REVEALING HUMAN-NATURE RELATIONSHIPS
THE CASE OF PORTLAND, OREGON

by

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Urban landscapes pose a significant challenge in striving for sustainability. Ecological services and resources that urbanites rely on within cities are for the most part hidden from thought and view. This severed connection between people and developing a direct connection with their environment disrupts the development of ecological concern, the ability to learn how ecosystems function, and how to behave in regards to the environment. Portland, Oregon is an example of a city with a well-known reputation for being environmentally friendly or "green". This research examines to what extent the city and its people are environmentally conscious, ecologically literate, and live in a landscape that is able to provide green infrastructure that is, in turn, conducive of the former attributes.

Acknowledgements

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I would also like to show deep gratitude to my family for their limitless care and encouragement throughout my undergraduate education. Without my dad's humor and optimism, my mother's wisdom and advice, and my sisters' love and encouragement I am not sure how I would have had the strength to clear the course of challenges and successfully complete this thesis and my major requirements.

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It is not necessarily the land that is broken, but our relationship to it, and what we really need to restore is that relationship.
– Robin Kimmerer (2013)

Global environmental crises such as over-consumption of resources, habitat fragmentation, biodiversity loss, collapsing ecosystems, are unavoidable issues that affect contemporary society. How aware of this is the average urbanite as they go about their daily lives? The urban landscape presents an obstacle in making ecological principles personally relevant as the origin of resources and services within the urban landscape are increasingly separated from the average urban dweller. While environmental consciousness is an important impetus for conservationist behavior, ecological literacy is essential in informing behavior, yet it needs to be learned through the direct everyday experience that green infrastructure can provide.

Environmental identity, ecological literacy, and green infrastructure are not articulated as interdependent factors in urban policy discourse. Portland, Oregon is the case study through which I will analyze people's articulation of their relationship with the natural landscape of their city through indicators of environmental identity, ecological literacy, and green infrastructure. My thesis question is twofold:

1. To what extent are principles and indicators of environmental identity, ecological literacy, and green infrastructure present in urban development initiatives and public discourse of the city in which they live?
2. How are the three subjects comparatively present in urban policy and public responses?

Urbanization and the Distancing Between People and Nature

With over half of the world's population now living in cities and the fact that this number is growing, the impact of urban spaces on our behavioral and perceptive relationships with our local ecosystems is one of this century's challenges. Cities tend to concentrate flows of energy and capital, and this concentration has far-reaching influence in terms of ecological impact (Rees 1997). Urban areas have their own unique ecological systems, supporting diverse human functions - water distribution, waste management, and the extraction and production goods - mostly hidden from the eyes and minds of the average urban dweller. This prevents the average urbanite from developing an environmental identity that is founded in direct ecological knowledge (Hester 2010). This separation between people and the systems that support human life within the city creates a dilemma for sustainability initiatives.

In ecological terms, urbanity is a large concentration of people, in which resources and energy are consumed and waste is produced faster than can be supported by the region occupied (Niemela 2011). Researchers suggest that unlike most biological systems that evolve to increase in energy efficiency as they increase in scale, urban areas tend to concentrate in space and increase in energy loss (Bettencourt et al. 2014). Resource consumption within cities also increases as technology and global trade increase (Rees 2014). These trends result in both increasing the geographical area as well as global connections that a city depends on for its functions and services. A single city can depend on resources from a collection of peripheral lands up to 200 times its size – a phenomenon known as *ecological footprint* (Rees 2014). This not only indicates a vulnerability to political instability and climate change, but also severe

distance between the average urbanite's perceptual and tangible connection to their resources. It would be false, however, to surmise from this that urbanization itself is the sole culprit of overconsumption. Another facet to urban consumption trends is a perceptual component. Standards of material wealth and consumerism are a major driver in increasing per capita consumption and a primary attraction for hopeful rural migrants (Rees 1996). Resource consumption per capita tends to increases regardless of geographic location, a particular similarity among cities globally. Consumption per capita is increasing faster than population growth (Rees 2014).

As cities become conduits of wealth, materials, and increased social interactions, the average urban dweller's connection to the origin of their resources as well as their interaction with their local ecosystems diminish. There is extensive literature on reducing the inefficiencies and adverse impacts of urban infrastructure on the immediate environment, and the significance of environmentalism in curtailing consumption (Newton 2011). Still, there is little discussion on the significance of the urban landscape, public perspectives, and ecological knowledge as integrated forces in understanding and addressing urban resource consumption trends and resulting environmental impacts.

Portland, Oregon is known for its "green" initiatives including encouraging public transit and active transport, river clean-ups, recycling and composting, and green roof installations (Corporate Knights 2012), yet it is uncertain how these changes affect Portlanders' relationship with their local environment. This research wants to shed light on this key relationship by tapping into policies, discourses, and lived experience of residents in one of America's greenest cities.

Human-Nature Relationship: An Integrative Lens

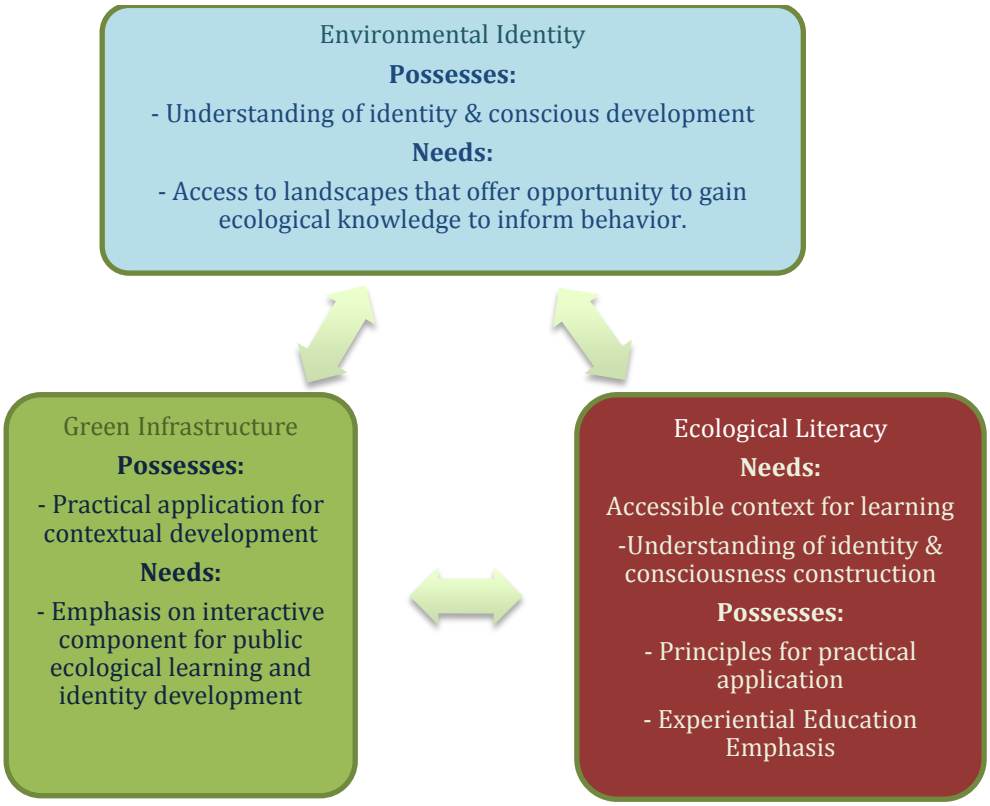

Figure 1 Interconnection of Human-Nature Relationship Subjects. This flowchart illustrates the interconnectedness between the three areas conducive of an urban human-nature relationship. Environmental consciousness, ecological literacy, and green infrastructure all have aspects that strengthen each other

Environmental Identity

How urban dwellers relate and engage with natural resources is in part a consequence of their environmental identity. Environmental identity refers to the degree to which we find similarity with and value nature (Clayton et al. 2003). One's environmental identity is largely dependent on the access to natural landscapes, moral inclusion of non-human natural entities, and social reinforcement, a process that begins during one's childhood. Incorporation of nature into our moral community instigates awareness of one's behavioral obligations (Clayton et. al 2003). This feeling of

connectedness is shown to increase with one's activity within natural settings (Vining et al 2008).

An environmental identity is attributed to an understanding of interconnectedness with the natural environment, which requires personal value or moral relevance (Clayton et al. 2003). Urban environments pose a challenge in obtaining experiences that lead to this level of understanding. It is difficult for urban dwellers to truly experience the impacts of one's actions on the environment. Even though it may be clear that a particular action has a negative impact, the environmental response is not personally accessible. In a recent study of Houston children, two out of three were able to show a general understanding of environmental problems, yet only one third of these children believed these issues directly affected them (Kahn 1997). Access to the environment and the ability to tangibly interact with non-human natural entities allows for cause and effect experiences that are essential in formulating an understanding of personal relevance (Clayton et al. 2003) (Figure 1).

Ecological Literacy

For environmental identity to emerge, one must not only have access to natural spaces, but also become educated of the ways in which the ecosystems function and in turn relate directly to the individual. What ecological learning opportunities does the urban landscape offer? The urban landscape has its own ecological processes, which a variety of human and non-human creatures must adapt to. However, the urban landscape is drastically different from the native ecosystems of the edge. By and large, this discontinuity of the urban landscape holds a very different picture for the urbanite about their local ecosystems. Urban ecological adversity presents itself in unique

forms, like heat-island effect (Niemela 2011), biodiversity loss (Turner 2004), and disturbance of ecosystem processes. The discontinuity of the urban landscape creates a gap in the urban dweller's knowledge of local ecosystems, making them fundamentally unable to engage with it.

