

AN ABSTRACT OF THE THESIS OF

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The practice of green infrastructure is synonymous with collaborative partnerships. Expertise from engineers, land care professionals, planners, and natural resource consultants are often required for successful project implementation. Traditionally, these professionals perform their responsibilities in their disciplinary “silos,” but this evolving area of sustainable development is creating a demand for professionals who can think analytically and work across disciplinary boundaries. Interdisciplinary Continuing Professional Education (CPE) trainings provide opportunities for professionals to learn alongside one another, conversing and negotiating new knowledge about emerging practices. This study applies a qualitative approach to gain insight into the motivations, instructional design processes and evaluation mechanisms utilized for interdisciplinary green infrastructure CPE trainings. A variety of green infrastructure CPE providers in the Pacific Northwest United States participated in the study, offering perspectives from agencies, nonprofits, consulting firms and academic institutions. Qualitative software was used to code patterns and themes; and a content analysis on survey evaluation tools was completed. Findings suggest that provider organizations aim to increase worker competency

and advance the field of green infrastructure by designing trainings that facilitate communication skills, enhance networking opportunities and exploit social learning activities. These three priorities are supported by the literature and appropriately foster communal environments shown to support the diffusion of innovative technologies. While training evaluation was found to lean heavily on standardized formal survey evaluation tools, several other informal evaluation approaches were found. A discussion of successful instructional design strategies for interdisciplinary audiences are presented for CPE provider organizations to adopt for future green infrastructure-related trainings.

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Value and Evaluation: A Case Study of Interdisciplinary Green Infrastructure Continuing
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I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

Christine M. Johnson, Author

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1. Introduction

Green Infrastructure is an emerging field of science poised to help solve the complex social, environmental and economic problems of today's rapidly urbanizing world. Defined frequently as a sustainable planning approach, green infrastructure leverages dual-functionality of native landscapes and urban greenspaces to manage stormwater through soil, vegetation, and other engineered mediums while enhancing ecosystems services (EPA, 2016; Benedict & McMahon, 2006). Green infrastructure applies broad-scale conservation and land-use strategies to protect critical water assets (i.e., watershed buffers, wetlands) and aims to prevent and reduce stormwater runoff (WERF, 2009). Combined with other stormwater management techniques, green infrastructure can decrease the impact of flooding events and divert stormwater flows away from overwhelmed systems (EPA, 2016; Madsen & Figdor, 2007; WERF, 2009). Expertise from architecture, engineering, planning and natural resources is essential for successful implementation of green infrastructure practices. These experts, who stem from traditionally distinct disciplines, must collaborate in order to provide the interdisciplinary approach required for green infrastructure practices (Steiner, Simmons, Gallagher, Ranganathan, & Robertson, 2013). Green infrastructure has been labeled as a scalable and flexible solution to stormwater management because it can be adapted to local context (Carlson, Barreteau, Kirshen, & Flotz, 2015).

While the effectiveness of green infrastructure practices on decreasing stormwater runoff and improving water quality have been proven over the past several decades (see Ahiablame, Engel, & Chaubey (2012) for review), the ability for jurisdictions and other organizations to adopt and implement these practices is often stunted by poor interdisciplinary cooperation, discrepancies across government policy, and ambiguous technical guidance on "best" approaches

and uses (Carlet, 2015; Keeley, 2013; White & Boswell, 2007). Professionals are unwilling to incorporate green infrastructure facilities into their projects because of limited experience or training, an attitude Carlet (2015) describes as a form of risk-aversion. This risk averse behavior may be well founded. In a recent review of unsuccessful green infrastructure projects, failures were typically due to technical miscalculations (Ahiablame et al., 2012; Sharma, Cook, Stephen, Tjandraatmadja, & Gregory, 2012), resulting from a lack of training and expertise. To address this practitioner expertise gap, training and technical guidance documents are recommended (Ahiablame et al., 2012; Barbosa, Fernandes, & David, 2012).

Recognizing the limitations of this single discipline approach and lack of expertise, the demand for both technical and professional skills for green infrastructure planning, implementation and management has sprouted new interdisciplinary continuing professional education (CPE) trainings. These collaborative trainings (e.g., conferences, workshops, seminars) encourage attendance of diverse disciplines, including private citizens. Interactions between scientists, practitioners and community members can lead to more attentive decision-making and can also encourage future inclusionary collaboration (Castella, Bourgoin, Lestrelin, & Bouahom, 2014). However, new practices also highlight the distinctive challenges related to collaboration that need to be assessed (Margerum & Robinson, 2015). To date, limited research has been conducted on how green infrastructure training programs are developed and maintained for an interdisciplinary audience. Previous research has explored community-based outreach programs (Chalker-Scott & Tinnemore, 2009; Margerum & Robinson, 2015) and land-grant university extension services (Reed, 2001; Sagor, Kueper, Blinn, & Becker, 2014). While these studies show that collaborative partnerships can lead to enhanced stakeholder engagement and

better use of limited resources; no research has yet addressed how interdisciplinary CPE trainings may facilitate relationships across stakeholder groups.

This study aims to address the gap in research and answer the question: *How can continuing professional education trainings be leveraged to promote interdisciplinary collaboration in green infrastructure?* The following sections review the current state of green infrastructure and introduce problems related to training a workforce on innovative interdisciplinary practices.

1.1. Green Infrastructure in the Pacific Northwest

In 2017, the Pacific Northwest states of Oregon and Washington received some of the highest precipitation amounts in the contiguous United States (NOAA, 2017). Climate change models for the region anticipate that precipitation will vary significantly over the next century, with precipitation possibly declining by up to 30 percent, but delivered as more frequent severe storms (Dalton, Mote & Snover, 2013; EPA, 2016; Mote & Salathé, 2010). Coastal communities face this pressure in combination with sea level rise, exacerbating storm surge and coastal flooding threats. Decision-makers tasked with preparing for these threats face another challenge alongside climate change: a booming development economy resulting in significant land-use change. From 2010 to 2016, the U.S. Census Bureau reported population growth of 8.4 and 6.8 percent Washington and Oregon respectively (2017). New residents are attracted to the region because of strong growth trends in tourism, professional and business services, trade, transportation, utilities, as well as education and health services (Bureau of Labor Statistics, 2017). This spike in employment and population growth creates a political environment ripe for conflict at the intersection of land development demands and environmental resiliency.

One of the main strategies for addressing this conflict is the incorporation of low impact development into environmental policy. Similar in definition to green infrastructure, the Environmental Protection Agency (EPA) defines low impact development as “an approach to land development (or re-development) that works with nature to manage stormwater as close to its source as possible” (2017). Low impact development is closely associated with mitigating the effects of stormwater runoff, and it consists of best management practices in compliance with the Clean Water Act. Both Oregon and Washington have National Pollutant Discharge Elimination System (NPDES) permits and Total Maximum Daily Load (TMDL) programs to facilitate achieving water quality standards.

Oregon and Washington, and more specifically the urban centers of Portland and Seattle, have been studied and acknowledged by academics and professionals alike as being leaders in the green infrastructure movement (EPA, 2010; Shandas & Messer, 2008; Wise, 2008; Young, 2011). Washington’s green infrastructure program sprouted from their 2007 Urban Forestry Management Plan that aimed to increase canopy coverage to 30 percent over 30 years (Wise, 2008). As a result, Washington now has a robust network of green infrastructure resources via the Washington Stormwater Center; a portal for all stormwater-related resources including manuals, reports and CPE trainings (WSC, 2017).

As a state, Oregon has focused the majority of its green infrastructure training and technical resources west of the Cascade Range, where the heaviest precipitation occurs and the most population growth is expected. In preparation for additional growth and pending future regulation, the Oregon Department of Environmental Quality (DEQ), Oregon Environmental Council (OEC), Oregon Sea Grant (OSG), Oregon State University (OSU), Oregon Department of Forestry (ODF), and several mid-sized cities entered a collaborative agreement to produce the

Template for LID Stormwater Manual for Western Oregon (DEQ, n.d). Designed for local adaption, this template provides a framework for communities to begin to plan and incorporate low impact development into codes and ordinances.

1.2. The Demand for a Green Infrastructure Workforce

The lack of a qualified labor base hinders the adoption of green infrastructure and low impact development as an approach to stormwater management (Carlet, 2015; Keeley, 2013). Traditional post-construction stormwater maintenance and management techniques are inadequate for green infrastructure facilities (Sharma et al., 2012), leaving otherwise experienced professionals in limbo. Maintenance of grey infrastructure systems often rely on machinery (e.g., pumps, vector trucks); whereas green infrastructure facilities require methodical physical maintenance (e.g., planting, pruning, leaf-blowing, power-washing). The Occupational Outlook Handbook identifies green infrastructure-related occupations (e.g., environmental engineers, scientists and specialists, architects, hydrologists, grounds maintenance workers) as trending positive, with a majority growing as fast or faster than average (BLS, 2015). Furthermore, the *Exploring the Green Infrastructure Workforce* report describes the need for a new workforce that requires the integration of technical skills with interpersonal skills (Jobs for the Future, 2017). Recent studies have also called for research on skill creation in the realm of green jobs (Consoli, Marin, Marzucchi, & Vona, 2016), and the curriculum development of existing certification programs (Water Environment Federation, 2015; Carrion-Crespo, 2011).

At the collegiate level, courses in sustainable planning, engineering and landscaping are slowly becoming integrated alongside more traditional topics that may help fill the need for a qualified green infrastructure workforce. However, the ability for universities to integrate new material into course curriculum can be limited by faculty experience, reliable instructional design

models, few incentives for instructors and the inability to reach consensus on what “sustainable” means (Hansen, 2012; Rao, Pawley, Hoffmann, Cardella, & Ohland, Matthew W., 2013; Wolcott et al., 2011).

Prior to green infrastructure, professionals specialized in specific aspects of stormwater facility design and function. These professionals are now being asked to communicate and collaborate with decision-makers, the public and experts in other disciplines to solve perplexing environmental issues (Keeley, 2013; Rao et al., 2013; Sample, Ringgold, Block, & Giltmier, 1999). Stummann and Gamborg (2014) compiled a list of ten “collaborative competencies” for natural resource professionals, including: organization and management of collaborative projects; effective written and oral communication; critical thinking; and performing socially responsible and ethical work. Technical competencies remain critical, but social skills are becoming increasingly relevant.

1.3. Training a Green Infrastructure Workforce

Due to the new interdisciplinary demand of green infrastructure, professionals in green industries, such as engineers and architects, receive more on-the-job training than workers outside of the green industries (Consoli et al., 2016). Practitioners reliant on implementing the best available knowledge and associated best management practices rely on continuing professional education to stay informed throughout their careers, refining skills and approaches as solutions become available (Ahn & Pearce, 2007; Dalton, 2007; Sample et al., 1999). Regulatory guidelines are also commonly communicated through formal education platforms (WSC, 2017; Eliason, Blinn, & Perry, 2003). The circumstances are fitting, then, for CPE to be the vehicle of dissemination of relevant knowledge and skills to green infrastructure professionals.

1.4. Purpose of Research

This study uses qualitative methods to understand the growing field of interdisciplinary green infrastructure CPE trainings in the Pacific Northwest. The nature of the research lends itself to a qualitative approach because little is known about how these trainings are developed and how they can serve the field of green infrastructure. This study examines provider organizations that offer CPE opportunities in Oregon and Washington. Approaches to program planning, curriculum development and methods of evaluation are explored.

Through the application of interviews and content analysis, this study addresses five research questions.

