	6	1	6	1	1	2	1	3		4	4	3	5	2	2
4	4	1	6	1		3	2	4			1	1	6	1	2
5	1	2	5	1	1	2	2	3	2	3	8	1	6	1	2
6	2	1	4	1	1	2	2	4	5	5	1	1	5	1	2
7	1	2	2	1	2	1	2	2	2	5	2	1	4	2	1
8	5	1	6	1	2	1	1	2	2	3	1	1	5	1	1
9	1	2	4	1	1	2	2	4	6	4	4	1	4	2	1
10	1	2	4	7	1	1	2	2	2	2	1	1	5	1	1
11	5	2	7			1	1	2			6	6	4	2	1
12	2	2	4	3	4		2	2	6	2	7	2	4	2	1
13	1	2	2	7	1	1	2	3	2	3	9	8	4	2	1
14	1	2		1	1						5	6	3	2	1
15	1	2	4	1	2	2	2	2	2	2	7	4	2	2	1
16	5	2	4	1	2	2	2	4	6	1	9	4	2	2	1
17	2	1	5	1	1	2	1	4	6	5	1	1	5	1	2
18												1	5	1	1
19	3	1	6	1	1	2	2	3	6	3	3	2	4	2	1
20	3	1	6	1	1	2	2	4	1	5	1	1	4	2	1
21	3	1	5	1		1	2	2	6	3		3	4	2	1
22	2	2	5	1	9	1	2	4	2	3	4	3	1	2	1
23	4	1	6	1	1	2	2	4	1	4	2	3	4	2	1
24	3	2	3	1	1	1	2	2	6	1	4	4	3	2	1
25	1	2	3	1	1	1	2	2	2	4	6	3	4	2	1
26	2	2	4	1	1	2	2	2	6		5	3	4	2	1
27	3	2	5	1	1	3	2	4	1			2	4	2	1
28		2		1							9	1	5	1	1
29	1	1	3	2	1	1	2	2	6	5	2	1	5	2	1
30	1	1	5	1		3	2	4	2	5	1	1	6	1	1
31	1	2	6	1	1	2	2	4	2	3	1	1	6	1	1
32	5	1	6	6	1	1	1	2			9	9	2	2	1
33	4	2	6	3	4		1	2	2			5	3	2	1
34	5	2	7	1	1	2	1	3		5	2	5	3	2	1
35	3	2	5	1	1	3	2	4	6	3		8	3	2	1
36	1	2	4	1	2	2	2	5	6	4	9	8	3	2	1
37	1	2	5	1	9	2	2	5	2	5	3	6	3	2	1
38	1	1	4	5		1	2	2	2	4	3	5	3	2	1
39	3	1	2	1	1	1	2		6		1	5	3	2	1
40	1	2	6	2	9		2	3				1	6	1	1
41	6	2	7	1	1	3	1	4	6	4	5	2	5	2	1
42	1	1	6	1	4	1	2	3	1	2	4	2	4	2	1
43	4	2	7	1	1		1	2	2	4	1	1	6	1	2
44	2	2	7	1	1	2	1	2	6	3	1	1	6	1	2

Demographic Variables (cont.)