Cityscapes are largely human-manicured mosaics of both native and exotic species, with limited access to observe and engage with native the flora, fauna, and ecological processes. Furthermore, the urban landscape hides otherwise natural systems from public view and interaction. Water distribution is pushed underground, only to appear magically out of faucets. Natural resources can be easily purchased in supermarkets, yet little is known of their original source of extraction. Waste is also transported away from the place of consumption, usually out of the general public's sight. This prevents the recycling of nutrients back into their source of origin (Rees 1996), but also severely limits the opportunity to learn about these relationships and about one's impact on these systems.

This severed connection between the average urbanite and the natural environment is cause for great concern in terms of ecological illiteracy, and a potential source of greater issues, as knowledge of local ecosystems is the catalyst to a type of worldview necessary for all to embrace more sustainable behavior and thus begin to solve global environmental problems (Capra 2006). David Orr, first coined the term *ecological literacy*, to bring attention to the difference between a "resident" and an "inhabitant". A resident is indifferent to locality except for the ability to gratify him or her, but an inhabitant bears "marks of their place", a sense of ownership and sense of

concern for one's community (Orr 1992). Five fundamental principles are outlined in Fritjof Capra's (2014) guidelines for achieving stronger ecological literacy.

1. Networks: All things are interconnected through networks
2. Nested Systems: Nested Systems: Layered units that are within themselves complex, and outside of themselves connected to a larger unit.
3. Cycles: Exchange of resources in continual cycles
4. Development: Ecosystem relationships are constantly changing, and require creativity and co-evolution.
5. Disturbance: Ecosystems undergo persistent disturbance and resulting self-organization.

A sixth unifying principle, not included explicitly in the list, is referred to as "legitimate behavior", informed by the preceding principles, with the purpose of maintaining the ability of ecosystems to be conducive of life (Capra 2014). While ecological literacy can provide the educational guidelines for practical application as an educational tool, it also requires accessible context for experience-based learning (Figure 1). Urban landscapes pose a great challenge in offering this necessary context for inciting public ecological literacy, but cities around the world are taking steps toward the integration of ecological processes into their built environment through green infrastructure, which in turn is essential to ecological literacy.

Green Infrastructure

Green infrastructure is the rethinking of parks, street trees, and rivers as valuable ecosystem resources. It allows for the re-conceptualization of the urban landscape as a functioning ecosystem that can conserve natural environments while also benefiting

people economically and culturally. The main purpose of green infrastructure is to take a proactive approach by promoting "more efficient and sustainable land-use and development patterns" (Benedict 2006 p.30) that are multifunctional in their benefits to people and native environments. Some examples of green infrastructure include habitat corridors, connected park systems, green roofs, pervious street surfaces, street-side water filtration swales, and urban food forests. This is in opposition to what is termed as "gray infrastructure", which consists of underground sewer systems, impervious pavement, etc. (Benedict 2006).

Green infrastructure principles include interconnecting ecological systems and habitats, collaborating across scales of jurisdiction, designing to reveal the connection of ecosystem services with human benefit, collaborating across sectors for consensus and understanding of green infrastructure, and multifunction of spaces to provide for economic, human, and ecological benefit. Through the incorporation of green infrastructure into the urban matrix, urban landscapes become settings and building blocks for ecological learning. Yet, it is not only about the open space itself. In order to be successful, green infrastructure initiatives are dependent on an ecologically literate population that can read the information embedded in the landscape and behave accordingly (Figure 1).

The following case study shows how these themes play out in the context of Portland, Oregon one of the world's greenest cities. This case study attempts to reveal how the city, despite its initiatives to reduce impacts of resource consumption, is insufficiently addressing the impact of hidden ecological systems on its public's relationship with the environment.

The City of Portland's Human-Nature Relationship, A Case Study

The city of Portland, Oregon provides an important case study of the significance of incorporating nature into the urban fabric. It is also a place where one would expect to find ecological literacy, given the reputation of Oregon as a mecca for lovers of nature. Portland has earned a nationally acclaimed title at one of the "greenest cities" based on categories including smart growth activities, land-use planning, transportation planning, pollution prevention, energy/resource efficiency, sustainable indicators, and governance (Corporate Knights 2012). Among the reasons for Portland's success is its multi-modal and integrated public transit system, free downtown public transit, a bike-share and car-sharing program, and citywide goals to reduce vehicle miles traveled (Corporate Knights 2012). In a TED talk, "The Walkable City" (an argument for sustainable urban design), Jeff Speck elaborates on Portland's initiatives aimed at incentivizing non-motorized transportation throughout the city, which have led to Portlanders driving 20% less than the rest of the country (Speck 2013).

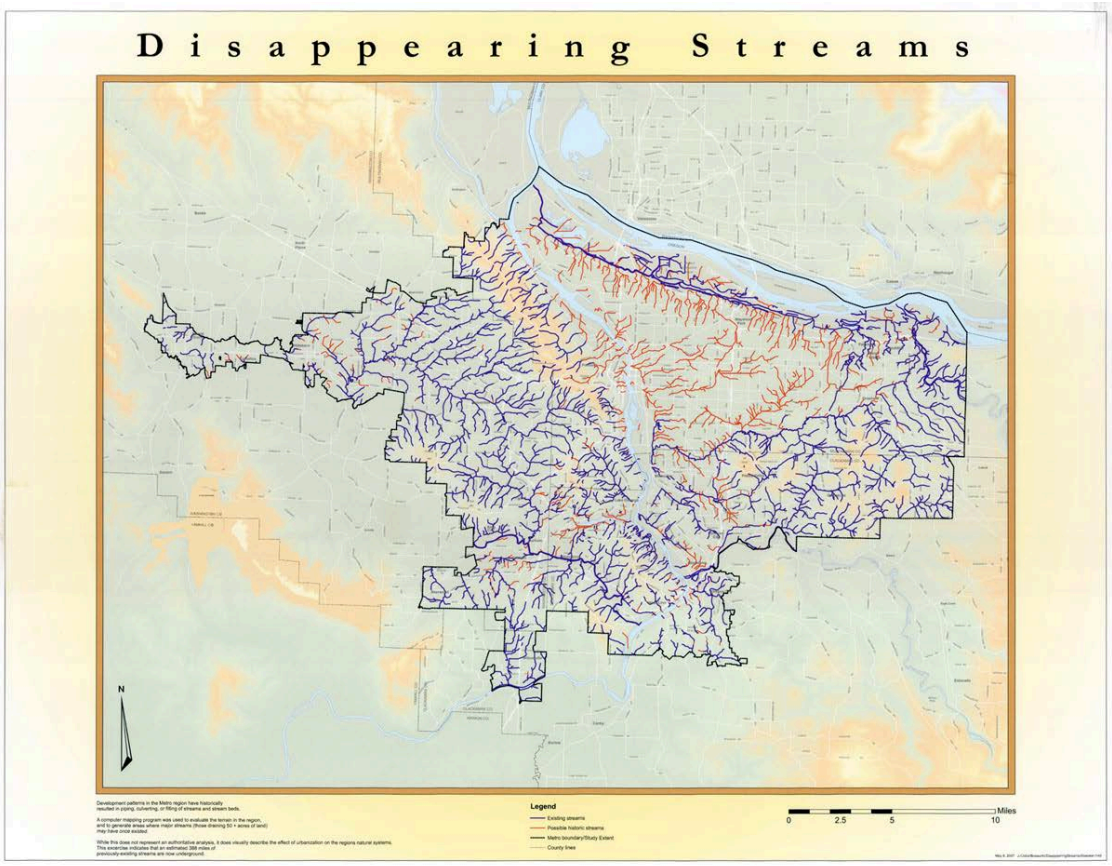

Figure 2 Portland's Hidden Streams - This map of Portland provides a visual representation of the streams that were buried (in red) in the construction of Portland, OR over the course of its history (King 2014).

However, Portland's green title does not include the ability of its citizenry to discover personal dependency on their ecosystem and have access to ecosystem knowledge within the urban matrix. Many systems that would occur naturally in the peripheral ecosystem are hidden within the urban landscape. Water systems in Portland are predominately hidden beneath streets and sidewalks (Figure 2). Throughout the city there are 2,000 miles of pipes delivering water from point to point. Many of these pipes were laid out to bury historic streams and serve traffic and pedestrian circulation over ecological continuity. Over the course of 150 years, Portland has culverted, piped, and filled roughly 388 streams (King 2014). Portland's potable water source is the Bull Run

Watershed, located 28 miles from the Portland Water Bureau office in Northwest Portland, and thus inaccessible and inconsequential to most residents of Portland.

The city's food system also illustrates a striking distance between people and the processes and places where the source of their food is produced. Roughly 90% of the food produced in the region is exported. While Portland residents purchase $4.5 billion worth of food annually, $4.3 billion is sourced outside of the Portland region (Cogan Owens Cogan 2014). So not only are people within Portland less likely to be aware of the conditions that farmers within the region are facing, but most Portlanders don't have personal relevancy with locally produced foods. Moreover, traditional native food crops such as camas (*Camassia quamash)*, tarweed (*Heliantheae madiinae*), and salal (*Gultheria shallon)*, are also not integrated into the local diet. Not only is dependency on local flora and fauna not a significant part of daily urban life, access to native flora and fauna within the city is limited in diversity. This also adds to the loss of opportunity to build a sense of interdependency and value for one's native environment, essential aspects in building a strong environmental identity backed by ecological literacy.