Manuscript one focuses on how interdisciplinary audiences influence continuing professional education trainings by asking the following three questions:

1. Why are organizations offering continuing professional education to interdisciplinary audiences;
2. How do organizations structure their curriculum to meet the interdisciplinary needs of their audience; and,
3. What makes interdisciplinary green infrastructure continuing professional education trainings valuable for all practitioners of green infrastructure?

Manuscript two applies Kirkpatrick's Four-Level Training Evaluation Framework (Kirkpatrick, 1959) to examine:

4. How do CPE providers evaluate the success of their trainings; and,
5. What evaluation tools do they apply to measure success?

The goal of this of this research is to reveal how continuing professional education is currently being delivered to practitioners of green infrastructure and to provide recommendations for future trainings and research.

2. Manuscript 1: Continuing Professional Education in the Emerging Field of Green Infrastructure: A Constructivist Approach to Interdisciplinary Trainings

2.1. Introduction

In the past decade, social practice and implementation researchers have observed a trend towards inclusive management approaches in integrative science fields (Carlson, Barreteau, Kirshen, & Foltz, 2015; Margerum & Robinson, 2015; Opdam et al., 2013). These trends are especially notable in the arena of environmental policy and management, where collaborative approaches to environmental issues, like nonpoint source pollution, require experts from various fields to work alongside one another. However, political, technical and experiential knowledge have often become barriers to consensus (Ahiablame et al., 2012; Carlet, 2015; Keeley, 2013; White & Boswell, 2007).

Green infrastructure is defined as a sustainable planning approach that uses vegetation, soil, and engineered mediums to collect, treat and convey stormwater runoff (EPA, 2016). Furthermore, green infrastructure has become synonymous with collaborative partnerships, uniting experts in the fields of engineering, landscape architecture, planning and natural resources. Public inclusion with green infrastructure projects has been shown to empower communities and encourage collaboration at the local level (Carlson et al., 2015; Shandas & Messer, 2008), making it a favorable solution to longstanding environmental issues.

In the Pacific Northwest, green infrastructure has been used as a tool to address water quality associated with stormwater runoff. Public interest and federal directives to restore the Willamette River and the Puget Sound have driven the region to adopt proactive strategies to addressing water quality issues. Oregon and Washington communities are also supported by robust academic institutions such as Oregon State University, Portland State University, the University of Washington, and Washington State University, all of which have strong reputations

for interdisciplinary research on sustainable infrastructure (Chalker-Scott & Collman, 2006; Rojas & Dossick, 2008; Shandas & Messer, 2008; Thomé, Ceryno, Scavarda, & Remmen, 2016). The abundance of stakeholder groups has enabled both states to gain national recognition from the Environmental Protection Agency (EPA) for their initiatives in translating green and sustainable infrastructure research into practice (EPA, 2010).

Implementation of best management practices by jurisdictions, non-profits, and others is creating a demand for continuing professional education (CPE) that addresses the challenges and opportunities associated with collaboration and innovation. CPE can provide educational opportunities for credit towards disciplinary licensure or certification, for professional development (e.g., employable skills), or simply of special interest. Green infrastructure CPE programs are administered in various ways (e.g., conferences, workshops, seminars) and offered by an assortment of providers. Professional certification and licensing associations such as the American Society of Civil Engineers, the American Society of Landscape Architects and the American Planning Association are responsible for providing appropriate coursework to members. Conversely, state and national agencies, other non-governmental organizations and state extension services often provide and sponsor CPE programs to fulfill grant obligations, inform decision-makers or educate practitioners about future policy changes (Eliason, Blinn, & Perry, 2003). Therefore, the need to tackle the multiplicity of CPE opportunities is a necessity for advancing the agenda of green infrastructure and identifying collaborative partnerships.

Studies on green and sustainable infrastructure have grown exponentially since 2003 (Thomé et al., 2016). Calls for research on technical and interpersonal skill development and trainings have been persistent throughout this time, (Ahiablame et al., 2012; Consoli et al., 2016; Margerum & Robinson, 2015) but have yet to be fulfilled. The study presented here addresses

this research gap by examining the coordination, curriculum development and implementation of recent interdisciplinary trainings in the field of green infrastructure. By thoroughly examining CPE provider organizations, this study addresses the following research questions: 1) why are organizations offering continuing professional education to interdisciplinary audiences; 2) how do organizations structure their curriculum to meet the interdisciplinary needs of their audience; and, 3) what makes interdisciplinary green infrastructure continuing professional education trainings valuable for all practitioners of green infrastructure?

2.2. Literature Review

This literature review was assembled by searching for social science publications on green infrastructure and sustainable urban planning. Additional literature from ecosystem management, forestry, landscape ecology, and natural resources are included to provide additional disciplinary insight. Furthermore, because green infrastructure is an internationally recognized tool for climate change adaptation (Matthews, Lo, & Byrne, 2015), studies based in U.S., Europe, Australia, and others are referenced. The following literature review first summarizes the many dimensions, meanings and practitioners of green infrastructure. A discussion of the challenges in creating and sustaining green infrastructure collaborations follows thereafter. Lastly, the literature review will cover an overview of CPE planning considerations.

2.2.1. Definitions of Green Infrastructure

While the term of “green infrastructure” is new, the concept dates back to the 1880’s with Frederick Law Olmsted’s keen eye for designing with the urban landscape (Spirn, 1985). Olmsted is universally recognized as a pioneer in park design, having designed Central Park in New York City and Golden Gate Park in San Francisco. Olmsted’s nephew, John Charles Olmsted, initiated similar sprawling park systems in Portland, Oregon and Seattle, Washington,

among others in the Pacific Northwest (Williams, n.d.; Cotton, 2014). Recognizing that people need nature in the monotony of brick and concrete cities, Olmsted began to “link” green spaces together, creating a network of hubs and corridors of parks and greenways (Benedict & McMahon, 2006). This interpretation of the term green infrastructure is widely used today, but the term has expanded and evolved over time (Table 2.1.). For the purpose of this study, green infrastructure uses the EPA definition: “An approach to stormwater management that uses soil, vegetation, and natural processes to restore the hydrological cycle to the landscape” (EPA, 2016).

Table 2.1. Definitions of green infrastructure and similar water-conscious approaches

Term	Definition
Ecologically Sustainable Development (ESD)	Going beyond the protection of the environment from the impacts of pollution, to also protecting, conserving and restoring natural resources (Wong, 2006).
Green Infrastructure (GI)/ Green Stormwater Infrastructure (GSI)	Green infrastructure is our nation’s natural life support system — an interconnected network of waterways, wetlands, woodlands, wildlife habitats, and other natural areas; greenways, parks and other conservation lands; working farms, ranches and forests; and wilderness and other open spaces that support native species, maintain natural ecological processes, sustain air and water resources and contribute to the health and quality of life for America’s communities and people (Definition developed by USDA Forest Service and Conservation Fund Staff as reported in Benedict & McMahon, 2006).
Low Impact Development (LID)	An approach to stormwater management that utilizes vegetation to mimic natural hydrological processes to reduce and manage stormwater runoff (EPA, 2016).
Sustainable Urban Drainage Systems (SUDS)	Drainage solutions that provide an alternative to the direct channeling of surface water through networks of pipes and sewers to nearby watercourses. By mimicking natural drainage regimes, SuDS aim to reduce surface water flooding, improve water quality and enhance the amenity and biodiversity value of the environment (British Geological Survey, 2017).
Water-Sensitive Urban Design (WSUD)	A recent planning and design philosophy in Australia primarily used to minimize the hydrological impacts of urban development on the surrounding environment (Morison & Brown, 2011; Wong, 2006).

2.2.2. Practitioners of Green Infrastructure

Environmental engineers, environmental specialists, and several other green infrastructure-related jobs represent some of the fastest growing occupations in the U.S. according to the Occupational Outlook Handbook (BLS, 2015). These practitioners are charged with having both technical and generalist expertise in their respective fields (Rao et al., 2013).

Municipal engineers faced some of the earliest challenges associated with successful implementation of green infrastructure technology. Wastewater engineers were erroneously assumed to understand low impact development principles when water quality regulations were first implemented (White & Boswell, 2007). This assumption, on the part of the administrators, resulted in technical failures early on, such as the installation of ineffective soil media (Ahiablame et al., 2012). As such, green infrastructure innovation is still met with resistance from the engineering community (Carlet, 2015). Researchers have called for technical training and long term monitoring to overcome this challenge (Ahiablame et al., 2012); however, local context is important to evaluate appropriate systems, procedures and methods, making it difficult to translate essential knowledge into a classroom setting (Kevern, 2011; Rao et al., 2013; Wolcott et al., 2011).

Green infrastructure is still an ambiguous concept for some planning professionals which has hindered its adoption (Matthews et al., 2015). Generally speaking, planners understand how sustainable planning plays a role in a community's economic, environmental, political and social viability (Campbell, 1996). Oftentimes planners implement green infrastructure to meet certain societal or environmental demands, but fail to integrate long-term management into implementation strategies. For example, planners are often tasked with spearheading urban forestry programs, integrating their knowledge about site history and context with urban forestry

principles (Young, 2011). An often neglected piece of an urban forestry program is the establishment of a long-term maintenance plan and necessary agreements which can fall to maintenance crews, and sometimes the public (Pincetl, Gillespie, Pataki, Saatchi, & Saphores, 2013). Hence, there is a disconnect as the green infrastructure matures and changes overtime. Having acknowledged education gaps such as this one, planning educators are being called upon to prepare professionals for their new responsibilities. New programs involve traditional planning topics (e.g., read and prepare maps, prepare forecasts, administer programs) with complementary session on innovative technologies, leadership and interpersonal skills (Dalton, 2007).

Engineering and urban or regional planning are only two of the many historically distinct disciplines converging with one another to solve the issue of failing infrastructure. Interdisciplinary collaboration is often identified as a challenge to implementing green infrastructure projects due to its inherent reliance on a variety of expertise and “fragmentation” of responsibilities (Keeley, 2013). However, when academics, practitioners and public administrators collaborate, there is an opportunity for conversations move beyond technical consultation and into knowledge transfer (Ugolini, Massetti, Sanesi, & Pearlmutter, 2015). Through collaborative conversations, mutual understanding of previously ambiguous concepts or unfamiliar jargon can be translated (Cash et al., 2003). Thus, CPE trainings can be designed to capitalize on interdisciplinary collaboration by offering students opportunities for open discussion and experiential learning activities (Ugolini et al., 2015).

2.2.3. Continuing Professional Education

CPE is labeled as a formal platform for professionals to gain skills in communication, collaborative problem solving, and conflict resolution (Sample et al., 1999). Kowalski, an

educational theorist, applied organization theory to depict three overarching influences on adult education programs: 1) the environment; 2) the organization offering the training; and, 3) the student (Figure 2.1.) (1988, p.77).