	Length_of_residency	Gender	Age	Ethnicity	Religion	Occupation	Retired_Status	Education	Political_Affiliation	Income	Proximity	Google_proximity	Home_value	Riverside	Jurisdiction
45	1	2	4	1	1	1	2	2	1	7	5	4	6	2	2
46	5	1	7	1	1	2	2	3	1	5	4	4	3	2	2
47	1	1	4	3	1	3	2	2	6	4	9	3	4	2	2
48	2	1	5	1	9	2	2	2	6	2	9	8	3	2	1
49	1	2	4	6	1			2				6	3	2	1
50	3	1	3	1	9	3	2	4	1	5	6	5	3	2	1
51	6	2		1	1		1	2			7	7	2	2	1
52	1	2	6	1	1	2	2	3	1	2	5	5	3	2	1
53	2	1	6	1	1	2	2	3	6	2	5	4	3	2	1
54												3	4	2	1
55	1	2	5	1	1	3	2	2	2	3	8	4	2	2	1
56	1	2	5	1	2	2	2	2	6		2	1	3	1	1
57	1		3	1	2	3	2	5	2	5	1	1	5	1	1
58	2	2	5	1	1	1	2	2	5	4	1	1	6	1	1
59											7	1	5	1	1
60	1	2		6	1	2	2	2	6	1	4	2	4	2	1
61	3	1	6	1	1	1	1	2	1	3	3	2	3	2	1
62	2	1	5	1	1	3	2	3	5		3	4	4	2	1
63	6	2	7	1	2	3	1	4	2		7	4	3	2	1
64	4	2	7	1	1	3	1	4	5	3	3	2	4	2	2
65											1	1	6	1	2
66	1	2	6	1	1	2	1	4	1			3	4	2	2
67	1	1	3	1	1	3	2	2	1	4	9	5	4	2	2
68	1	1	2	1	2	3	2	4	2	2	9	6	2	1	1
69											3	3	4	2	1
70												1	5	1	1
71	3	1	5	1	1	2	1	5	1	7	1	2	4	2	1
72	3	1	5	1	1	1	1	2	6	2	1	3	3	2	1
73	3	2	4	1	9		1	3	6	4	4	3	4	2	1
74	1	2	3	1	2	2	2	4	2	4	9	5	3	2	1
75	2	1	6	1	2	3	1	2	2	4	9	6	4	2	1
76	3	2	7	1	2		1	4		5	9	6	5	2	1
77	2	2	6	1	1	2	1	2	2	5	9	6	4	2	1
78	3	2	4	1	1	2	2	2	6	5	5	9	4	2	1
79	4	1	5	1	1	2	1	4	2	4	9	4	4	2	1
80												4	4	2	1
81	4	2	5	1		3	2	5	2	4	6	3	4	2	1
82											1	1	3	1	1
83	1	2	6	1	1	1	2	2		2	1	1	5	1	1
84	4	2	5	1	1	2	2	2	6			1	4	2	1
85	1		5	1	2	2	1	2	6	1	9	2	2	2	1
86	2	2	4	1	1	2	2	4	6	3	1	1	3	1	1
87	4	2	6	1	9		2	5	6		2	3	4	2	1
88	1	2	3	1	1	2	2	3	6	3	8	6	5	2	1

89	3	1	4	1	1	1	2	2	6	5	9	9	3	2	1
90	1	1	3	1	2	2	2	4	5	4	9	7	2	2	1
91	1	1	6	1		2	1	4			9	3	3	1	2
92											4	2	4	1	2

Coding of Demographic Variables:

Length_of_residence (yr)

<10	1
11~20	2
21~30	3
31~40	4
41~50	5
>50	6

Gender

Male	1
Female	2

Age

18-25	1
26-30	2
31-40	3
41-50	4
51-60	5
61-70	6
>70	7

Ethnicity

White	1
Black	2
Native	4
Latino	5
Pacific Islander	6
Other/Mix	7

Religion

Christianity	1
Unaffiliated	2
Buddhism	4
other	9

Occupation

unskilled	1
skilled	2
professional	3

Retired_Status

retired	1
not retired	2

Education

<high	1
high	2
Associates	3
Bachelor	4
Master	5

Political_Affiliation

Republican	1
Democratic	2
Independent	5
none	6

Riverside

Riverside	1
Nonriverside	2

Income

<30	1
30-49	2
50-74	3
75-99	4
100-149	5
150-199	6
>200 (K)	7

Proximity/Google Proximity

<200	1
200-300	2
300-400	3
400-500	4
500-600	5
600-700	6
700-800	7
800-900	8
>900 (ft)	9

Home_value

<100	1
100-150	2
150-200	3
200-250	4
250-300	5
>300 (K)	6

Jurisdiction

King County	1
Renton	2

Appendix V: Behavior Variables

	B1	B2	B3	B4	B5	B6	B7	B8	B9
1	1	1	0	1			0	0	
2	1	1	1	1	1	1	1	0	0
3	1	1	0	0	1	1	0		0
4	1	1	1	1	1	1	0	1	0
5	1	1	1	1	1	1	1	0	0
6	1	0	0	1		1	0	1	
7	1	1	1	0	1	1	0	1	0
8	1	1	1	1	1	1	0	1	0
9	1	1	1	0	1	0		0	0
10	1	1	1	0	1	1	0	1	0
11	1	1	1	1	1	1	1	0	0
12	1	1	1	1	1		1	0	0
13	1	1	1	1	1		0	1	
14	1	1	1	1	1	1	0	1	0
15	1	1	1	0	1	1	0	1	0
16	1	1	0	0	0	1	0	0	0
17	1	0	1	1	0		0	1	0
18									
19	1	1	1	1	1			1	0
20	1	1	1	1	0	0	1	1	1
21	1	1	1	0	1	0	1	0	0
22	1	1	0	0	1	1	0	0	0
23	1	0	1	0	1	1	1	1	0
24	1	1	1	0	1		1	1	0
25	1	1	0	0	1	0	1	1	0
26	1	1	0	0	1	1			0
27	1	1			1				0
28									
29	1	1	0	0	1	1	1	1	0
30	1	1	1	0	1	1	0	0	0
31	1	1	1	0	1	1	1	0	0
32	1	0	1	0	1	1	0	1	0
33	0	1	1	0	1	1	0	1	0
34	1	0	1	1			1	1	0
35	1	1	1	1	1	1	1	1	0
36	1	1	0	0	0	1	1	0	0
37	1	1	1	1	1	1	1	1	0
38	1	1	1	1	1		1	1	0
39	1	1	1	0	1	1	1	0	0
40	1	1	0	0	1	1	1	1	0
41	1	1			1		1	0	0
42	1	0	0	0	1	1	1	0	0
43	1	0	1	0	1		1	0	0
44	1	1	1	0	0	1		1	0
45	1	1	1	1	1		1	0	0