Access to natural spaces is essential to developing environmental identities, especially for children. Parks and open spaces do abound in Portland, with 76% percent of Portlander's living within a half-mile walking distance (Figure 2). By 2035, Portland hopes to ensure all its citizens are within a half-mile walking distance (PBS 2012). While access is important, it is unclear how these spaces reveal ecological lessons to Portlanders and are conducive of developing a sense interdependency and resulting conservationist behavior.

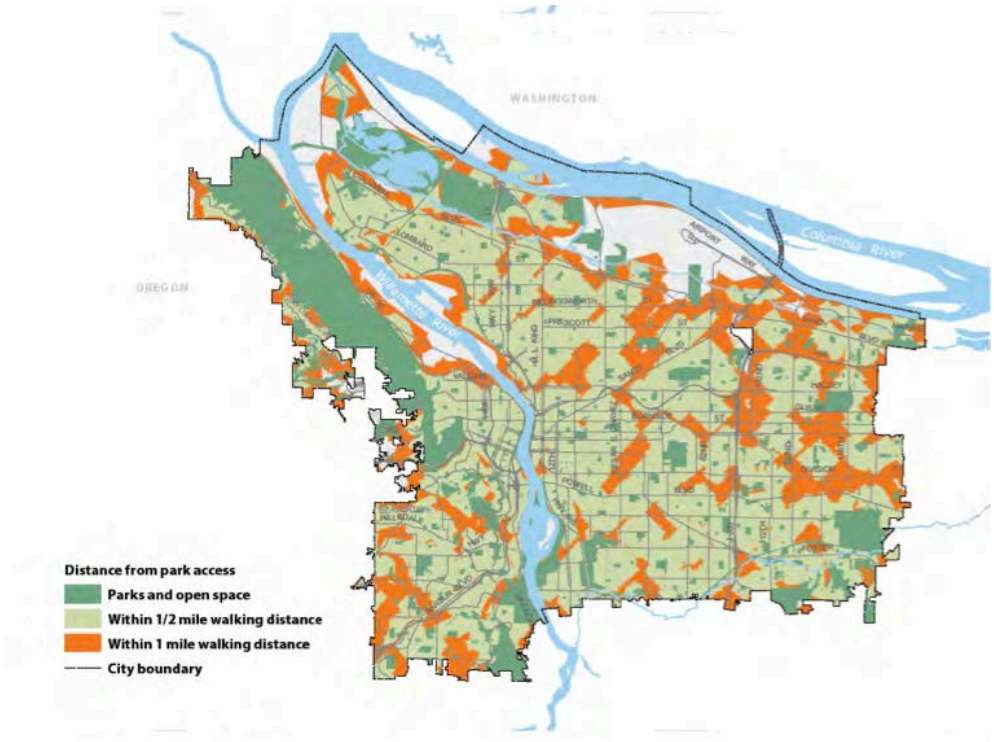

Figure 3 Portland's Accessible Parks and Open Spaces. This map of Portland displays the range of accessibility to parks and open space (in dark green) within a half-mile (in light green) to a mile (in orange) walking distance (PBS 2012).

While Portland has made some great accomplishments and promises towards transforming the city into a sustainable one, there is little evidence of addressing the distance created between people and their ability to build a self-relevant relationship with nature within the urban landscape. It is uncertain whether Portland's green infrastructure acknowledges how environmental identities develop and are maintained. This study is intended to look at where the gaps are between the City of Portland's public policy and the people's relationship with nature in terms of integrating environmental identity, ecological literacy, and green infrastructure. The strengths and gaps that emerge, will present opportunities for encouragement as well as change that will aid Portland and its citizens to develop a more sustainable relationship with the environment.

Methodology: A Triangulation Approach for a Comparative Perspective

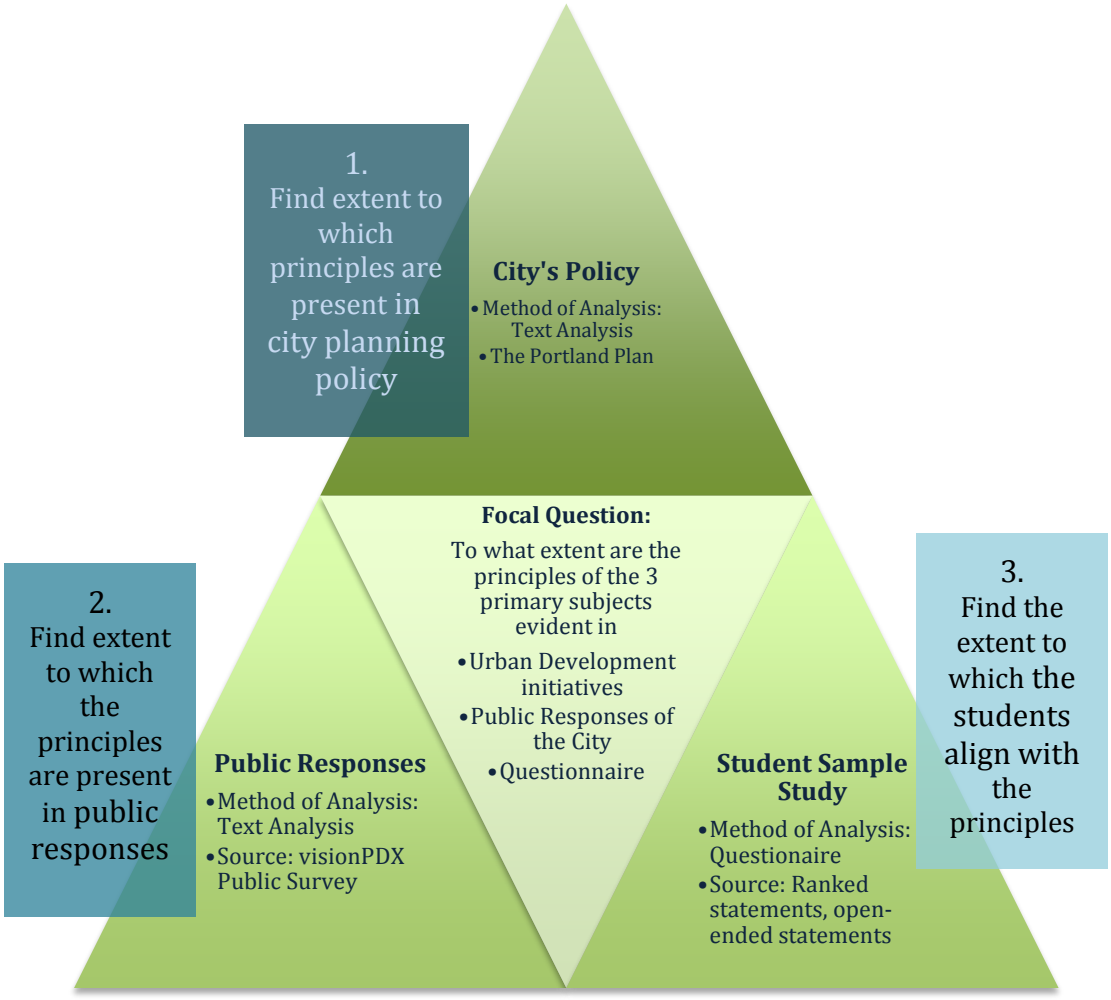

Figure 4 Triangulation of Methods - This diagram displays the triangulation of techniques in addressing the thesis question and their corresponding purpose.

In order to address the research question, this study employed a triangulation of techniques. The first step in the Methodology consisted of a discourse analysis of citywide policies. The goal was to assess the extent to which the principles of environmental identity (EI), ecological literacy (EL), and green infrastructure (GI) were present in urban planning and development efforts (refer to Table 1). I examined the

2012 Portland Plan, the City of Portland's a comprehensive plan elaborating on current conditions, goals, implementation initiatives, and indicators of success for creating a prosperous, educated, healthy, and equitable city (Portland Bureau of Sustainability 2012). This point of analysis covers city-planning policy and gives a basis for discovering the degree of connection between policy and the general public's awareness of them. To collect quantitative data from The Portland Plan, I recorded the number of times environmental identity, ecological literacy, and green infrastructure appeared in the entire document, but on individual pages, principles were not recorded more than once. Quotes that illustrated these general themes were recorded and used as qualitative data.

The second method compared the extent to which the primary subjects, environmental identity, ecological literacy, and green infrastructure were apparent in people's discussion about their city and its future. I collected both quantitative and qualitative data from the 2006 visionPDX public survey, which was referenced in the construction of the Portland Plan (BPS 2008). The survey responses were accessed through the City of Portland's Archives. In reviewing the survey responses, I recorded whether or not the principles of EI, EL, and GI were apparent in Portlanders' discussion of their city through their survey responses. Meanwhile, I recorded quotes that well represented the subject principles. To ensure a random selection, I chose every third survey that was available (collecting a total of 48 surveys), but may have failed to truly represent the diversity of perspectives that a stratified sample would have provided.

In the last method, I conducted a sample study through a brief online questionnaire administered to students of the Clark Honors College (CHC) at the

University of Oregon who were citizens of Portland. The questionnaire collected responses from a total of 54 participants. These students offered the perspective of a group of highly educated people who have grown up as children in the city. This provided a more direct perspective on how the principles of environmental identity, ecological literacy, and green infrastructure resonate in the daily lives of Portlanders'. The questionnaire consisted of Likert-scale statements that participants ranked in terms of agreement and disagreement on a scale from 1 to 5, with 1 indicating strong disagreement and 5 indicating strong agreement (Table 2 in Appendix B). The questionnaire also included open-ended questions to gain a more nuanced understanding of the participant's level of awareness and identification with urban nature and discourses of ecological integrity (Appendix C), followed by a few demographic questions.