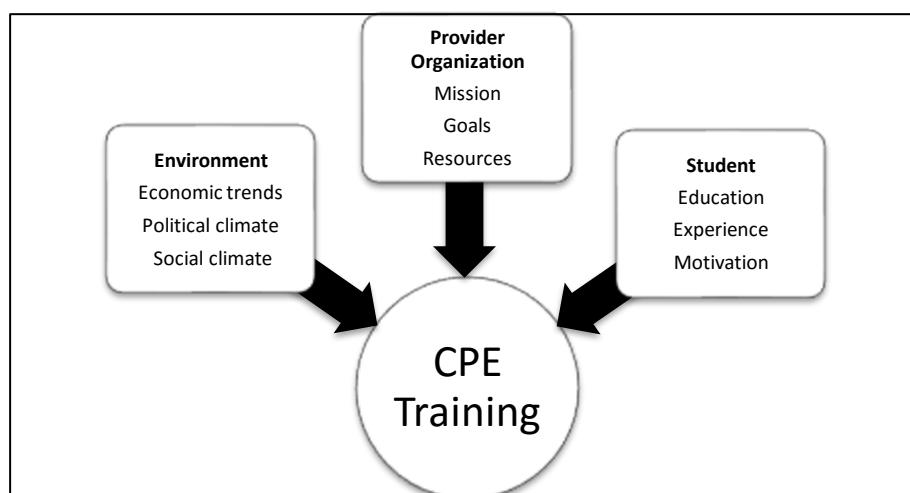


Figure 2.1. Three factors influencing adult education. Adapted from Kowalski (1988, p.77)

In the context of green infrastructure, the environment includes political, social and economic trends. Resentment towards adopting new practices, limited capacity to implement practices, and a lack of trained professionals would all qualify as environmental influences on a training. Environmental topics in green infrastructure span local, regional and national government, and attract a variety of provider organizations. Provider organizations have missions, goals and/or resources that align with the given environmental context, and influence CPE trainings by contributing resources. The student, or green infrastructure professional, is the third factor influencing the training. Each student brings his/her own knowledge, values and experience to the training, which can influence the type and level of curriculum presented and the success of the knowledge transfer.

When organizations plan CPE trainings in the field of green infrastructure they attempt to navigate these three influences. The environment demands professionals who possess technical

and interpersonal skills. Provider organizations respond to this demand by collaborating with technical experts (e.g., porous pavement contractors, landscape architects) and social institutions (e.g., community organizations, watershed councils, water coalitions) to develop ambitious agendas. When trainings are well-developed, students react and respond by applying new skills, changing their behavior and ultimately (albeit hopefully) influencing the longevity of green infrastructure systems.

This study adds to existing literature by examining how CPE trainings are planned and implemented for an interdisciplinary audience. As reviewed above, green infrastructure has emerged as a sustainable planning approach for communities which aim to solve complex environmental issues while also providing ecosystem services. Green infrastructure practitioners have experimented with practices over the last few decades; however, the transition has been met with technical, social and institutional barriers. One such barrier is interdisciplinary collaboration. CPE trainings may provide an opportunity to enhance collaboration skills by addressing knowledge gaps, clarifying jargon and introducing concepts through experiential learning activities. As such, this study examines the opportunity for CPE trainings to meet the growing and evolving needs of green infrastructure professionals.

2.3. Methodology

2.3.1. Study Description

Three research questions guided this study on interdisciplinary green infrastructure CPE trainings: 1) why do provider organizations choose to invite an interdisciplinary audience to their trainings; 2) how do provider organizations structure training curriculum to meet the needs of their interdisciplinary audience; and, 3) what makes these trainings valuable for all practitioners of green infrastructure. A grounded-theory qualitative approach was applied to explore this

recent trend. Grounded theory is a systematic approach to research that generates theory through the analysis of methodically collected data (Leedy & Ormrod, 2013, p. 146). Interviews can be a preferred approach for exploratory research investigating recent phenomena (Salant & Dillman, 1994), because they allow for free-flowing thought and may uncover topics not yet acknowledged. This study approach aims to advance the literature on planning and executing valuable CPE trainings in the emerging field of green infrastructure.

2.3.2. Study Sample Criteria

Green Infrastructure CPE trainings were measured against study criteria and interviews were conducted with representatives from the provider organizations. This study defined CPE trainings as conferences, workshops, or seminars that professionals in green infrastructure-related fields attend to receive timely and relevant knowledge, skills, and resources. CPE trainings included in this study had to meet study criteria (Table 2.2.). These criteria were developed to capture the diversity and breadth of programs being offered in Oregon and Washington where green infrastructure practices have been integrated into policies meant to achieve water quality standards. An inclusive database of all CPE trainings related to green infrastructure does not exist; therefore, an extensive search was conducted to identify trainings. The interdisciplinary nature of green infrastructure represents a level of difficulty in the search for CPE trainings, hence the search conducted was exhaustive, but may not be comprehensive. Once trainings were identified, provider organization representatives were contacted via the telephone number or email listed on training flyers or organization websites.

Table 2.2. Study criteria for interdisciplinary green infrastructure CPE trainings

Criterion	Specification
Date	Conducted within 9/1/2013 – December 31, 2016
Location	Oregon or Washington
CPE Topic	One of the following topics related to green infrastructure: <ul style="list-style-type: none"> – Climate change – Facility design – Facility engineering – Facility construction – Low Impact Development (bioswales, raingardens, planters) – Maintenance – Porous/Permeable pavement – Resiliency – Stormwater benefits – Water quality or watershed health
Audience	Minimum of two audience groups: <ul style="list-style-type: none"> - Elected officials - Environmental Consultants - Landscape Architecture and Design - Land Care Professional (grounds maintenance) - Municipality Staff (Engineer, Stormwater Manager, Planner) - Private Contractors (Architects, Engineers, Consultants, etc.) - Private Property Owners
Provider Organizations	Minimum of two organizations types: <ul style="list-style-type: none"> – Type I: Educational Institutions – Type II: Informal Education Organizations – Type III: Non-education Organizations

2.3.3. Provider Organization Typology

Provider organizations approach CPE trainings differently, and understanding these differences across organizations could highlight areas where curriculum development is exceptional or simply mediocre. For instance, a nonprofit focused on water quality likely has a variety of outreach materials for a public audience, but may be less prepared to provide training in a formal classroom setting. Conversely, a professional association may take a more formal approach to reach necessary benchmarks for certification; however, resources connecting the

topic to social benefits may be scarce. To assist with recognizing similarities and differences across organizations, an established typology developed by Darkenwald and Merriam (1982, p.155-181) was adapted and guided research design. Providers of CPE trainings, and the individuals representing them, were categorized into one of the four following groups which offer adult education:

Type I: Educational institutions. These organizations traditionally serve adult learners in a traditional organized educational institution such as four-year colleges and universities, community colleges, and through extension services. Non-credit seeking adults are a secondary audience that educational institutions serve, but not the primary student audience served.

Type II: Informal education organizations. For these organizations, education is a secondary function for which they feel a responsibility to offer to their members. Arguably the broadest type, groups such as cultural organizations, community organizations, governmental agencies, and occupational associations are included in this category.

Type III: Non-education organizations. Organizations that offer education as a means of making progress in their discipline or field are considered “non-educational.” They offer education as “a means to an end” but do not have education as their primary mission. This typology is designed to categorize the diversity of organizations that contribute to green infrastructure trainings, enabling researchers to identify and address redundancies and gaps in training resources.

2.3.4. Interviews

Provider organization representatives were asked a series of questions from a semi-structured interview questionnaire. The questionnaire was organized into three sections. First, questions were designed to understand organizational involvement in CPE trainings (i.e., how and why did organizations participate in the training). Those questions focused on the purpose, motivation, recruitment and outreach strategies for the training. Next, participants were asked about how they developed the program with emphasis on the educational approach, resources referenced, influence of the interdisciplinary audience on the content or curricula presented and associated activities. Finally, participants were asked to reflect on the challenges and benefits of having an interdisciplinary audience and how they may approach interdisciplinary trainings differently in the future. Interview sessions were audio-recorded per consent of the interviewee and transcribed.

To aid in data analysis, transcripts were imported into the qualitative software program Nvivo. Qualitative databases are used to aid researchers in data organization and theme analysis (Leedy & Ormrod, 2013; p.159) and still depend upon the researcher for interpretation and context (Bazeley & Jackson, 2013, p.2). As transcription was being completed, the researcher took notes on common themes that later formed the framework of the codebook. Coding is a qualitative analysis technique that highlights major points of discussion and enables the researcher to track patterns and themes that exist throughout the data. Data were thematically coded and connected to demographic and categorical values through the application of classifications. After each interview was classified, a matrix coding query with attribute values was generated to provide a broad level comparison across organization types. The query identifies thematic nodes corresponding with given classifications and provides quantitative data

to direct further analysis. Data are presented in the results narrative and with thematic tables that include key quotes. Themes are presented with interview and reference counts. Reference counts are the number of interviews the theme appeared in and how many times the theme was mentioned.

2.4. Results

Twenty-two telephone interviews, ranging from 27 - 75 minutes, and two email interviews were conducted from September 2016 to February 2017. Interviews were conducted until saturation was reached and no new patterns or themes were being produced with additional interviews. The following results are organized into four sections. First, trainings and provider organizations included in the study are summarized (Table 2.3.). Second, thematic findings resolving why organizations invited interdisciplinary audiences to their trainings are presented. Next, instructional design challenges and strategies are examined. To conclude the results section, three overarching themes - communication skills, social learning, and networking - are discussed to explain how interdisciplinary CPE trainings can be valuable experiences for all practitioners of green infrastructure.

Table 2.3. Summary of interdisciplinary green infrastructure CPE trainings

Green infrastructure CPE training <i>Date, state,</i> Purpose		Provider organizations	Audience²	CEU³	Duration	Size	Funding Source
Fall 2016 Stormwater Starts - Landscape Best Practices for Water Quality <i>September 2016, OR</i> Train and foster a community of environmental stewards on stormwater reduction best management practices at the residential scale; promote social learning and volunteerism.		<ul style="list-style-type: none"> • Green Girl Land Development Solutions • Independence Gardens • Southwest Watershed Resource Center • Stanberger Outreach Consulting* • West Multnomah Soil and Water Conservation District (WMSWCD)* 	<ul style="list-style-type: none"> • Homeowners • Landscape Contractors • Land Care Professionals • Municipality Staff • Neighborhood Associations 	U	3-4 days	20-40	• WMSWCD
Green Gardening Workshop 2015 - Resilient Landscapes for Our Changing Urban Environment <i>October 2015, WA</i> Provide relevant and timely information to land care professionals on sustainable landscaping practices with particular focus on reducing urban runoff and pesticide application.		<ul style="list-style-type: none"> • Cascadia Consulting* • Local Hazardous Waste Management Program (LHWMP) • Seattle Public Utilities (SPU) 	<ul style="list-style-type: none"> • Landscape Contractors • Land Care Professionals • Nurseries 	Y	3-4 days	100-250	<ul style="list-style-type: none"> • LHWMP • SPU • Student Fee (\$30)
Introducing Green Infrastructure for Coastal Resilience⁴ <i>February 2016, OR</i> Connect coastal decision-makers with basic information about green infrastructure; initiate conversation about green infrastructure facilities and resiliency planning, and their connection to disaster preparedness.		<ul style="list-style-type: none"> • National Oceanic and Atmospheric Administration Office for Coastal Management (NOAA) Oregon Coastal Management Program* • South Slough National Estuarine Research Reserve* • University of Oregon's Partnership for Disaster Resiliency 	<ul style="list-style-type: none"> • Elected Officials • Grassroots Organizations • Private Contractors • Property Owners • Municipality Staff 	U	1 day	40-60	<ul style="list-style-type: none"> • NOAA • SSNERR

<p>Low Impact Development (LID) Operations and Maintenance Trainings 2011 – 2016, WA</p> <p>Series of topical trainings offered multiple times a year. Focuses are generally on policy, permit compliance and technical guidance (e.g., porous pavement installation). Promote networking opportunities and state-funded resources.</p>	<ul style="list-style-type: none"> • Building Industry Association of Washington* • Herrera Environmental Consultants* • SVR Design Company* • Washington Department of Ecology(WADE)* • Washington State University College of Agriculture, Human and Natural Resource Sciences* • Washington State University Extension 	<ul style="list-style-type: none"> • Elected Officials • Land Care Professionals • Private Contractors • Municipality Staff 	Y	Varies	Varies	<ul style="list-style-type: none"> • WADE • Student Fee (Varies)
<p>Managing Stormwater in Oregon - The Business of Stormwater Regulation and Compliance⁴ <i>May 2016, OR & WA</i></p> <p>Share relevant and timely information from leading industry experts and regulators to a diverse range of industry professionals; promote networking opportunities.</p>	<ul style="list-style-type: none"> • Clean Creek Systems Inc. • Clean Water Services • Clean Way • DJC Oregon • Empurion • Farallon Consulting • Filtrexx Sustainable Technologies • Geosyntec Consultants • GSI Water Solutions, Inc. • Herrera • Integral Consulting Inc. • Kennedy/Jenks Consultants • Landau Associates¹ • Lane Powell Attorney and Counselors • Northwest Environmental Business Council* • Pace Analytical • PBS Engineering + Environmental • Perkins Cole • River City Environmental Inc. • Sound Earth Strategies • Stormwater Rx • The Water Report 	<ul style="list-style-type: none"> • Environmental Consultants • Environmental Solutions Providers • Industry Vendors • Private Contractors 	Y	2-day	100-200	Student Fee (\$250)

Oregon Landcare Peer Learning Session

August 2015, OR

Teach land care professionals to work towards a holistic approach to sustainable landcare; Promote networking opportunities; share maintenance strategies.