Behavior Variables (cont.)

	B1	B2	B3	B4	B5	B6	B7	B8	B9
46	1	1	1	1	1	1	1	1	0
47	1	1	1	0	1	1	1	1	0
48	0	1	0	0	0	0	0	0	0
49	1	1	1	1	1	1	0	1	0
50	1	0	1	1	0	0	1	0	1
51	1	1	1	1	1	1	1	1	0
52	1	1	1	0	1		0	1	0
53	1	1	1	0	1	1	0	0	0
54									
55	1	1	1	1	1	1	1	0	0
56		0	1	1	1	1	1	1	0
57	1	1	1	1	1	1	1	0	0
58	1	1	1	1	1	1	1	1	0
59									
60	1	1	1	0	1	1	0	1	0
61	1	1	1	1	1	1	1	1	0
62	1	1	1	1	1	1	0	1	0
63	1	0	1	1	1		1	0	0
64	1	0	0	0	1	1	1	1	0
65									
66	1	0	0	1	1		0	1	0
67	1	1	0	0	1	0	1	0	0
68	1	1	1	1	0	1	0	1	0
69	1	1	0	0	1	1	1	1	0
70									
71	1	1	1	1	1	1	1	1	0
72	1	1		0	1	1	0	1	
73	1	1		1	1	1		0	0
74	1	1	0	0	1	1	0	0	0
75	1	1	1	1	1	1	1	0	0
76	1	1	1	1	1		1	1	0
77	1	1	1	1	1	1	1	0	1
78	1	1	1	1	1	1	1	0	0
79	1		0	1	1	1	1	0	0
80									
81	1	1	0	1	1	1	1	1	0
82									
83	1	1	1	1	1		0	1	0
84	1	1	0	1		1	1	1	
85	1	1	0	0	1	1	1	1	0
86	1	1	1	1	1	1	1	0	1
87	1	1	1	1	1	1	1	0	1
88	1	1	1		0	1	1	1	0
89	1	1	1	0	1	1	1	1	0
90	1	1	1	1	1		1	1	0

Note: B1~B9 refer to behavior questions #1~#9 in Appendix I Survey Questionnaire, 1:Yes, 0: No

Appendix VI: Demographic & Preference ANOVA Tables

Gender:

Robust Tests of Equality of Means

		Statistic[a]	df1	df2	Sig.
Forested_Bank	Welch	.271	1	77.913	.604
Public_Access	Welch	6.422	1	68.537	**.014**
Log_Jam	Welch	1.228	1	75.719	.271
Hard_Bank	Welch	6.037	1	77.327	**.016**
Lawns	Welch	4.225	1	77.772	**.043**
Gravel_bank	Welch	.126	1	73.844	.724
Rip_rap	Welch	6.657	1	72.111	**.012**

a. Asymptotically F distributed.

GoogleEarth Housing Proximity to the River:

Robust Tests of Equality of Means[b]

		Statistic[a]	df1	df2	Sig.
Forested_Bank	Welch	1.299	8	12.677	.326
Public_Access	Welch	1.411	8	16.825	.262
Log_Jam	Welch	.309	8	12.352	.948
Hard_Bank	Welch	6.972	8	13.729	.001
Lawns	Welch	1.422	8	18.354	.252
Gravel_bank	Welch	1.097	8	12.254	.426
Rip_rap	Welch	.	.	.	.

a. Asymptotically F distributed.

b. Robust tests of equality of means cannot be performed for Rip_rap because at least one group has the sum of case weights less than or equal to 1.