The responses from the 2006 visionPDX public survey and statements in the Portland Plan were codified based on the principles and indicators discussed (Table 1 in Appendix A) to highlight the presence of EI, EL, and GI. The statements used for the student sample Likert-scale were also constructed based on the principles and indicators (Table 1 in Appendix A). The results should not only reveal the extent to which the three primary subjects are present, but also present differences between city policy and public responses. Suggestions for improvement in the integration of the EI, EL and GI based on the gaps highlighted are provided in the discussion section.

Results: Strengths and Weaknesses in Portland's Human-Nature Relationship Development

Overall Methods Comparison

Environmental identity (EI) was the most represented subject in the 2006 visionPDX public survey responses and the 2012 Portland Plan. Collectivism and access to natural spaces were the most cited principles of environmental identity to appear in the above-mentioned documents. Out of the 48 responses examined from the public survey, 72% made mention of an EI principle, in comparison to only 48% of the Portland Plan (Figure 5 and 6). EI principles also appeared to be agreed upon by a large percentage of the students' surveyed, yet it did not score as high as ecological literacy (Figure 5).

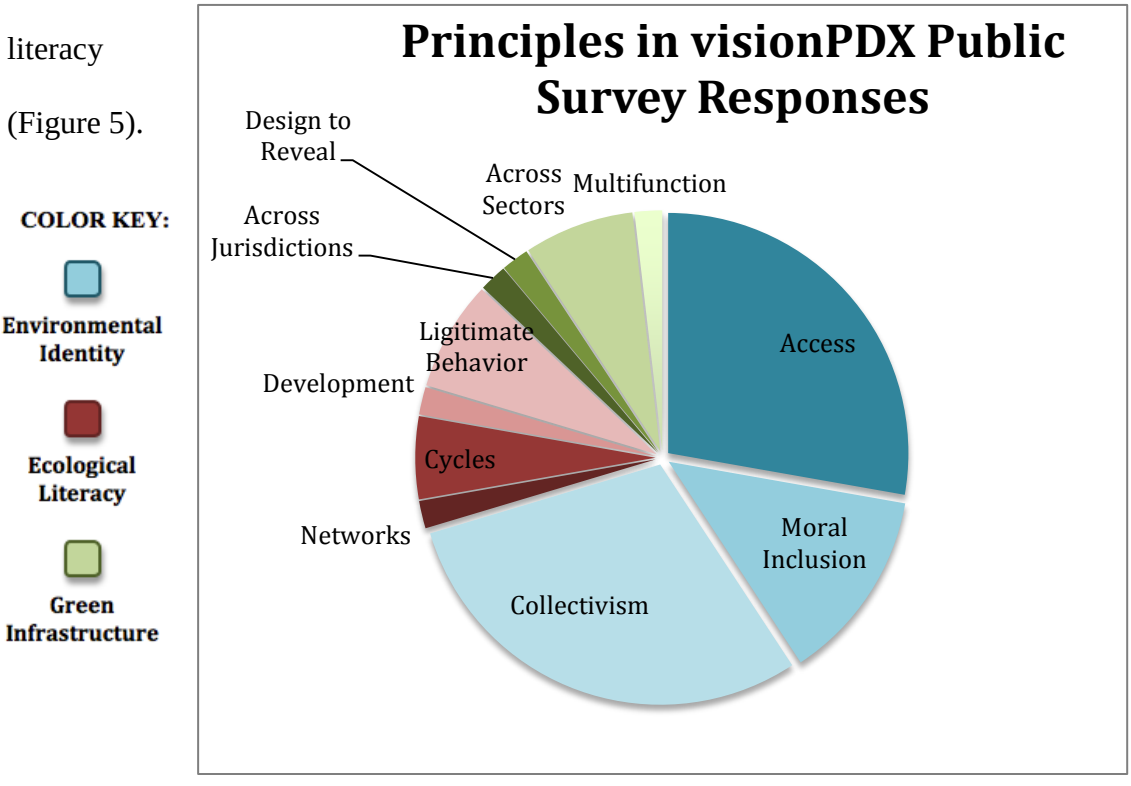

Figure 5 Percent Presence of Principles in visionPDX Public Survey - percentage of the principles' appearance in the visionPDX public survey responses. N=48

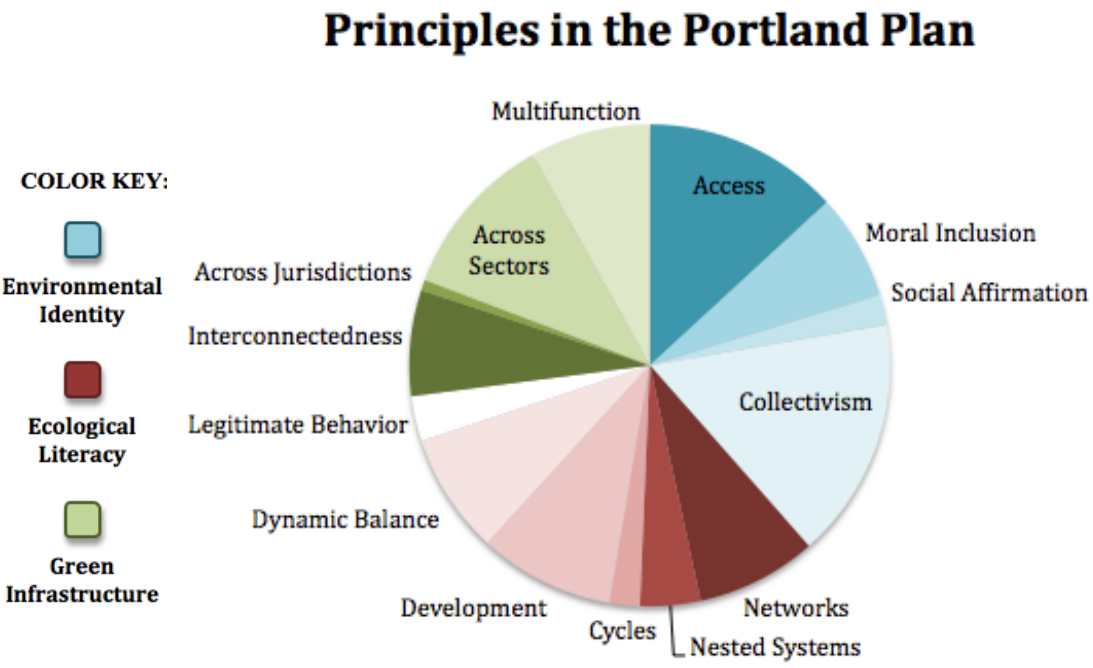

Figure 6 Percentage of Principles in Portland Plan - percentage of the principles' presented in the 2012 Portland Plan. N = 144

A major gap shared among all methods was the low level of awareness or mention of green infrastructure-related principles. Students in the CHC displayed a high level of ecologically literacy, yet their responses illustrate a more limited awareness of green infrastructure (GI). Portland's city policy and the public responses to the VisionPDX survey also showed low levels of awareness of GI, but low levels of ecological literacy (EL) as well (Figure 5 and Figure 6). On the contrary, in the sample study, participant's agreement with EL and EI are closest in average (Figure 9). The sample study shows overall agreement with the three subjects' principles, but a general variability as shown by the high standard deviation (Figure 9 and Appendix B).

Environmental Relationship: A Comparison Between Subjects

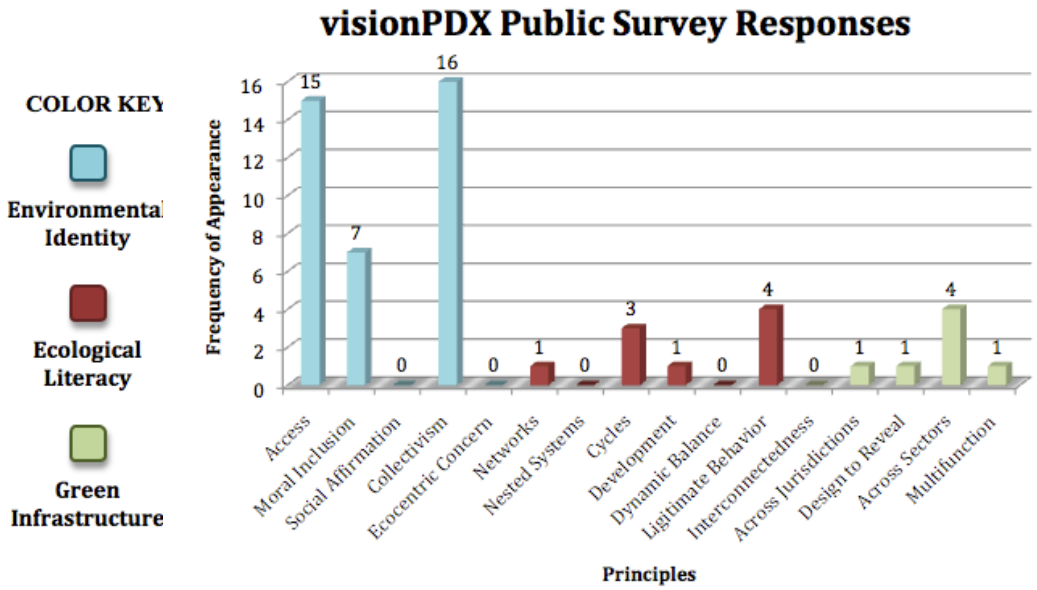

Figure 7 visionPDX Public Survey Responses - presence of principles in the responses from the 2006 visionPDX public survey. Total average = 3.4, EI total average = 7.6, EL total average = 1.5, GI total average = 1.4, N = 48