<ul style="list-style-type: none"> • Native and Urban Gardens, Inc.* • Oregon Tilth* 	<ul style="list-style-type: none"> • Landscape Contractors • Land Care Professionals • Private Contractors • Property Owners 	N	1-2 hours	10-30	<ul style="list-style-type: none"> • Oregon Tilth
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Oregon Water and Wastewater Infrastructure Finance Workshop⁴

July 2015, OR

Provide relevant and timely information for decision makers, city staff, and facility operators regarding funding programs and resources available for rural communities to support water infrastructure.

<ul style="list-style-type: none"> • Business Oregon, Infrastructure Finance • Indian Health Services • League of Oregon Cities • Oregon Association of Water Utilities • Oregon Department of Environmental Quality • Oregon Health Authority • Rural Community Assistance Corporation* • USDA Rural Development 	<ul style="list-style-type: none"> • Agency Representatives • Elected Officials • Municipality Staff • Private Contractors 	Y	1 day	40-60	<ul style="list-style-type: none"> • RCAC via USDA Grant • Student Fee (\$30)
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Pacific Northwest Pretreatment Workshop

September 2016, OR & WA, 3 days

Provide relevant and timely information to new and experienced pretreatment professionals; promote networking opportunities; share operation strategies.

<ul style="list-style-type: none"> • City of Bend • City of Eugene • City of Klamath Falls • City of Portland • City of Vancouver* • Clark Regional Wastewater District • Clean Water Services • Oregon Association of Clean Water Agencies • Pacific Northwest Control Training Association¹ 	<ul style="list-style-type: none"> • Agency Representatives • Municipality Staff • Sewer District Staff 	Y	3-day	50-100	<ul style="list-style-type: none"> • Sponsors • Student Fee (\$320)
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Portland Ecoroof Symposium <i>October 2016, OR & WA</i> Elevate green roof knowledge across range of industry sectors, addressing main concerns and opportunities; promote networking opportunities.	<ul style="list-style-type: none">• Audubon Society of Portland• Diadem• East Multnomah Soil and Water Conservation District (EMSWCD)• Etera• Firestone Building Products• Green Feathers• Greenroof Info Think-tank*• Mahlum• Portland State University*• Professional Roof Consultants• Tremco	<ul style="list-style-type: none">• Elected Officials• Industry Vendors• Grassroots Organizations• Municipality Staff• Private Contractors• University Students	Y	2-day	100-150	<ul style="list-style-type: none">• EMSWCD• Student Fee (\$25)
	Rain Garden Training for Professionals <i>November 2015, WA</i> Develop a skilled workforce of trained professionals on rain garden systems and other LID strategies. Meet the demand for	<ul style="list-style-type: none">• City of Everett• Snohomish Conservation District*• Washington State University Extension (Snohomish County)	<ul style="list-style-type: none">• Homeowners• Landscape Contractors• Land Care Professionals• Municipality Staff	Y	2-day	30-50
University of Washington Extension ProHort Class: Reconstructing Natural Areas in the Built Environment <i>January 2016, WA</i> Build community around urban restoration projects; promote networking opportunities.	<ul style="list-style-type: none">• Urban Forestry Services, Inc.*• Seattle Parks and Recreation• University of Washington• University of Washington Botanic Gardens*• Washington State University• Washington Department of Natural Resources, Urban and Community Forestry Program• USDA Forest Service Pacific Northwest Research Station	<ul style="list-style-type: none">• Arborists• Elected Officials• Grassroots Organizations• Land Care Professionals• Municipality Staff	Y	2-day	75-100	<ul style="list-style-type: none">• Student Fee (\$150)

Vegetated Private Water Quality Facilities Management Training ⁴

May 2016, OR

Develop a skilled workforce of trained contractors, maintenance workers, and other land care professionals on what LID facilities are, why they are required, how to properly maintain and inspect them, and how to communicate with private landowners.

- Clean Water Services*
- Portland Community College*

- Land Care Professionals
- Landscape Contractors
- Municipality Staff
- Property Owners
- University Students

Y

2-day

< 50

- PCC via National Science Foundation Grant

Washington State University Kitsap County Extension Professional Rain Garden

Workshop

October 2015, WA

Increase capacity for rain garden installations in the Puget Sound area by teaching skills and knowledge to small business owners, land care professionals and municipal staff; promote networking opportunities; promote resources.

- Washington State University Extension (Kitsap County)¹
- Kitsap Conservation District
- Kitsap County Public Works

- Homeowners
- Land Care Professionals
- Landscape Contractors
- Municipality Staff

Y

2-day

50-100

- Kitsap County Public Works

*Denotes phone interview.

¹Denotes email interview.

²Audiences listed are a summary; additional disciplines may have attended.

³Continuing Education Units available for practitioners - U= Unknown, Y=Yes, N=No.

2.4.1. CPE Training Summary

2.4.1.1. Trainings

The study sample captured a variety of trainings with different topics, purposes, audiences and structure. The overarching purpose of each training was to share timely and relevant knowledge with target audiences. These trainings invited members of the public, decision-makers, industry representatives and green infrastructure practitioners to conferences, workshops, seminars and peer-learning sessions. Trainings ranged in size from 10 students in peer-learning sessions to over 250 at conferences. Generally speaking, as trainings grew in size, they required additional organizational support to communicate with presenters, volunteers, and steering committee stakeholders.

Continuing education credits (also known in units or hours) were available at 10 of the 13 trainings. Specific types of credits (i.e., American Planning Association, International Society of Arboriculture, etc.) were not asked about in the interviews, however the representatives mentioned the following professions in association with credits: architects, engineers, landscape architects, landscape contractors, landscape designers and planners.

A noticeable trend in the sample is location. A majority (11 of 13) of the trainings were held in densely populated cities that fall under federal National Pollutant Discharge Elimination System (NPDES) Phase I and Phase II permitting requirements. The other two trainings, Introduction of Green Infrastructure for Coastal Resiliency and Oregon Water and Wastewater Infrastructure Finance Workshop, were held in unregulated small Oregon communities where stormwater management, and more importantly infrastructure management, are topics of critical concerns for decision-makers with limited resources.

2.4.1.2. Provider Organizations

Provider organizations interviewed reached a broad range of organization types and disciplines (Table 2.4.). Of the 13 trainings, the number of organizations cooperating on a single training event stretched from two to twenty-two. Informal education organizations were the most represented with 67 percent ($n=16$) of all organizations. These organizations recruited students and presenters, and acted as planning team mediators. Educational institutions (21 percent; $n=5$) served as coordinators and program developers. They contributed years of formal education experience to training development. Non-education organizations were the least represented (12 percent; $n=3$). Non-educational organizations were sourced to share local expertise. Experts were sometimes asked to provide contacts to be recruited but otherwise did not perform any training coordination tasks.

All provider collaborations were based on existing relationships. Several of these collaborative partnerships started through contracted services (e.g., City of Everett and Snohomish Conservation District) or by performing work in similar fields (e.g., Stamberger Outreach Consulting and Green Girl Land Development Solutions), others are collaborative by intentional design (e.g., NOAA and South Slough National Estuarine Research Reserve). Yet new relationships with organizations were also formed because planning teams were purposefully assembled to represent the interdisciplinary audience as described below.

Table 2.4. Summary of provider organizations interviewed

Organization type	Organization sub-type
Educational institutions (<i>n</i> =5)	
Portland Community College	Non-Extension
Portland State University	Non-Extension
University of Washington Botanic Gardens	Extension
Washington State University College of Agricultural, Human, and Natural Resource Sciences	Extension
Washington State University Kitsap County Extension	Extension
Informal education organizations (<i>n</i> =16)	
Clean Water Services	Agency/Regulatory Body
National Oceanic and Atmospheric Administration	Agency/Regulatory Body
Oregon Tilth	Agency/Regulatory Body
Washington Department of Ecology	Agency/Regulatory Body
Greenroof Info Think-tank (GRiT)	Nonprofit
Rural Community Assistance Corporation	Nonprofit
Snohomish Conservation District	Nonprofit
South Slough National Estuarine Research Reserve	Nonprofit
West Multnomah Soil and Water Conservation District	Nonprofit
Cascadia Consulting	Private-Education
Herrera Environmental Consultants	Private-Education
Stamberger Outreach Consulting	Private-Education
Urban Forestry Services, Inc.	Private-Education
Building Industry Association of Washington (BIAW)	Professional Association
Northwest Environmental Business Council (NEBC)	Professional Association
Pacific Northwest Control Training Association (PNSCTA)	Professional Association
Non-education organization (<i>n</i> =3)	
Landau Associates	Private
Native & Urban Gardens Inc.	Private
SvR Design Company	Private

2.4.2. Why Interdisciplinary Audiences?

Organizations elected to target interdisciplinary audiences because green infrastructure itself requires multiple disciplinary expertise and relies on multiple stakeholders. From this

central theme, labeled **interdisciplinary reality**, two sub-themes were identified: **address gaps** and **impact** (Table 2.5.).

Educational institutions remarked that they wanted to address gaps in knowledge and understanding across disciplines. This theme, **address gaps**, suggests that an interdisciplinary audience facilitates holistic learning by letting people from different disciplines share their experiences with those less familiar. Representatives acknowledged that practitioners of green infrastructure need to have a mutual understanding of one another's role in order to design functional and practical facilities.

The problem we were looking to address at the symposium demanded that we were [interdisciplinary] because they are all involved in some piece of these larger projects. They need to be able to understand each other's role and each other's motivations and constraints and that was the best way to achieve the balance that we were looking for. - Educational Institution Representative (EIR) 1

The second theme, **impact**, logically concludes that because green infrastructure impacts multiple disciplines, all disciplines should be invited. While this is true on many fronts, targeting a diverse audience is also resource-intensive.