Appendix VII: Attitude & Preference Correlations Tables

Correlations

		Gravel_bank	Participation
Gravel_bank	Pearson Correlation	1	.253*
	Sig. (2-tailed)		.031
	N	84	73
Participation	Pearson Correlation	.253*	1
	Sig. (2-tailed)	.031	
	N	73	74

*. Correlation is significant at the 0.05 level (2-tailed).

Correlations

		Gravel_bank	Religion
Gravel_bank	Pearson Correlation	1	.283*
	Sig. (2-tailed)		.018
	N	84	69
Religion	Pearson Correlation	.283*	1
	Sig. (2-tailed)	.018	
	N	69	71

*. Correlation is significant at the 0.05 level (2-tailed).

Correlations

		Private_Rights	Lawns
Private_Rights	Pearson Correlation	1	.357**
	Sig. (2-tailed)		.002
	N	71	71
Lawns	Pearson Correlation	.357**	1
	Sig. (2-tailed)	.002	
	N	71	87

**. Correlation is significant at the 0.01 level (2-tailed).

Correlations

		Religion	Log_Jam
Religion	Pearson Correlation	1	-.267*
	Sig. (2-tailed)		.024
	N	71	71
Log_Jam	Pearson Correlation	-.267*	1
	Sig. (2-tailed)	.024	
	N	71	87

*. Correlation is significant at the 0.05 level (2-tailed).

Correlations

		Gov_Role	Lawns
Gov_Role	Pearson Correlation	1	.236*
	Sig. (2-tailed)		.043
	N	74	74
Lawns	Pearson Correlation	.236*	1
	Sig. (2-tailed)	.043	
	N	74	87

*. Correlation is significant at the 0.05 level (2-tailed).

Correlations

		Forested_Bank	Human_oriented_mng
Forested_Bank	Pearson Correlation	1	.308**
	Sig. (2-tailed)		.007
	N	87	76
Human_oriented_mng	Pearson Correlation	.308**	1
	Sig. (2-tailed)	.007	
	N	76	76

**. Correlation is significant at the 0.01 level (2-tailed).

Appendix VII: Attitude & Preference Correlations Tables (cont.)

Correlations

		Gravel_bank	Human_oriented_mng
Gravel_bank	Pearson Correlation	1	.277*
	Sig. (2-tailed)		.017
	N	84	74
Human_oriented_mng	Pearson Correlation	.277*	1
	Sig. (2-tailed)	.017	
	N	74	76

*. Correlation is significant at the 0.05 level (2-tailed).

Correlations

		Gravel_bank	Flood
Gravel_bank	Pearson Correlation	1	.283*
	Sig. (2-tailed)		.017
	N	84	70
Flood	Pearson Correlation	.283*	1
	Sig. (2-tailed)	.017	
	N	70	73

*. Correlation is significant at the 0.05 level (2-tailed).

Correlations

		Rip_rap	Human_oriented_mng
Rip_rap	Pearson Correlation	1	.289*
	Sig. (2-tailed)		.013
	N	83	74
Human_oriented_mng	Pearson Correlation	.289*	1
	Sig. (2-tailed)	.013	
	N	74	76

*. Correlation is significant at the 0.05 level (2-tailed).

Correlations

		Human_oriented_mng	Log_Jam
Human_oriented_mng	Pearson Correlation	1	.465**
	Sig. (2-tailed)		.000
	N	76	76
Log_Jam	Pearson Correlation	.465**	1
	Sig. (2-tailed)	.000	
	N	76	87

**. Correlation is significant at the 0.01 level (2-tailed).

Correlations

		Gravel_bank	Erosion
Gravel_bank	Pearson Correlation	1	.270*
	Sig. (2-tailed)		.024
	N	84	70
Erosion	Pearson Correlation	.270*	1
	Sig. (2-tailed)	.024	
	N	70	73

*. Correlation is significant at the 0.05 level (2-tailed).

Correlations

		Forested_Bank	Erosion
Forested_Bank	Pearson Correlation	1	.274*
	Sig. (2-tailed)		.019
	N	87	73
Erosion	Pearson Correlation	.274*	1
	Sig. (2-tailed)	.019	
	N	73	73

*. Correlation is significant at the 0.05 level (2-tailed).

Appendix VIII: Behavior Logistic Regression Models

B3: Do you try to remove knotweed or other non-native plants in your backyard?