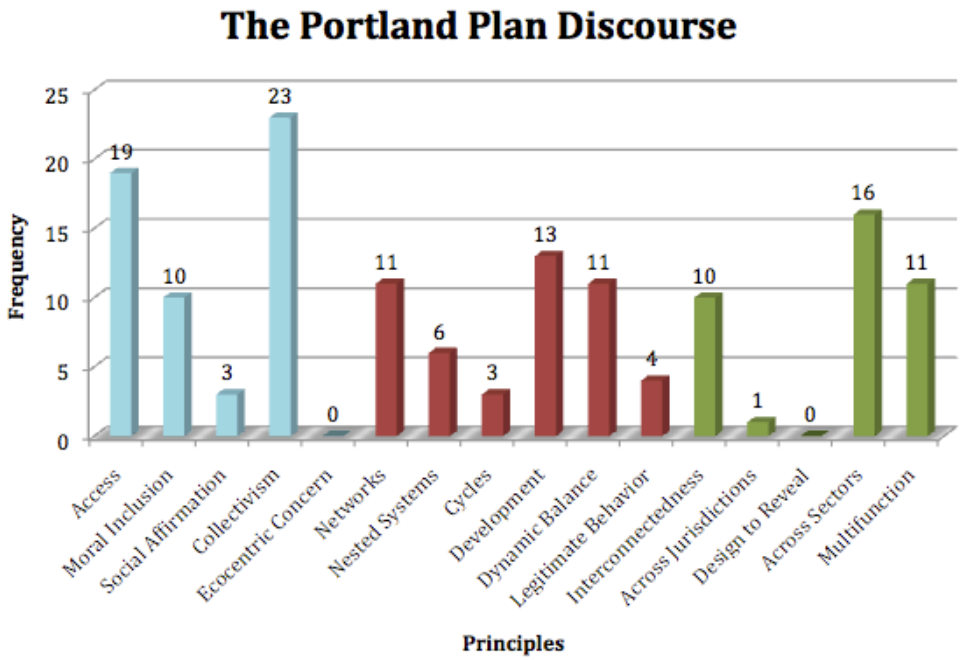

Figure 8 Presence of Principles in the Portland Plan - frequency of the principles' present in the 2012 Portland Plan document. Total average = 8.8, EI total average = 11, EL total average = 8, GI total average = 7.6. N = 144

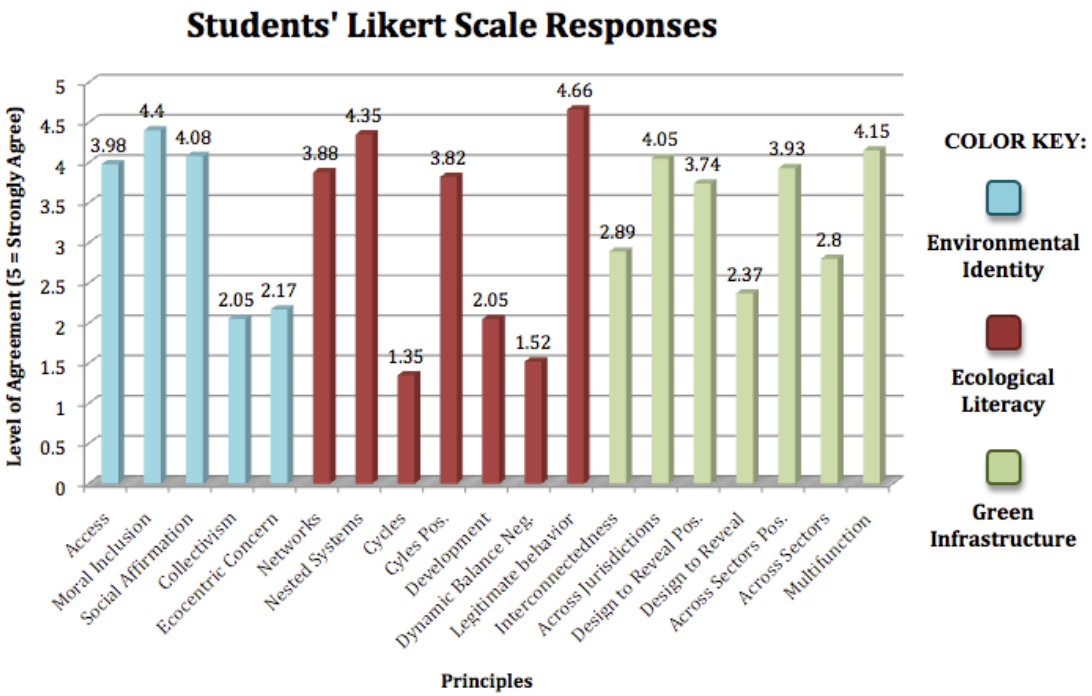

Figure 9 Sample Study Likert Scale – Value of agreement and disagreement with a particular principle. Total average = 3.62, EI total average = 3.65, EL total average = 3.97, GI total average = 3.26. N = 54

Environmental Identity

There were particular principles of environmental identity that were well represented. Collectivism was frequently referenced in both the visionPDX public survey, and the Portland Plan (Figure 7 and Figure 8). In the public survey, this theme was manifested in the mentions of concern for equitability, and social justice, which were also emphasized in The Portland Plan. In the students survey, agreement on *collectivism* and *ecocentrism* was low even though the statement was more social centric as in the Portland Plan and the public survey responses. Other EI principles in the student survey such as *moral inclusiveness*, *social affirmation*, and *access* appeared frequently in their responses, evidence of a strong environmental identity (Figure 5). The Portland Plan and the public survey showed very low values of *social affirmation* and *ecocentric concern*.

In comparison to other EI principles, *ecocentric concern* was consistently de-emphasized in both the analysis of the city's policy and the responses from the visionPDX survey. Ecocentric concern also ranked fairly low in the students' survey responses (with an average value of 2.17 out of 5) (Appendix B, Table 3).

Ecological Literacy

In both the student and visionPDX survey *legitimate behavior* received the highest value among all of the EL principles. In the students' sample, this principle received the highest value (4.66), and lowest in standard deviation (0.73) (Appendix B, Table 4). In contrast, the principle with the highest value in the Portland Plan was *development*, followed by *dynamic balance* and *networks* (Figure 8). The students' sample did better than the public survey responses in showing an understanding of other EL principles such as *nested systems*, which received the second highest value of the EL principles (Figure 9 and Figure 7). A point of similarity between all methods was that the EL principle with the lowest comparative value was *cycles.*

Green Infrastructure

In comparison to the other GI principles, the three methods yielded high values for *collaboration across sectors.* Among CHC students, the highest-valued GI principle was *multifunction* (refer to Figure 9). Likewise, the city plan showed a number of references to the principles of *multifunction* and *interconnectedness* (Figure 8). On a point of similarity, all methods yielded consistently low values with regard to the principle known as *design to reveal* compared to other subjects and GI principles.

Synergies and Discrepancies Between Portland and its Citizens' Human-Nature Relationship

visionPDX Public Survey: Consciousness without Context

Overall, the responses gathered from the visionPDX survey of the general Portland population showed high values of environmental identity, particularly in terms of the *collectivism*, *access* nature, and *moral inclusion* principles. According to Susan Clayton and Susan Opotow (2003), *moral inclusion* is likely to be bolstered by *access*, in which the opportunity to find self-relevance will more likely make natural entities more valuable to an individual. Yet, whereas the literature suggests that low levels of *ecocentric concern* may be associated with a low value of *moral inclusion* (Clayton et al. 2003), data from this study showed an inverse relationship, in which *ecocentric concern* is ranked very low, yet *moral inclusion* was comparatively high. This suggests that there is a missing element in the public's environmental identity development. The public's sense of interdependency was insufficiently concerned with the environment (most responses were socially centric in this regard). In the process of developing an environmental identity that is conducive of environmental conservation behavior, it is essential that an individual understands how they are directly dependent on their ecosystem to live out their daily lives (Clayton et al 2003). As such, the public missing a sense of interdependency is also evident in low values for both *ecocentric concern* and *legitimate behavior* (Figure 7). Portlanders in this sample show concern for their natural environment, but don't know the specifics of their ecosystem and why it is important to them.

Fritjof Capra describes ecological literacy principles as indivisible threads leading to *legitimate behavior* (Capra 2010). Although, EL principle *legitimate behavior* was above the total average (3.4), the overall percentage was very low (8%) (Figure 7). In comparison to the other EL principles, the public had a higher value for *legitimate behavior*. This shows that while the public had some understanding of conservation behavior, when it came to the specifics of ecological knowledge, the public was largely illiterate. This puts into question whether or not the public is even able to act on their understanding of *legitimate behavior*.

In addition, the absence of the GI principle *design to reveal*, which is key in developing environmental identity and ecological literacy within the urban landscape, corresponds with the deficiency of both ecological knowledge and the sense of ecocentric interdependency. Likewise, the literature also fails to draw link between green infrastructure, ecological literacy and the development of an environmental identity. The principle *design to reveal* is intended to encourage awareness for further support of GI (Benedict et al. 2006), but the literature also falls short of utilizing green infrastructure to encourage ecological literacy. For the urban matrix to be devoid of a landscape through which the public can interact with and develop an understanding of key ecological functions, is to have a citizenry that is personally unattached and unable to make well-informed decisions that invest in the robustness of their ecosystem.