These two themes reappeared in interviews with informal education organizations. While agencies commented that they were mandated to take an inclusive approach, they recognized that inclusivity is necessary to move the field forward. Hence, the mandate only partially explains the motivation for recruiting an interdisciplinary audience. The context in which green infrastructure implementation is performed requires a diverse target audience.

It is sort of our mandate to do, but I think in terms of trying to implement green infrastructure, it is really a multidisciplinary effort. You need people from the design world involved, you need people from the regulatory world involved, decision-makers, obviously. I think that is what makes it both an interesting and challenging endeavor. - Informal Education Organization (IEO) 1

Nonprofits further supported the theme that inclusivity leads to greater growth in the field, leaning on CPE platforms to act as a vehicle to understand connections between disciplines.

The very nature of on-structure vegetation is highly interdisciplinary and that is actually one of the biggest challenges to more successful green roofs and living walls...you have to have a lot of knowledge base... For that reason, we really needed everyone to speak together because it is like a three-legged stool; you can't be missing any one of those legs or else it is going to collapse. - IEO 2

Hosting interdisciplinary audiences exemplified the inter-dependency of disciplines to successfully implement green infrastructure projects. Representatives from educational institutions and informal education organizations consistently supported the themes of addressing gaps and reaching a scope of impact.

Non-education organizations did not have any prominent thematic findings. Since this group comprises the smallest unit with only three representatives, in-depth analysis was limited. One representative did not partake in recruiting efforts and the second representative had no direct comments. The third representative was the only study participant to associate audience size with revenue.

This is a function of balancing the size of the venue with expected revenue. We can make these small and focused at the expense of revenue. We could potentially make smaller, more profitable events that are more tailored. – Non-education Organization Representative (NOR) 1

Representatives purposefully chose to invite interdisciplinary audiences to their trainings to address barriers to effective communication and enhance understanding of disciplinary responsibilities. Representatives also agreed that green infrastructure impacts a multitude of professions and should be inclusive in recruitment efforts.

Table 2.5. Interdisciplinary reality sub-themes and supporting quotes

Sub-theme	Counts	Additional Supporting Quotes	References	Additional Supporting Quotes
<i>Educational institutions</i>				
Address gaps¹	Professionals from different disciplines need to learn from one another to address gaps in practices across disciplines.	Kind of the three-legged stool- the contractor, the facility owner, and the agency or the municipality- the goal being to reach all of those folks and have them all have the same information so that their expectations were kind of known. - EIR 2	Interviews: 5 References: 5	We want to make sure that we have the consultants, the rule makers, the mayors, the solution providers... we have a pretty diverse group of people that get involved in the planning. - IOR 3
Impact²	Green infrastructure impacts a lot of people from different disciplines; therefore, a large audience pool is used.	Interviews: 2 References: 2	Interviews: 6 References: 6	Our permit requirements for low impact development happens at different levels at different disciplines and there is plenty of information that is applicable across disciplines. - IOR 4

¹Count total for address gaps: Interviews: 7; references: 9.²Count total for impact: Interviews: 8; references: 8.

Table 2.6. Balance theme supporting quotes

Counts ¹	Additional Supporting Quotes	References	Additional Supporting Quotes
<i>Educational institutions</i>			
Interviews: 2 References: 5	It is just a wide range of both what they bring to us skillset wise but also when they turn around and go back out to the field what their responsibilities are. So, targeting information that is going to keep everybody engaged ... but can't skip over anything at the same time. [It] is a real tough thing to do. - EIR 2	Interviews: 10 References: 12	Sometimes the knowledge that [the speakers] are putting out there is too basic and sometimes it is too complex. It is based on sort of the average knowledge of those attending. Sometimes it is hard to gage if this is way too technical or if everyone in the room is going to know what they are saying. They do a good job, but that is the challenge. - IOR 5
	We seek to find a balance between making the topic matter rich enough to appeal to those with professional-level knowledge while also not having any topic be at too high a level for someone to whom rain garden related topics are new. - EIR 4		There are different levels of understanding in the room. Often we get folks from large communities that maybe have more expertise and experience with projects. We get people who honestly don't know much about how to develop a project. They don't have a plan; they don't know where to start. - IOR 6

¹Count total for balance: Interviews: 12; references: 17.

2.4.3. Instructional Design for Interdisciplinary Audiences

2.4.3.1 Curriculum Selection and Scale

All organizations agreed that developing curriculum for an interdisciplinary audience was a challenge. Event organizers had to consider how to cater to an audience of not only various disciplines, but also varying levels of experience. Conferences utilized topic tracks to address discipline and expertise discrepancies, but workshops and seminars struggled to strike a balance. The theme labeled **balance** coded the overwhelming comments made about this program development challenge (Table 2.6.). Many worried about the “dewatering of content” and how that had the potential of not meeting student needs and/or expectations.

One challenge is making it relevant and worthwhile to everybody who is attending. Part of that is striking the right balance between presenting information that might be unfamiliar to some people in the room but might be super basic to other people in the room and kind of knowing how advanced or how introductory to make the material. - EIR 1

Expectedly, the barrier in the classroom is illustrative of the barrier in the field. Each green infrastructure practitioner attends a training with different levels of experience and knowledge, making it difficult at best to gauge where the baseline level of knowledge is. One representative made the powerful connection to practice in this comment:

You have people at either end of the bell curve if you will. Some people think that it is not technical enough and they would have liked to get more out of it, and a handful of people thought it was too much or too technical.... but having multidisciplinary trainings also helps to address some of the kind of multidisciplinary styling that is actually significant barrier, we see as a significant barrier to effective implementation. - IOR 4

This theme transcended all organization types. Even representatives with years of education and training experience found it challenging to strike a balance with curriculum.

2.4.3.2. Instructional Design Tools

Provider organization representatives were asked if they used any training models or adult education resources to aid in their planning. While educational institutions did supply some theoretical expertise alongside their collaborative partners, they did not apply well-known adult education theories (e.g., andragogy, Social Constructivism, logic models). Informal education organizations filled this void by leaning on instructional design support in the form of a curriculum review committee or internal instructional design team. These curriculum review committees or internal instructional design teams gave advice on event organization and activities. Four of the thirteen trainings benefited from these resources. Incidentally, at least one learning theory was unknowingly applied and found to be effective.

Experiential knowledge and **existing resources** emerged as two informal instructional design tools (Table 2.7.). These themes were coded simultaneously three times to describe how a training was developed. Hence, both experiential knowledge and existing resources were often used together to plan a training.

I don't think we looked at any specific kind of resources other than just look at other courses and other materials that were out there and from our own background and knowledge and working with stuff in the past and what works well for those types of courses. - IOR 7

Representatives were confident that their experiences attending and facilitating other trainings were credible explanations for selecting program design. This notion is not without merit, as many do have some form of training on communication or education; however, it is interesting that resources on how to plan and execute CPE were not referenced more often. It is unclear from the interview data if this is attributed to the lack of resources on how to conduct CPE trainings, or because it is not in the representative's repertoire to return to guiding principles.

Table 2.7. Instructional design sub-themes and supporting quotes

Sub-theme	References	Additional Supporting Quotes	References	Additional Supporting Quotes
	<i>Educational institutions</i>		<i>Informal education organizations</i>	
Experiential knowledge¹ Past experiences were used to guide instructional design.	Interviews: 1 References: 2	I have done it for 20 years ... it wasn't formalized but I used things that I have learned about teaching classes and doing workshops to develop this in a way that would fit with the learners. - EIR 2	Interviews: 7 References: 12	You know the truth is I have been doing this my whole career. I mean I have been doing this for over 30 years. I would say that what I bring to [the training] is that kind of lifelong work experience and on-the-job training. - IOR 8
Existing resources² Previous training resources were used to assist with instructional design.	Interviews: 2 References: 2	I have tended to just build upon the models that already existed. We kind of just looked at the programming that has been offered here and to learn from what works well and what doesn't and try to build it on what has been successful. - EIR 1	Interviews: 5 References: 5	I mean we have our format that we use for all of our conferences really. We do these kind of niche conferences. - IOR 3

¹Count total for experiential knowledge: Interviews: 8; references: 14.

²Count total for existing resources: Interviews: 7; references: 7.

2.4.4 Skills and Experiences Valuable to all Green Infrastructure Practitioners

Informal education organizations had the strongest insights into valuable skills and experience for all practitioners of green infrastructure: **peer-to-peer learning**, **interpersonal skills** and **networking** (Table 2.8.). Hands-on interactive learning activities with peers were highly regarded as a best management practice for an interdisciplinary audience. Activities were categorized as peer-to-peer learning activities if there was a lively discussion across disciplines or if students physically participated in performing an action as a group. Examples included conducting soil infiltration tests, mock facility inspections, design charrettes, demonstration site tours and small group brainstorming sessions. These activities were coded particularly for their social learning value. Peer-to-peer activities were said to achieve a deeper level of understanding and promotion of cross-disciplinary conversations.

That is the huge benefit I think with the interdisciplinary or how we sort of design the activities ... They are mostly to get people to start talking about green infrastructure and their work and to use language around green infrastructure to talk to each other. That drives creativity in the field and networks and all of that good stuff. - IOR 1

Representatives noticed that when students interacted with one another during these activities, their perspectives shifted and they found a more personal connection to the new information being presented.

Peer-to-peer activities also facilitated **interpersonal skills**, such as communication, listening and mediation. Representatives acknowledged that having an interdisciplinary audience gave students the opportunity to gain new perspectives from their peers that, in turn, made them more flexible when negotiating differences in opinion. Strong interpersonal skills can foster productive conversations:

What we have done with our partnership with [regulator] is sort of bring them closer together, a mutual ground if you will, and begin to sort of talk about these issues in a more civil way. - IOR 3

Reconciling the above two themes, the value of **networking** was mentioned by the half of the representatives. Networking suggests that connections made at the training will extend beyond the boundaries of the event. For example, municipality staff may have networked with agencies to learn about a grant application process and continue conversations via email and phone. Similarly, communities with like climatic conditions may have exchanged best management practices for stormwater management and share project specs. Regardless of the information and resources exchanged, beneficial professional connections were made.

The whole [purpose] with this program was that now people knew each other, so now when they go out to work, they would either work in their own organization or they might network with people that they met at the conference. - IOR 8

Networking opportunities generally emerged during interactive training activities, when professionals had to collaborate or discuss as an interdisciplinary group. Representatives remarked that these three themes, peer-to-peer learning, interpersonal skills and networking, promoted a collaborative learning environment valuable for all practitioners.

Informal education organization representatives provided a keen eye into the challenges and successes of producing valuable interdisciplinary green infrastructure trainings. Their background knowledge on key issues and important stakeholders influenced program development. With additional resources from educational institutions, and credible expertise from non-education organizations, informal education organizations delivered valuable experiential learning environments.

Provider organizations ultimately chose to recruit and train interdisciplinary audiences because the field of green infrastructure requires interdisciplinary collaboration. Representatives relied on experiential knowledge and existing resources to develop trainings. The most challenging part of program planning was achieving a balanced curriculum for a diverse group of students. Despite these challenge, peer-to-peer learning activities were found to facilitate dialogue across disciplines, enhance interpersonal skills and provide opportunities for networking. Practitioners of green infrastructure prefer to learn from and amongst their peers. These finding are examined in the broader context of green infrastructure and social learning theory in the discussion section below.