Block 1: Method = Enter

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Forested_Bank	-.856	.459	3.476	1	.062	.425
	Public_Access	-.906	.383	5.586	1	**.018**	.404
	Log_Jam	.239	.320	.558	1	.455	1.271
	Hard_Bank	.322	.459	.492	1	.483	1.380
	Lawns	.046	.433	.012	1	.915	1.048
	Gravel_bank	.719	.442	2.654	1	.103	2.053
	Rip_rap	-.514	.548	.880	1	.348	.598
	Constant	4.733	2.289	4.275	1	.039	113.627

a. Variable(s) entered on step 1: Forested_Bank, Public_Access, Log_Jam, Hard_Bank, Lawns, Gravel_bank, Rip_rap.

Block 1: Method = Enter

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Participation	-2.644	1.600	2.732	1	.098	.071
	Private_Rights	-1.808	1.086	2.774	1	.096	.164
	Gov_Role	1.368	.712	3.691	1	.055	3.927
	Religion	-1.548	.710	4.756	1	**.029**	.213
	Pro_Environ	5.646	2.389	5.586	1	**.018**	283.145
	Human_oriented_mng	-2.912	1.535	3.596	1	.058	.054
	Human_dominance	1.048	.849	1.526	1	.217	2.853
	Flood	2.251	1.326	2.882	1	.090	9.497
	Erosion	.180	.538	.112	1	.738	1.197
	All1_3	1.097	1.076	1.039	1	.308	2.995
	Reg_AW	3.480	1.624	4.588	1	**.032**	32.446
	Constant	-7.584	5.762	1.733	1	.188	.001

a. Variable(s) entered on step 1: Participation, Private_Rights, Gov_Role, Religion, Pro_Environ, Human_oriented_mng, Human_dominance, Flood, Erosion, All1_3, Reg_AW.

Appendix VIII: Behavior Logistic Regression Models (cont.)

B3: Do you plant any native plants in your backyard?

Block 1: Method = Enter

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Forested_Bank	.162	.364	.198	1	.657	1.176
	Public_Access	-.995	.362	7.564	1	**.006**	.370
	Log_Jam	-.456	.305	2.232	1	.135	.634
	Hard_Bank	-.162	.434	.140	1	.709	.850
	Lawns	.905	.408	4.922	1	.027	2.473
	Gravel_bank	.851	.443	3.700	1	.054	2.343
	Rip_rap	.074	.500	.022	1	.882	1.077
	Constant	-1.383	1.886	.537	1	.464	.251

a. Variable(s) entered on step 1: Forested_Bank, Public_Access, Log_Jam, Hard_Bank, Lawns, Gravel_bank, Rip_rap.

Appendix IX: Demographic & Attitude ANOVA Tables

Gender:

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Human oriented management	Between Groups	4.788	1	4.788	7.597	.007
	Within Groups	44.120	70	.630		
	Total	48.908	71			

Ethnicity:

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Flood Awareness, Importance, Preparedness	Between Groups	10.475	3	3.492	4.014	.011
	Within Groups	53.063	61	.870		
	Total	63.538	64			

Religion:

Robust Tests of Equality of Means

		Statistic[a]	df1	df2	Sig.
Human dominance	Welch	7.682	3	9.240	.007
Neighborhood plans	Welch	5.289	3	7.902	.027

a. Asymptotically F distributed.

Education:

Robust Tests of Equality of Means

		Statistic[a]	df1	df2	Sig.
Private Right Protection	Welch	3.314	3	19.000	.042
Religious/spiritual Role	Welch	5.352	3	15.479	.010

a. Asymptotically F distributed.

Political Affiliation:

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Public Participation	Between Groups	5.247	3	1.749	2.808	.047
	Within Groups	36.124	58	.623		
	Total	41.371	61			
Small Government	Between Groups	16.238	3	5.413	4.044	.011
	Within Groups	77.633	58	1.339		
	Total	93.871	61			

Appendix IX: Demographic & Attitude ANOVA Tables (cont.)

Riverfront/non-riverfront:

Robust Tests of Equality of Means

		Statistic[a]	df1	df2	Sig.
Public Participation	Welch	7.352	1	40.100	.010
Private Right Protection	Welch	7.410	1	43.817	.009
Religious/spiritual Role	Welch	5.659	1	23.957	.026
Neighborhood plans	Welch	5.708	1	33.275	.023
Regulation Awareness	Welch	5.145	1	35.565	.029

a. Asymptotically F distributed.

Previous Jurisdiction before annex-Renton/King County:

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Gov_Role	Between Groups	12.000	1	12.000	8.532	.005
	Within Groups	102.667	73	1.406		
	Total	114.667	74			
Human_dominance	Between Groups	7.076	1	7.076	7.002	.010
	Within Groups	72.767	72	1.011		
	Total	79.843	73			