The Portland Plan: An Eco-consciousness without Public Ecoliteracy

Similar to the public survey responses, the Portland Plan also showed high value placed on *access* and *moral inclusion*, but also showed little evidence of the *ecocentric concern* principle. According to the literature, *moral inclusion* should be a

primary factor in the development of *ecocentric concern* (Clayton et al. 2003). Along similar lines, *legitimate behavior* ranked low in both city policies and the public survey, yet *collectivism* was the highest valued principle in the Portland Plan. Underlining *collectivism* should be the understanding of the interdependence between society and natural systems (Clayton et al. 2006), which should also inform conservationist behavior (*legitimate behavior)* (Capra 2010). In other words, the city's policy does incorporate nature into its moral obligations, understanding the importance of interdependencies. Yet the city's environmental identity fell short of outlining explicitly what it was to behave in an acceptable conservationist manner in relation to the environment. That there was this discrepancy also with in the public's responses indicates that the City of Portland has not included among their priorities to invest in ecological education to empower its citizenry to make ecologically minded decisions in their daily lives.

The avenue through which Portland could provide ecological education is also missing. City plans showed little evidence of the GI *design to reveal* principle, which should in reality constitute an important connection between green infrastructure and environmental identity development. Moreover, absence of the principle, *design to reveal,* illustrated a strong disconnect between context and ecological learning, specifically in building the public's sense of self-relevancy.

CHC Student Survey: Identity without Action

Several discrepancies became apparent through the analysis of the survey likert-scale and open-ended questions. Particularly evident was a missing connection between extending moral value to the environment and a sense of self-relevancy with the

environment. To explain in detail, *moral inclusion* was highly valued, yet both *ecocentric concern* (a factor of *moral inclusion*) and *collectivism* (the understanding of interdependency through self-relevancy) were ranked below average (Figure 9). Environmental identity development is dependent on the extent to which an individual includes nature into their community of moral obligations, yet without a sense of interdependency an individual is not likely to have stake in being actively involved in environmental conservation (Clayton et al. 2003). Since the sample study showed a high value for *social affirmation*, which should support the development and maintenance of *ecocentric concern* (Clayton et al. 2003), this indicates that there is some other factor that is hindering the development of *ecocentrism* and *collectivism* and the resulting behavioral attributes.

Despite the high value placed on the principle of *access*, the context (*design to reveal*) through which to make EL principles both evident and self-relevant, received inconsistent values. Although the student survey showed high levels of environmental literacy, they lacked specific understanding of ecological principles (i.e. *cycles*, *development*, and *dynamic balance)*, which the literature shows to support ecologically minded behavior. Thus, while the students may believe conservationist behavior is good, they don't know the specifics of ecological principles that would constitute legitimate behavior. Both the low understanding of specific EL principles in the students' responses and the absent mention of an educational context in the city's policies illustrates insufficient opportunity through which the students (or general public) could develop both specific ecological knowledge and a sense of interdependency that would encourage conservationist behavior.

Discussion: Implication of Gaps for a Sustainable City

Thesis Questions:

1. To what extent are principles and indicators of environmental identity, ecological literacy, and green infrastructure present in urban development initiatives and public discourse of the city in which they live?

2. How are the three subjects comparatively present in urban development initiatives and public discourse?

visionPDX Survey: Portlanders' Abstract Environmental Consciousness

An Abstracted Environmental Identity

The sample collected from the public survey indicates that Portlanders have a moderate environmental identity, yet it also shows that this identity is superficial. The public's articulation about their city and the issues that concerned them were mainly devoid of ecological issues that impacted their lives directly. Comments relating to *collectivism* involved improving "communication between various groups, with citizens being heard", or in brief, "People working together!" While this does illustrate an understanding of interdependency, there was no explicit mention of interdependency in relation to the environment. Statements such as "maintain the environmental wellness of our city" or "clean up the river" that did show moral obligation to their environment, but did not elaborate further on why "environmental wellness" was personally concerning, or in what ways the health of the environment could be improved. Overall statements did reveal an appreciation for natural-like spaces, for example, "our beautiful rose garden and the little parks". Yet this appreciation was centered on the beauty of these spaces without recognizing the environmental impacts of these resource-intensive,

largely non-native spaces. Statements were generally brief and did not elaborate on how natural landscapes had human and ecological relevance to the individual besides their aesthetic beauty. Although this could be a reflection of the lack of specificity in the questions asked in the Vision PDX public survey, the explicit lack of ecocentric concerns is troubling when it comes to forming priorities and making daily decisions. When it comes to building a sustainable city, it is imperative that its citizens are recognized as having agency in their own ecosystems (no matter within the urban landscape or not). A sustainable city must include a public that is also ecologically literate and personally concerned with the robustness of the ecosystem in which they live. It is essential that the public's daily decisions be based on a foundational knowledge of ecosystem functions and services that enable citizens to provide educated support, as well as constructive criticism, on the city's sustainability initiatives. In order to foster an ecologically savvy public dedicated making decisions that maintain the robustness of their ecosystem, the city must provide a landscape that is conducive of environmental identity and ecological literacy.

Lack of Subject Integration

When Portlanders talk about their city, they show a low level of awareness of green infrastructure initiatives and ecological principles, suggesting either a deliberate disregard for these topics in their city's perceptions, or a generalized lack of awareness. Perhaps the vision PDX survey questions were too broad to get detailed responses about the public's values and understandings of local ecosystem's services, and educational and interactive contexts in the city. Even so, the Portlanders who participated in the public survey did have the opportunity, to mention what mattered most to them, and

green infrastructure and ecological education was largely absent from their responses. The lack of specific ecological knowledge, and absence of, or at least the unawareness of the urban landscape offering the context for ecological knowledge correlates with the missing pieces in the Portland Plan.

The Portland Plan: The City's Missing Public Ecological Education

The Plan's Link from Literacy to Action

Within City policy, moral inclusion is more elaborately stated than in the Vision PDX public survey. Despite the scarcity of explicit examples of *legitimate behavior*, as a whole, the plan shows a high degree of concern for environmental health as an essential element in ensuring sustainable futures. This is exemplified in the plans' references to watershed planning initiatives:

> "To create a healthy connected city, we must consider the potential impacts of our decisions on the health, safety and welfare of Portland's residents and on our city's watersheds and the natural environment"

The statement draws a clear link between *moral inclusion*, *collectivism* (in terms of interdependency) and informing behavior. Unlike the public survey, the city's public policy displays a better understanding of ecological principles, has a focused moral inclusion (i.e. watersheds, trees, and salmon), and acts on this knowledge to improve environmental health. For example, the plan included efforts to mitigate the Portland Harbor Superfund site and increased investment in green infrastructure.

On a contrary note, both the Portland Plan and the vision PDX survey share a similar emphasis on social issues. While the Portland Plan is primarily concerned with social interdependencies, it also recognizes the interdependencies between human and ecological health. The plan recognizes the significance of interconnecting people,

habitat, and water systems to the overall goal of achieving a healthier city, albeit at the scale of the watershed. The plan also illustrated an understanding of ecosystem disturbances and change (i.e. Climate Action Plan) and how the city might become resilient in the face of change (i.e. *development* and *dynamic balance*).

Lack in Providing Public Ecological Education

In comparison to the public survey, the city's public discourse displays a stronger ecological literacy, yet this does not manifest into a fully developed environmental identity or an understanding of how green infrastructure may provide an educational service. Because of its comprehensiveness, the Portland Plan falls short of providing the necessary detailed information about whether or not its programs are closing the gap between the urban landscape and the public's ecological illiteracy. Despite the missing details, the plan still presents a lack of priority in the city's function through revealing and interactive design that encourages ecoliteracy. Incorporating public ecological education into the urban landscape requires conceptualizing green infrastructure as the vital source for fostering the public's sense of interdependency with their natural environment via direct engagement.

The closest thing to public contextual education in the plan is the stated encouragement of community environmental stewardship groups. One such program is the Intertwine Alliance, launched in 2011, the alliance is a coalition of public, private, and non-profit organizations that acquire natural areas, conduct restoration projects, create and complete trail networks, and encourage public access to these spaces. The public can be involved through independent outdoor activities (i.e. fishing) or through the several grassroots groups are also a part of the Intertwine Alliance (i.e. tree planting

or native habitat restoration). The intertwine alliance also emphasizes the importance of green infrastructure for ecosystem services. Even in this case, it is unclear how or if specific information on ecosystem services are made accessible to the public through revealing design or interaction. In addition, it is not clear how the community groups interact with the environment, and whether or not ecological principles are involved. Contextual education through green infrastructure initiatives is also absent in the plan, though this may be provided in more elaborate GI-focused documents (i.e. Portland's 2014 Stormwater Management Manual). Whatever the case, it is evident in the public's responses that there is a clear disconnect between the city's public discourse and the public's detailed ecological knowledge and personal sense of interdependency.

The Ecoliteracy Gap

The city's public discourse shows awareness of how the City's health and resilience cannot be separated from the health of localized ecosystems (as illustrated by the Plan's commitment to expand support for green infrastructure). A major discrepancy is the lack of concern for public ecological education in the form of both programs and the urban landscape itself, which are reflected in the residents' lack of ecological literacy, limited green infrastructure knowledge, and abstracted environmental identities. Falling short of initiatives to bolster environmental identity development (specifically self-relevancy) and ecoliteracy through urban design, the city is likely to perpetuate the perceptual separation between the human and the natural environment, glossing over the issue of hidden systems and ecologically uninformed behavior.