Table 2.8. Value sub-themes and supporting quotes

Sub-theme	References	Additional Supporting Quotes	References	Additional Supporting Quotes
<i>Educational institutions</i>				
Peer-to-peer learning¹ Students interact with one another through a guided discussion or activity.	Interviews: 1 References: 3	There are certain things that go to heart when your peers bring them up and reinforce them that I can't replicate. - EIR 2	Interviews: 10 References: 16	We do have people share their experiences which we encourage and that has been a great benefit and value in terms of peer to peer information sharing and networking and mutual support. - IOR 6
Interpersonal skills² Communication, listening, and mediation skills.	Interviews: 2 References: 2	I just think getting people together to talk about, we are all working on the same thing, you know, but from a different angle, to just start having conversations we learn more from each other... when we were talking about it, it gave them a different idea about how to address the things they see as problems. - EIR 5	Interviews: 8 References: 11	It is kind of assembling a feedback loop and you see things when you maintain a facility that may change how you design things in the future. - IOR 7
Networking¹ Students make professional connections with peers.	Interviews: 1 References: 2	...I've seen them taking advantages of those opportunities and looking for career opportunities with the contacts that they've met. - EIR 1	Interviews: 10 References: 18	The networking value, which is always very important. We have people that got to conferences and never got to sessions. They stand in the hall and talk the whole time, and that is fine. - IOR 3

¹Count total for peer-to-peer learning: Interviews: 11; references: 19.²Count total for interpersonal skills: Interviews: 10; references: 13.³Count total for networking: Interviews: 11; references: 20.

2.5. Discussion

Interdisciplinary green infrastructure CPE trainings are one tool provider organizations can use to increase the technical and interpersonal competencies of green infrastructure professionals. Trainings bring relevant and timely technical knowledge to students, while also providing a platform for interdisciplinary collaboration to happen in an uncontested atmosphere. Provider organizations have recognized that green infrastructure is not a discipline that should be taught in silos; rather, it should reflect the interdisciplinary reality of the environment. This atmosphere facilitates knowledge sharing and creates social capital (Patterson, Smith, & Bellamy, 2013). Without fully recognizing it, provider organizations in this study have applied the theory of Social Constructivism to achieve balanced and effective trainings that promote interdisciplinary collaboration.

Social Constructivism, also known as Piagetian Constructivism, is a learning theory that argues that learning is an active process, whereby adults learn when they actively converse with their peers and negotiate new knowledge, constructing their own meaning through the process (Paour, 1990). Reality, knowledge and learning provide the foundation for social constructivists (Kim, 2001). Through social interactions, students formulate their perspective on the reality of the environment. Knowledge is then created through those interactions, to which the student has a personal connection. Learning requires social interaction to be most effective. Trainings provide the “scaffolding” for students to construct or build new knowledge with existing knowledge. This theory regularly bolsters experiential learning activities and discussions to disseminate new information that is pertinent and meaningful to students. Baldwin and Rosier (2015) have recommended experiential learning activities for planning education, advising

instructors to have student-centered experiential learning activities that are practical, guided and offer opportunity for reflection.

Provider organizations in this study consistently expressed the value of having engaging local presenters. Local presenters are able to deliver new information in a relatable context to their peers (Carlet, 2015). Their realities are similar in mindset to the students, which enables students to incorporate new knowledge with preexisting knowledge more effectively. Local presenters are often champions of innovation – persistent and enthusiastic voices who are able to speak confidently to the success of an innovative technology (Howell, Shea, & Higgins, 2005). Champions of innovation go beyond expertise in a subject and speak to cultural and contextual obstacles. In the context of green infrastructure, these champions are spreading ecological wisdom (Wang, Palazzo, & Carper, 2016). Wang et al. (2016) defines ecological wisdom as “the willingness and ability to integrate expert ecological knowledge with site-specific familiarity in gaining stakeholder support for actions to enhance human experience.” Professionals with ecological wisdom are competent, responsible and relatable. Students want to learn from someone with these credentials. Thus, local presenters can engage with their peers and invite active discussion, through which knowledge can be transformed.

The cultural and contextual obstacles that peers discuss with one another act as a bridge, connecting disciplines to one another. When a groundskeeper presents his/her challenges to maintaining a parking lot bioswale, their expertise about the plants, soil and site invite conversation from peers in periphery disciplines. An arborist may provide recommendations on a pruning technique, whereas a planner may have the historical background about design intent. These comments evolve into constructs of the environment, and through social interaction each

professional acquires new knowledge. Furthermore, interpersonal skills are gained because the practitioners have a better understanding of each other's responsibilities.

Experiential learning activities can take a variety of formats in the field of green infrastructure. Demonstration site tours and guided roundtable discussions, while sometimes unstructured or casual, can still foster an experiential learning environment. Peer-learning sessions, where local experts host short presentations at a site of interest, require minimal organization and student resources. Sessions could be scheduled over the lunch hour in a central location and have a targeted audience. Sustainably designed sites, such as arboretums, ecoroofs, LEED certified buildings and greenways provide design elements to which multiple disciplines can relate. These experiences offer an informal atmosphere for professionals to learn from one another in anticipation of future collaborative projects.

Cooperative collaboration at the provider organization level ensures that students receive timely and relevant information. Findings from this study suggest that provider organizations collaborating on interdisciplinary green infrastructure CPE trainings should use available instructional design resources such as logic models to incorporate experiential learning activities. Furthermore, provider organizations should look to one another for expert advice on technical and interpersonal student needs.

2.5.1. Directions for future research

Green infrastructure is still a young and evolving field of interdisciplinary science. Research on technical barriers to green infrastructure implementation should continue, but results should be applied to, and shared with, CPE programs. This partnership would reveal specific knowledge gaps between researchers or academics, and practitioners. A second direction for future research could take a closer look at student needs and preferred learning styles, tapping

into concrete student motivations. Student needs and learning styles may be linked to discipline and respective work environments, which in turn could influence CPE. There is also an opportunity for future research on Train the Trainer (TTT) programs. The objective of TTT programs is to train new instructors by providing formal coaching to inexperienced facilitators (Russo, 2016). In the medical field, TTT programs have been shown to effectively disseminate knowledge, improve physician behavior and increase confidence (Field, Burke, McAllister, & Lloyd, 2007; Pearce et al., 2012). A green infrastructure TTT program could target local champions and teach them how to run effective trainings.

2.5.2. Limitations

The study criteria and small sample size limit research findings to similar green infrastructure trainings in the Pacific Northwest. Inter-coder reliability, or coder comparison, was not used in this study, thus results should be interpreted with some caution. Furthermore, this study did not include webinars as a possible CPE opportunity. Webinars have become increasingly popular in recent years and including them from the study sample may have produced slightly different results.

2.6. Conclusion

This study shows that provider organizations, and more specifically informal education organizations, have an important role in providing valuable curricula to green infrastructure practitioners. Provider organizations of green infrastructure continuing education program--who must collaborate to offer these programs--recognize that green infrastructure professionals need to learn from and with one another in order to expand their perspectives and develop interpersonal skills. Experiential learning opportunities that foster peer-to-peer learning, communication skills and networking can effectively achieve training objectives focused on

collaboration and rapport-building. Findings from this study suggest that CPE can be an effective learning platform that connects disciplines with one another and spurs collaborative problem solving.

Green infrastructure is a constantly evolving area of interdisciplinary science that requires ongoing education. To ensure that practitioners stay current, provider organizations should offer interdisciplinary trainings that incorporate technical innovation with interpersonal skill development. As shown by this study, many provider organizations recognize that experiential learning opportunities are enjoyable and effective ways to learn new skills. Organizations should continue to leverage the pragmatic applications of these activities.

3. Manuscript 2: Tools that Tell the Tale: A Case Study of Evaluation Tools Applied to Interdisciplinary Green Infrastructure Continuing Professional Education Trainings

3.1. Introduction

The dissemination of innovative technologies has long relied on continuing education platforms for knowledge and skill transfer across social networks (Katz, Levin, & Hamilton, 1963). In these social learning environments, field experts share their experiences and instill confidence the efficacy of new technology, cultivating new users overtime (Carlet, 2015; Howell et al., 2005; Virkkala, 2007). This is especially true for the emerging field of green infrastructure, an approach to stormwater management and natural resource planning that replaces traditional grey infrastructure with vegetation, soil and other mediums to treat and manage stormwater at the source and provide additional social, economic and environmental benefits (EPA, 2016). As innovation with green infrastructure practices continues to refine job skills, professionals in related industries--particularly architects, engineers and planners--are turning to professional conferences and on-the-job trainings to stay current (Ahn & Pearce, 2007; Consoli et al., 2016; Dalton, 2007; Sample et al., 1999). Furthermore, the challenges of today's complex social, economic, and environmental systems have demanded that professionals in green occupations perform analytical skills at high levels (Carrion-Crespo, 2011; Consoli et al., 2016), moving training beyond technical competency and into the arena of professional development.

Over the past two decades, the demand for a competent green infrastructure workforce of architects, engineers, land care professionals, planners, etc., hereinafter referred to as “green infrastructure practitioners” has grown (Carlet, 2015; White & Boswell, 2007), and is expected to increase as occupations in environmental science and engineering continue to maintain faster than average job growth (BLS, 2015). Recent studies have called for continued research on skill creation in the realm of green jobs (Consoli et al., 2016) and curriculum development of existing

certification programs (Water Environment Federation, 2015; Carrion-Crespo, 2011). In response to this call, several stormwater certification and certificate programs have emerged (i.e., DC Water's National Green Infrastructure Certificate, American Public Works Association's Certified Stormwater Manager, Washington Stormwater Center's Low Impact Development Operations and Maintenance Certificate Program), however these programs are still in their infancy and there is limited information regarding their instructional design and effectiveness (WEF, 2015; APWA, 2016; WSC, 2017).

Demands for green infrastructure skill development are especially relevant in the Pacific Northwest region of the United States where green infrastructure for stormwater management has become an integral part of community and environmental resiliency. Portland's Grey to Green initiative and Seattle's Street Edge Alternatives program (commonly called SEA streets) are just two examples of how green infrastructure is being incorporated into highly urbanized and impervious landscapes to manage stormwater and meet federal National Pollutant Discharge Elimination System (NPDES) permit requirements (City of Portland, 2017; Seattle Public Utilities, 2016). State environmental agencies from Oregon and Washington have served as a catalyst for green infrastructure adoption by providing practitioners with document clearing houses like the Washington Stormwater Center (www.wastormwatercenter.org) and adaptable resources like Oregon's *Template for LID Stormwater Manual for Western Oregon* (WSC, 2017; DEQ, n.d.). Appropriately so, the region has become fertile ground for research and training on these practices, producing a mosaic of both formal academic and informal Continuing Professional Education (CPE) opportunities.

Organizations offering interdisciplinary green infrastructure CPE trainings span the dimensions of academia, extension, private industry, government and nonprofits, all with the

common mission of reducing the environmental impact of nonpoint source pollution. However, each provider organization approaches training differently, incorporating their values into the training experience, curriculum design, and evaluation techniques (Kirkpatrick, 1994; Kowalski, 1988; Michalski & Cousins, 2000).

Historically, planning for adult education workshops, seminars and conferences has been a simplistic linear process beginning with a needs assessment, recruitment of a representative planning team, development of objectives and curriculum, and implementation of an evaluation mechanism (Kowalski, 1988, p.150); although this final step of evaluation is often neglected (Bernthal, 1995). The rise of free electronic survey tools, such as SurveyMonkey®, have made it easier than ever before for provider organizations to quickly create and distribute evaluation surveys via email links. These standardized but informal evaluation surveys are the familiar and preferred evaluation tool to measure training satisfaction. Yet training evaluation surveys often fall short of providing meaningful data, such as new skills acquired. Moreover, they can mislead organizers into believing that the training met learning objectives and will result in increased competency without actually measuring for that effect (Darkenwald & Merriam, 1982). For example, positive feedback on a survey evaluation does not necessarily equate to achievement of stated objectives or of knowledge gain. There are other evaluation tools available, such as interviews, focus groups, reflection and observation, that may more accurately assess competency in new skills, retention of material and satisfaction, though these tools take more resources to develop, implement and interpret (Bernthal, 1995; Kirkpatrick, 1994; Kowalski, 1988).

This study examined the challenges and opportunities associated with evaluating interdisciplinary green infrastructure CPE trainings in Oregon and Washington. Two questions

guided the study design: 1) how do CPE providers evaluate the success of their trainings; and 2) what evaluation tools do they apply to measure success? This study analyzed both informal and formal methods of evaluation using a mixed-methods approach of interviews with training providers and content analysis of workshop survey evaluations. Kirkpatrick's Four-Levels of Training Evaluation, a holistic and flexible approach to program evaluation that looks at reaction, learning, behavior and results was applied to aid investigation (Kirkpatrick, 1959). These four levels provided a framework for the evaluation, leading to a more thorough examination of the approaches CPE providers use for interdisciplinary green infrastructure trainings. This study aims to advance knowledge of the evaluation methods available and in use by organizations providing CPE in the field of green infrastructure.

3.2. Literature Review

The first part of this literature review examines the purpose of evaluating CPE trainings, offering a summary of why and how evaluation is traditionally performed and justification for its integral role in developing effective trainings. Part two introduces Kirkpatrick's Four-Levels of Training Evaluation as a tool for examining interdisciplinary green infrastructure CPE trainings. Part three discusses the onset of electronic survey tools as a cost-effective and attractive tool for survey evaluation distribution.

3.2.1. Purpose of Program Evaluations

CPE provider organizations vary in interdisciplinary trainings, and many of these organizations do not have a background in evaluation (Darkenwald & Merriam, 1982; Anderson, Smith & Hammick, 2015), let alone time and resources to dedicate to evaluation (Bernthal, 1995). Program evaluation is an important step to assessing training effectiveness and student satisfaction, two factors that guide program organizers on how to improve upon current

instructional design (Kirkpatrick, 1994). While program evaluation can and should be tailored to each program, Kowlaski (1988, p.150) advises four standards to achieve meaningful evaluation of adult education: a) data should be collected with the intent of future application; b) methods should be precise, and provide ‘objective information of “what is” not “what should be”’; c) evaluation should drive decision-making; and, d) evaluation is a process and subject to ongoing criticism. Moreover, evaluation should complement the planning process, reinforcing theory-informed ideas that have been proven to reach program objectives and adapt ideas that may be less clear (Kirkpatrick, 1994; Kowalski, 1988).

In the specific case of interdisciplinary trainings, theory-informed evaluation can play an important role in informing providers of which training experiences best foster collaborative practice. Educators of interprofessional education courses in the medical profession recently observed this disconnect between course objectives, learning theory and evaluation and responded with theory-driven curriculum evaluation (Anderson, Smith, & Hammick, 2015; Frye & Hemmer, 2012; Reeves et al., 2011). Frye and Hemmer (2012) define theory-driven curriculum evaluation as an approach to evaluation that uses guiding research questions to identify evaluation objectives and fitting theoretical frameworks. Thus, there is no ultimate theory or evaluation approach appropriate for each training, but rather the aims of the training program should define what theories and subsequent evaluation techniques are appropriate.

3.2.2. Kirkpatrick’s Four-Levels of Training Evaluation

Donald Kirkpatrick’s four-level approach to training evaluation has offered training providers a simple methodical approach to program evaluation since its’ introduction in 1959 (Kirkpatrick, 1959). The Kirkpatrick four-level framework promotes the use of survey tools, focus groups, and interviews for effective and reliable evaluation at four levels: reaction,

learning, behavior and results (Kirkpatrick, 1994) (Table 3.1.). Although traditionally used in the fields of business and leadership development, the framework has recently migrated into science-based fields and higher education. The healthcare field favors this approach for its focus on learner-centered outcomes (Abdulghani et al., 2014; Anderson et al., 2015; Frye & Hemmer, 2012). Each level of evaluation is valuable and offers training organizers different information about the program. However, as the levels progress, the methodology and evaluation tools applied become more complex and resource intensive. The four levels are described further in the following subsections. Limitations and alternatives are discussed thereafter.

Table 3.1. Adapted Outline of Kirkpatrick's Four-Level Evaluation Framework (Chang & Chen, 2014; Kirkpatrick 1994)

Level	Characteristics	Tools	Example questions
<i>Level 1</i> Reaction	How students feel about the training or learning experience.	<ul style="list-style-type: none"> • Focus group • Interview • Survey evaluation 	<ul style="list-style-type: none"> • How well were the learning objectives met? • What was the most valuable part of the workshop? • What was the least valuable part of the workshop?
<i>Level 2</i> Learning	A measurement of the increase in knowledge or skills from before to after the learning experience.	<ul style="list-style-type: none"> • Focus group • Group assignment • Interview • Performance record • Survey evaluation • Written report 	<ul style="list-style-type: none"> • How well did you master the following learning objectives? • What is your level of understanding of [topic]?
<i>Level 3</i> Behavior	Students apply what they have learned from the training to their place of work.	<ul style="list-style-type: none"> • Interview • Performance record • Delayed survey evaluation • Written report 	<ul style="list-style-type: none"> • How will you apply the new skills you learned to your place of work? • Has your behavior changed as a result of the training?
<i>Level 4</i> Results	How the training impacts the students place of work. Whether it evoked organizational change.	<ul style="list-style-type: none"> • Delayed survey evaluation • Interview 	<ul style="list-style-type: none"> • Has organization performance improved? • Did the training lead to more informed decision-making by decision-makers?

3.2.2.1. Level One: Reaction

Most program evaluations typically reach the first level of Kirkpatrick's model - reaction, which asks students for an assessment of the training, program or course. Questions typically relate to satisfaction with the facilitator or instructor, materials and content delivered. Level One includes relevancy, points of confusion or weaknesses and overall satisfaction. In one senior-level engineering course, undergraduate educators applied a survey evaluation tool to measure student's perceived usefulness of a modeling software (Diefes-Dux, Samant, Johnson, &

O'Connor, 2004). The evaluation tool allowed students to identify problems and propose potential solutions, providing instructors tangible feedback on curriculum design.

Evaluation and training researchers have failed to reach consensus on what constitutes a reaction question. For instance, Kirkpatrick emphasizes the value of instruction, stating that good instruction should result in a satisfactory experience (1994). Bernthal (1995) separates the quality of instruction from reaction arguing that poor scores associated with instruction could be a manifestation of student resentment and frustration towards new policies or practices. Regardless, both viewpoints provide insight into student perspectives of training highlights and lowlights, and provide evaluators with information to guide future decisions.

3.2.2.2. Level Two: Learning

Level Two evaluates the quantifiable skills and information that were learned during the training. At this level, the evaluation tool should be performance-based and measurable (Kirkpatrick, 1994). In the context of green infrastructure, appropriate Level Two evaluation measures could include simulation activities, conducting inspections and completing checklists, or site analysis. In cases where demonstrating knowledge in the field has been impractical, instructors have asked landscape architecture students to demonstrate their knowledge of site design principles by creating a list of design features and providing justification for the selected features (i.e., functionality and placement). Students then receive constructive feedback on their conceptual designs from instructors or experts, and the students revise their designs accordingly (Hansen, 2012).

Healthcare educators have taken similar approaches to measure learning, critiquing interprofessional education courses in developing Asia countries to ensure medical professionals are competent in designing collaborative programs (Kim et al., 2015). These approaches, while

time-consuming, offer direct feedback to the instructor about which concepts are being grasped by the students, and which concepts deserve more attention or clarification. If hands-on assessment activities are not feasible (typically due to time and resource constraints), survey evaluation tools can include self-assessments of learning comprehension and skill proficiency.

3.2.2.3. Level Three: Behavior

Level Three is the application of newly acquired skills and the transformation of knowledge into action at a place of work. This level assesses whether the student's behavior will change because of what they learned from the training, which can be measured using delayed surveys, interviews or other face-to-face observations (Chang & Chen, 2014). Level Three assessments attempt to link workshop training with the work environment. Unlike the Level One and Level Two assessments, Level Three assessments can uncover institutional opportunities (e.g., supportive managers and administrators) and barriers (e.g., constrained budgets) that enhance or inhibit a student's application of new knowledge and skills from a workshop training to their job (Bernthal, 1995). As an emerging technology, green infrastructure has been met with resistance from city staff, the public and decision-makers (Carlet, 2015; Keeley, 2013; White & Boswell, 2007) and could benefit from reliable evaluation measures illustrating the connection between training and behavior change.

3.2.2.4. Level Four: Results

At the broadest level, and arguably the most difficult to assess, is results. Level Four assessments aim to measure the greater purpose of the training and can include immediate tangible accomplishments, such as materials produced, money saved or improved quality of work (Kirkpatrick, 1994, p.64). It is the level that measures "proof of concept." For example, Level Four assessments for green infrastructure trainings provided to jurisdictions could include

the number of permits completed and collected, new codes or policies enacted that support or promote green infrastructure, and/or greater maintenance of LID facilities. Level Four assessments have been traditionally difficult for organizations to implement with limited resources (imagine trying to compare students to a control group or perform a return on investment), and are often excluded from analysis because it is simply too difficult to measure improved performance (Kirkpatrick, 1994, p. 64). In response to these challenges, Kirkpatrick and Kirkpatrick (2007) revised earlier recommendations and now suggest that stakeholders define the desired results. In a study evaluating leadership development programs in the field of medicine, training organizers referred to a steering committee to develop program objectives. Stakeholders on the steering committee expanded the zone of influence beyond the students in the course and were able to use their experiences to drive additional organizational change (Throgmorton, Mitchell, Morley, & Snyder, 2016).

3.2.2.5. Limitations to the Kirkpatrick Four-Level Training Evaluation Framework

The literature on Kirkpatrick's Four-Level Training Evaluation is robust, however academia has failed to reach consensus on full intent and applicability of the framework. While Kirkpatrick (1996) did not intend for his four levels of evaluation to be interpreted as a model it has been studied as one nonetheless. Evaluation experts have critiqued the "model" for decades (Alliger & Janak, 1989; Bates, 2004), adding and adapting it as they feel appropriate. The framework can be interpreted as incomplete because it fails to acknowledge student preferences and organization context (Bates, 2004). It has also been critiqued for suggesting causal linkages. Kirkpatrick argues that positive evaluation is the result of effective trainings (1994); however, that evidence does not extend beyond the reaction level into other levels (Bates, 2004; Holton, 1996). A third limitation - incremental importance of information – pegs the levels against one

another, suggesting that reaction is the least valuable form of evaluation, and results the most valuable (Alliger & Janak, 1989; Bates, 2004). However, this can be argued as an interpretation. As evaluation tools reach additional levels of the framework or progress further into the model, they often provide more information or are more telling of a program's value. Nevertheless, Kirkpatrick's framework can also be used in conjunction with other education and evaluation models, such as logic models, as recommend by Frye and Hemmer (2012).