CHC Students Survey: A City without Ecosystem Services and a Citizenry without Action

Abstract Ecological Literacy and Environmental Identity

Similar to the public survey, the students' survey reveals an abstract understanding of ecological principles and limited environmental identity. While their understanding of ecological principles is high when compared to their fellow Portlanders, the students' understanding of specific principles is limited. Despite this, students show a strong support of conservationist behavior, supported by a similarly strong environmental identity that is maintained by social standards (i.e. *social affirmation*). The contrast between their affinity for nature and their understanding of ecological processes was emphasized by their weak values for interdependency and ecocentric concerns. This seems to suggest that without specific knowledge of ecosystem functions and services, it is difficult for one to build a sense of self-relevancy or interdependence with their natural environment. Even though an individual may widely incorporate nature within their sense of moral obligation, this is not enough to guarantee environmental behavior (even though they state support for it). Interdependency removes the individual from a position of central significance and enlightens their behavioral obligations (Clayton et al. 2003). In this regard, the students' responses reveal abstracted environmental identities and ecological literacy, in which the point of fulfillment would be a sense of interdependency through an understanding of ecological functions and services. As previously discussed, Portlanders revealed a similar relationship with their environment, even without the direct questions provided in the student questionnaire. Future studies providing direct

questions about Portlander's would serve well to examine whether or not these discrepancies, as revealed in this study, are maintained.

Perceptive Separation of Urban and Ecological Functions

When students were asked when they felt most connected to the environment, most provided examples that were absent of any urban or human influence. There were gradients of this feeling, but this quote is telling:

> "When I took a hike in the middle of the city. What I love about Portland is that it is so green. Granted downtown has a ton of buildings and concrete but there are a large amount of parks and hiking trails in the middle of the city."

As in this quote, responses about one's environmental connection were mostly based on recreation or relaxation in natural areas without mention of interdependency due to the ecological services it may provide. However, it is unclear whether urban spaces were perceived as a place of interdependency, as opposed to natural areas. Future studies could further enlighten this urban versus nature relationship in terms of perceptions of places of dependency. Even so, the student sample articulated the urban landscape as having boundaries between what could provide an environmental experience and what was considered urban. The city itself was not considered as having its own ecological systems or providing ecological services. When asked specifically about examples of green infrastructure in Portland, nearly all participants couldn't explain the personal relevance or general function of green infrastructure. This suggests that more work needs to be done in the way Portland designs its public spaces so that the gap between access to nature and awareness of ecological interdependencies may be bridged through urban experiences of nature in ecologically revealing design.

Consciousness Without Action

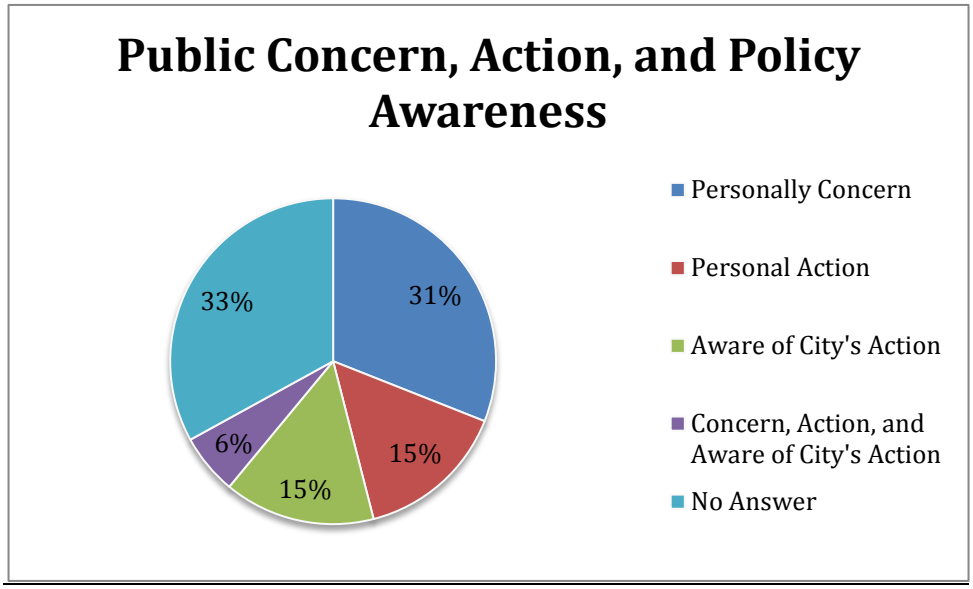

Figure 10 Percent of Public Concern, Action, and Policy Awareness - This pie chart depicts the percentage of participants that were personally concerned about environmental issues, took action to address the issue, and/or were aware of city policy addressing the issue.

This research data showed a strong environmental consciousness, but a disconnect with action both at the city level and the personal level. Just 31% of the students' survey respondents were able to point at environmental issues they were personally concerned about (Figure 10). Only 15% were personally taking action to address their environmental concern. In addition, only 15% of respondents knew of a specific example in which the city was taking action to address their environmental concern. Even fewer (6%) actually illustrated that they were personally concerned, were taking action on this concern, and knew of an example in which the city was also acting to address their environmental concern (Figure 10). This suggests a severe gap in two primary areas. The first gap is between an individual possessing an environmental identity and being able to or knowing how to take action to address environmental

concerns. Second is the city's either insufficient action or ability to make their efforts known to the general public. A representative quote illustrates this perspective:

> "I think overall Portland is a green city. There is a growing consciousness towards how each individual action effects the larger environment, and things like biking, composting, and urban farming are on the rise. However, there are a lot of people who like the idea of conservation, and talk about it, but don't take action."

Although participants agreed that Portland has an environmental identity, they also showed some concern with the way the city of Portland is going about constructing its "green" identity. When asked to offer solutions to address this discrepancy, most focused on changes in transportation rather than green infrastructure and ecological education. Even though participants recognized that the city needed to follow up their environmental identity with educated action, they were personally unable to provide the link between the urban context and ecological education. They were not able to say what elements of the urban landscape would provide residents with the kind of environmental knowledge the city needs to sustain its "greenness" in the long-run. The students were able to recognize this gap in the city, but they were unable to address it personally.

Portland provides essential services for living in the urban landscape, but the student responses reveal that these services - ultimately provided by the natural environment – are not made visible or relevant to the individual. Moreover, natural areas were articulated as places of recreation and relaxation, but not providing essential services that an individual developed a sense of interdependency with. Incorporating ecological services as an integral part of the urban landscape is, therefore, essential in reconnecting people with their natural environment as the source of their daily needs, thus establishing a sense of interdependency and motivating environmentally

responsible behavior. While ecologically revealing urban design is essential, it must also provide opportunity for direct public interaction with their natural environment in a way that develops an ecocentric sense of interdependency.

Limitations

The sample study represents a population that is highly educated and active, which could explain their strong moral inclusion and values for ecological principles, but this is not representative of the whole Portland population. Comparing the visionPDX public survey sample with the Portland Plan, there are some limitations since the public survey sample is not large enough to represent the Portland population and the survey questions were not direct enough to ask specifically about the public's understanding of EI, EL, or GI. In addition the public survey did not focus on the public's personal activities and habits in regards to engaging with the natural environment. The Portland Plan, as a comprehensive plan, does not provide sufficient detail to make strict conclusions on the city's initiatives (i.e. the extent to which GI includes an educational component). Overall this is a preliminary study and will need more thorough data to come to a more comprehensive picture of how the city and its people integrate EI, EL, and GI into urban life and landscapes.

Conclusion: Bridging the Gap Between Portland and Portlanders' Human-Nature Relationship

Both in the public's responses and the city's discourse, there was a general deficiency in presenting the urban landscape as a context for developing ecologically literate population that finds personal relevancy with their local ecosystem. This compromises the ability for the public to make informed decisions for the sustainability of their city. While all sample study subjects agreed that EI, EL, and GI are interdependent, none saw the value of the urban landscape as a context for prompting ecological literacy, or a self-relevant relationship with their natural environment. The general understanding of the relationship between the three subjects can be illustrated in this statement from the sample study:

> "Environmental identity is perceived by those with ecological literacy, and when those to combine into laws and ideas, green infrastructure can become a reality"

Green infrastructure is seen as a result of knowledge and identity, but not vice versa. This perspective correlates with the sample study responses that articulate the idea that the urban landscape is separate from ecological functions and self-relevant functions. Similarly, the city's public policy emphasized equitable accessibility to parks and open space, but no design to reveal the ecological relevancy of these spaces. Investment in developing the general public's sense of ecological interdependency has the potential to bridge the gap between the strong identity and limited, uneducated action.

Although Portland carries the distinction as an environmentally conscious city and citizenry, it generally lacks the links between its urban landscape and providing the means for developing an ecologically literate public that can make responsible decisions

regarding the environment. Until the links between environmental identity, ecological literacy, and green infrastructure are complete, sustainability cannot be realized. It is crucial in this age of urbanization that cities are recognized as part of the ecosystem fabric and provide the context for developing human-nature relationships in which the people are ecoliterate agents within their environment.

Appendix A

Subjects, Principles, and Indicators

Subject	Principle	Indicator
Environmental Identity	1. Experience in Context 2. Incorporation into Moral Community 3. Identity is maintained and refined by social legitimacy. 4. Identity is more compatible with collectivism than individualism – interdependence 5. Nature is seen as distinct and social conflicts are less prominent	1. Access to environment dominated context – places for interaction and direct response. 2. Entities of the environment are largely or entirely incorporated into one's moral community. 3. Social connections are supportive and encourage further behavior associated to an environmental identity. 4. Environmental issues are of higher concern than social problems
Subject	**Principle**	**Indicator**
Ecological Literacy	1. Networks: Everything is interdependent and connected through networks. 2. Nested Systems: Layered units that are within themselves complex, and outside of themselves connected to a larger unit. 3. Cycles: Exchange of resources in continual cycles. 4. Development: Connections are constantly changing in which organisms are not just competitive, but mutually dependent. 5. Dynamic Balance: An ecosystem is constantly self-organizing due to fluctuations and disturbances. 6. Legitimate behavior is defined by the preceding principles and is dependent on the overarching purpose of maintaining the ability of ecosystems to be conducive of life.	1. Networks: The individual recognizes that interconnectedness permeates daily life. 2. Nested Systems: The individual recognizes themselves and subjects as layered units each connected to a larger complex unit. 3. Cycles: They can articulate or indicate via their behavior their how their daily activities or needs fit within an ecological an ecological cycle, rather than closed loops. 4. Development: Their behavior indicates that they are responsive to pressures on their ecological connections by learning and changing behavior accordingly. 5. Dynamic Balance: Based on the recognition that there is no final or climatic state of relationships within an ecosystem, the individual has the ability to recognize that relationships must constantly adapt. 6. Limitation of Behavior: An individual is able to decipher between behavior that will inhibit or maintain the ability of ecosystems to be conductive of life. This requires a display of understanding the preceding principles.

Subject	Principle	Indicator
Green Infrastructure	1. Interconnectedness of ecological systems and habitats seen as whole units, rather than independent. 2. Collaboration across scales of jurisdictions (public and private). 3. Design to reveal connection of ecosystem services with human benefit. 4. Collaboration across sectors is necessary for consensus and access to understanding green infrastructure. 5. Multifunction of spaces to provide for economic, human, and ecological benefit.	1. Physical connection between sites. Restoration due to recognition of the greater importance of one or a series of places. 2. Collaboration across political jurisdictions and land use zoning. 3. Design gives public access to view, interact, manage, and be educated about the significance of the spaces 4. Partners with various public (government offices, community centers, and community groups) and private organizations (businesses, engineering firms, and environmental organizations). 5. Designs recognize the wide range of ecological services and how they relate to human needs such as clean air, water, food and material resources, and (culture?)

Table 1 Subjects, Principles and their Indicators - Principles of environmental identity, ecological literacy, and green infrastructure are listed with their corresponding indicator statements. This table was used to codify data from the Portland Plan and the 2006 visionPDX public survey.

Appendix B

Online Questionnaire Linkert Questions and Corresponding Principles

Subject	Principle	Survey Statement (levels 1-5 disagree strongly –agree strongly)
Environmental Identity	1. Experience in Context	[+] "I often take time to go out to enjoy the outdoors, where there are fewer people and plenty of greenery"
	2. Incorporation into moral community	[+] "I believe killing another living thing for no reason is immoral"
	3. Identity is maintained by social legitimacy	[+] "My friends and I are actively involved in environmentally friendly activities such as recycling, composting, or gardening"
	4. Identity is more compatible with collectivism than individualism, which emphasizes interdependence	[-] "It is my right to use my property as I alone see fit"
	5. Nature is seen as distinct and social conflicts are less prominent	[-] "I am more worried about the quality of water because it affects human survival, as opposed to affecting the ecosystem"
Ecological Literacy	1. Interdependence through networks	[+] "The daily decisions I make have far reaching impacts, because of my connections to my community and local environment"
	2. Nested systems	[+] "My town, state, and country are not isolated but all connected, even globally"
	3. Cycles: Exchange of resources in continual cycles	[-] "Increased concentration of CO_2 in the atmosphere is a big problem because once

		it's in the air it never goes away" [+] "one animal's waste becomes another's source of food, eventually becoming nutrients again for the original food source"
	4. Development: Connections constantly change, organisms are not just competitive, but also mutually dependent	[-] "In nature it is only a dog-eat-dog world, competition drives behavior"
	5. Dynamic Balance: Ecosystems constantly self-organize due to constant fluctuations and disturbances	[-] "Ecosystems should be protected from change and restored for their original state"
	6. Legitimate behavior: Maintain the ability of ecosystems to be conducive to life	[+] "It is better to ensure that natural resources can still provide for future generations, than to use resources up because it is currently profitable"
Green Infrastructure	1. Interconnectedness of ecological systems and habitats seen as whole units, rather than independent.	[-] "Asphalt streets don't have any impact on habitats outside of the city"
	2. Collaboration across scales of jurisdictions (public and private).	[+] "I would rather the city cooperate with other cities and private land owners, than to just deal with the city's interior alone when planning for sustainable development initiatives"
	3. Design to reveal connection of ecosystem services with human benefit.	[+] "I would like urban designs to not only provide ecosystem and human services, but also make it more apparent how it functions" [-] "It is more important to me that urban designs just provide services, I don't need to know or see how it functions"

4.	Collaboration across sectors is necessary for consensus and access to understanding green infrastructure.	[+]"It is important to me that urban designs plans collaborate with many different people and sectors in order to have more support" [-]"Collaborating with many different people and sectors will only hinder urban design plans from being completed"
5.	Multifunction of spaces to provide for economic, human, and ecological benefit.	[+] "Parks shouldn't just look beautiful, but should also provide economic benefits, and have habitat for native species"

Table 2 Questionnaire Likert-Scale Statements - This table shows the correlation between the statements presented in the questionnaire and the principles of environmental identity, ecological literacy, and green infrastructure. The plus and negative signs represent the statement's affirmation or contradiction to the principle it relates to.

Questionnaire Results from Linkert Questions

Environmental Identity

#	Answer	Min Value	Max Value	Average Value	Standard Deviation	Responses
1	1. "I often take time to go out to enjoy the outdoors, where there are fewer people and plenty of greenery"	2.00	5.00	3.98	0.80	40
2	2. "I believe killing another living thing for no reason is immoral"	2.00	5.00	4.40	1.01	40
3	3. "My friends and I are actively involved in environmentally friendly activities such as recycling, composting, or gardening"	2.00	5.00	4.08	0.86	40
4	4. "It is my right to use my property as I alone see fit"	1.00	5.00	2.95	0.97	39
5	5. "I am more worried about the quality of water because it affects human survival, as opposed to affecting the ecosystem"	1.00	5.00	2.83	1.06	40

Table 3 Likert-Scale Responses for Environmental Identity Principles N=54

Ecological Literacy

#	Answer	Min Value	Max Value	Average Value	Standard Deviation	Responses
1	1. "The daily decisions I make have far reaching impacts, because of my connections to my community and local environment"	1.00	5.00	3.88	1.04	40
2	2. "My town, state, and country are not isolated but all connected, even globally"	2.00	5.00	4.35	0.80	40
3	3. "Increased concentration of CO2 in the atmosphere is a big problem because once it's in the air it never goes away"	1.00	5.00	3.65	1.12	40
4	4. "one animal's waste becomes another's source of food, eventually becoming nutrients again for the original food source"	3.00	5.00	3.82	0.72	39
5	5. "In nature it is only a dog-eat-dog world, competition drives behavior"	1.00	5.00	2.95	0.98	38
6	6. "Ecosystems should be protected from change and restored for their original state"	1.00	5.00	3.48	0.99	40
7	7. "It is better to ensure that natural resources can still provide for future generations, than to use resources up because it is currently profitable"	2.00	5.00	4.66	0.73	41

Table 4 Likert-Scale Responses for Ecological Literacy N=54

Green Infrastructure

#	Answer	Min Value	Max Value	Average Value	Standard Deviation	Responses
1	1. “Asphalt streets don’t have any impact on habitats outside of the city”	1.00	3.00	2.11	0.77	37
2	2. “I would rather the city cooperate with other cities and private land owners, than to just deal with the city’s interior alone when planning for sustainable development initiatives”	3.00	5.00	4.05	0.71	40
3	3. “I would like urban designs to not only provide ecosystem and human services, but also make it more apparent how it functions”	2.00	5.00	3.74	0.82	39
4	4. “It is more important to me that urban designs just provide services, I don’t need to know or see how it functions”	1.00	5.00	2.63	0.88	38
7	5. “It is important to me that urban designs plans collaborate with many different people and sectors in order to have more support”	2.00	5.00	3.93	0.86	40
8	6. “Collaborating with many different people and sectors will only hinder urban design plans from being completed”	1.00	4.00	2.20	0.85	40
9	7. “Parks shouldn’t just look beautiful, but should also provide economic benefits, and have habitat for native species”	1.00	5.00	4.15	0.88	41

Table 5 Likert-Scale Responses for Green Infrastructure N=54

Appendix C

Open-Ended Questions

1. Give an example of when you felt most connected to your local environment in the Context of Portland, Oregon?

2. How do you feel about Portland being perceived as a “green” city? Is this title fitting? Why or why not?

3. Describe a time, preferably in Portland, when you felt involved in supporting your local environment and community?

4. If you were able to redesign Portland what kind of functions or features would Portland have?

5. Do you have a favorite outdoor space in Portland? Can you describe it and explain why it is your favorite space?

6. Is there a place in Portland that was really explained the history and/or significance of the local ecosystem? Please provide the name and explain why it was so effective in informing you.

7. Describe an event or place in your life that really revealed the significance and function of your local ecosystems.

8. Is there an environmental issue you particularly feel connected to? What have you done to address this issue? Do you know if or how Portland is currently trying to address this issue?

9. Do you think you have seen and example of green infrastructure in Portland, Oregon? Can you describe what it was and its functions?

10. Do you think the three subjects environmental identity, ecological literacy, and green infrastructure are interrelated or not?

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