3.2.3. Alternatives to Kirkpatrick Four Level Framework: Logic models and TOP models

Kirkpatrick's multi-level framework is not the only theoretical evaluation model applicable to interdisciplinary green infrastructure CPE trainings. The National Oceanic and Atmospheric Administration's (NOAA) *Designing Education Projects* planning guide promotes the use of logic models and Targeting Outcomes of Programs (TOP) to plan programs that meet immediate, short-term and long-term outcomes, with evaluation accompanying the process (2009). Logic models are program planning tools that connect program goals and related activities with targeted outcomes (W.K. Kellogg Foundation, 2004). Drawn with boxes and arrows, logic models visually communicate learning that occurs between inputs and outcomes (Figure 3.1.). The medical profession has found logic models to be an asset to the program development process by enabling them to link activities to intended outcomes and identify appropriate methods of evaluation (Parker, Burrows, Nash, & Rosenblum, 2011).

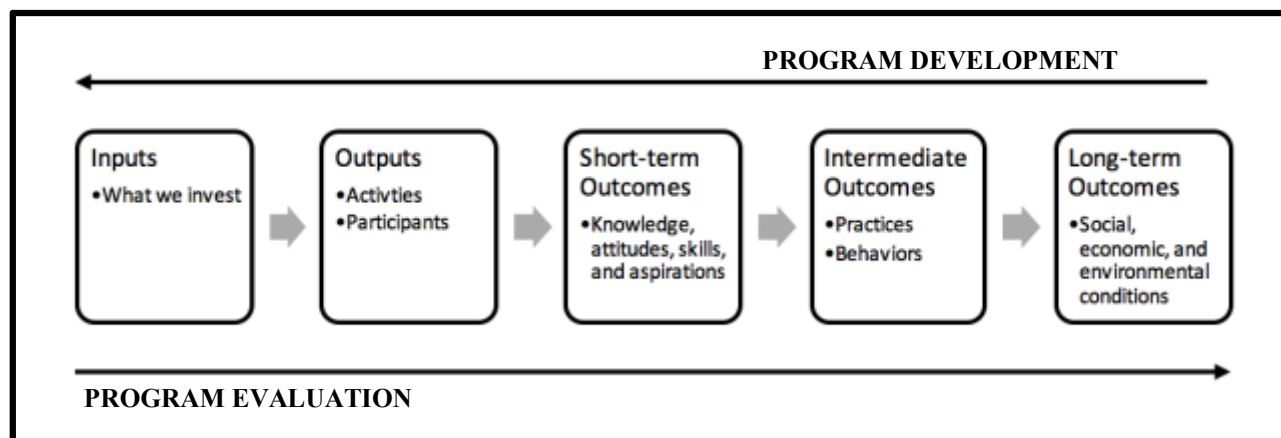


Figure 3.1. Project logic model. Adapted from NOAA (2009) and W.K. Kellogg Foundation (1998)

Alternatively, the TOP model uses a hierarchical approach to solving social, economic and environmental problems by targeting specific outcomes, tracking progress towards outcomes, and evaluating program impact (Rockwell & Bennett, 2004). In this model, seven 'steps' of a reflected staircase guide educators and organizers through program development and program evaluation (Figure 3.2.).

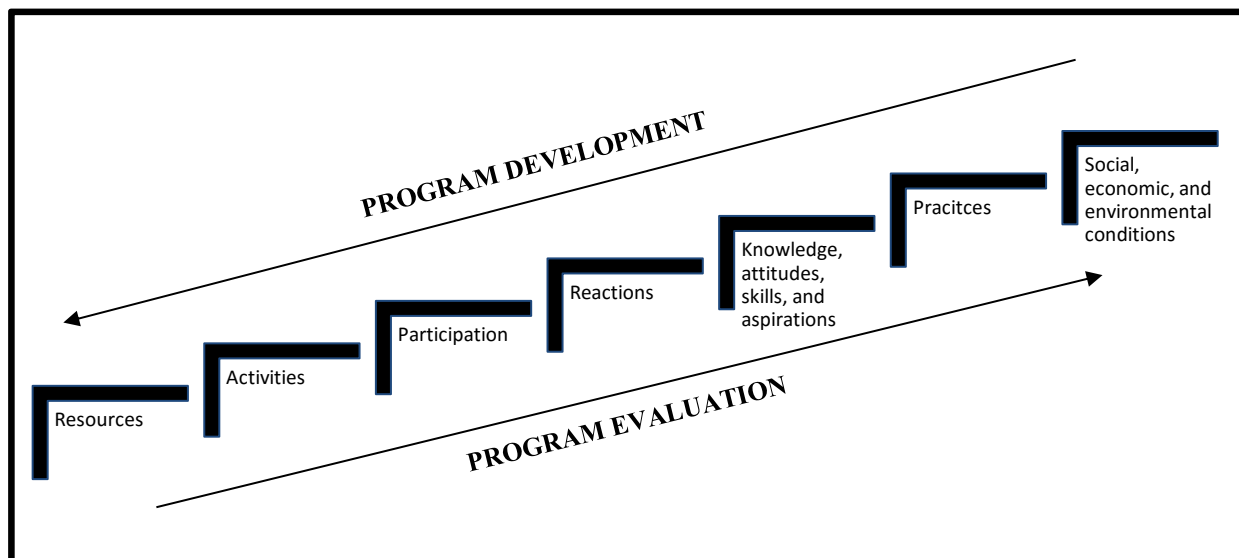


Figure 3.2. TOP model programming staircase. Adapted from NOAA (2009)

3.2.4. Electronic Survey Tools

Electronic survey tools (also known as Web-based surveys) have evolved over the past two decades and have been heavily compared and contrasted to traditional paper-based methods (Archer, 2003; Greenlaw & Brown-Welty, 2009; Sun & McClanahan, 2003). When electronic survey tools were initially developed, practitioners reported the process of building surveys as laborious (Shannon, Johnson, Searcy, Lott, & others, 2002); however, recent advancements in technology and increasing familiarity with web-based tools have made designing surveys easier now than ever before (Couper, 2000). Electronic survey tools offer question templates, permitting quick survey design that is flexible to the developer's needs. Data is readily available to survey developers, enabling trainers to generate quick reports for administrators and sponsors (West, 2007; Wissman, Stone, & Schuster, 2012). Furthermore, West (2007) reported respondents feeling less distracted and rushed when completing a training evaluation online as opposed to in-person, resulting in higher-quality responses.

Many free survey tools were built by professionals in the technology sector, not necessarily "survey methodology professionals," though the latter group do have a favorable opinion about electronic survey tool use and cost-effective applicability (Shannon et al., 2002). Survey researchers and academics with specialized training in survey design have examined the use of electronic surveys for research purposes favoring electronic survey tools for their ability to reduce costs in time and labor, data entry error, automation and analysis (Couper, 2000; Greenberg, 2005; Greenlaw & Brown-Welty, 2009; Sun & McClanahan, 2003). However, this research also points to some validation issues tied to electronic surveys, primarily maintaining respondent confidentiality, sampling procedures and response rate (Couper, 2000); concerns likely moot for CPE trainings with registration. Normally training evaluation surveys are not

intended to carry statistical significance; however, some principles of survey design, such as balanced scales and reliable methodology, may still aid in producing a reliable tool.

Limited literature on ‘informal’ uses of electronic survey tools by businesses or nonprofits for internal and external evaluation exist outside the of land-grant university extension. University extension professionals credit commercial electronic survey tools, such as SurveyMonkey®, as an attractive cost-effective solution to training evaluation (Archer, 2003; West, 2007; Wissman et al., 2012). Superficial advantages of electronic surveys, such as attractive formats and flexible design, are balanced with practical advantages, like readily available results, reduced errors in data entry and ease of data analysis (Archer, 2003; Greenberg, 2005; Greenlaw & Brown-Welty, 2009; Van Selm & Jankowski, 2006; West, 2007; Wissman et al., 2012). Since interdisciplinary green infrastructure CPE trainings range in duration and location (classroom setting or field setting), electronic survey tools can be a suitable option for some organization providers.

One disadvantage to electronic survey tools is the assumption that participants have access to the internet (Greenberg, 2005; Greenlaw & Brown-Welty, 2009; Lewis, 2016; Shannon et al., 2002; West, 2007). As of 2015, the National Telecommunications and Information Association reported that 27 percent of U.S. households, notably those in low-income communities, did not use the internet at home (Lewis, 2016). If audience participants include members of the public, especially in underserved, low-income communities, an alternative approach is advised. Secondary education often required of green infrastructure professionals suggests that most green infrastructure practitioners who attend interdisciplinary CPE trainings have access to the internet at their workplace. Nevertheless, as green infrastructure migrates into the fields of environmental justice and equity and inclusion, training organizers should consider

whether or not electronic evaluation surveys are an appropriate tool for respondents less familiar with digital technologies (Greenlaw & Brown-Welty, 2009; West, 2007), thereby leading to low response rates (Shannon et al., 2002).

This literature review highlights the role evaluation plays in program planning. Organizations that provide interdisciplinary green infrastructure CPE trainings may be unaware about how to systematically apply evaluation tools because they lack formal program evaluation training. As such, this study aims to understand what evaluation methods are currently being applied with the intent of highlighting opportunities for enhanced application of evaluation tools. Kirkpatrick's Four-Level Training Evaluation Framework was selected to guide this inquiry for its flexibility, recognition and ease of use. Since organizations providing interdisciplinary green infrastructure CPE trainings are diverse themselves, this framework aligns with the context of the study.

3.3. Methodology

3.3.1. Study description

This study is a component of a larger research project exploring interdisciplinary green infrastructure CPE trainings. For this study, a mixed-mode approach of interviews and document analysis from trainings in Oregon and Washington was applied to answer the following two questions: 1) how do CPE providers evaluate the success of their training programs; and, 2) what evaluation tools do they apply to measure success? Previous research on evaluation of CPE programs is limited to only quantitative studies outside the disciplines of green infrastructure; using a combined qualitative study with content analysis may reveal new information and phenomena regarding green infrastructure CPE programs. Interviews are an effective information-gathering technique when trying to address specific exploratory questions (Salant

and Dillman, 1994). Through these interviews it was uncovered that typical training evaluation practices included evaluation surveys, which prompted collection to use for content analysis. The qualitative interview data and the content analysis of program evaluation surveys provide a comprehensive picture of how trainings are both formally and informally evaluated.

3.3.2. Study Sample Criteria

This study took a selective sample of green infrastructure CPE trainings in the Pacific Northwest to interview training organizers and analyze evaluation tools. CPE is labeled as the formal platform for professionals to gain skills in communication, collaborative problem solving, and conflict resolution (Sample, Ringgold, Block, & Giltmier, 1999). This inclusive definition of CPE permits workshops, conferences, and other organized learning events to be eligible for the study. Study criteria was organized into the following five categories: date, location, topic, audience and provider organizations. CPE trainings were considered if they were conducted between September 1, 2013 and December 1, 2016 and held in Oregon or Washington. The date restriction was established to capture a wide pool of suitable CPE trainings that reflect the timeliness of green infrastructure innovation while also limiting error from conducting retrospective interviews. The geographic scope was selected for convenience and relevancy. Oregon and Washington have embraced green infrastructure as a tool for achieving watershed health, having implemented state-wide programs and policies to support adoption (DEQ, n.d.; WSC, 2017). Trainings also had to meet curriculum or topical criteria including: 1) learning objectives directly related to green infrastructure practices (e.g., bioswales, rain gardens, green roofs, urban forests), policies, and/or regulations; 2) promote an interdisciplinary learning environment as shown by training providers representing at least two different organizations, and potential students spanning several different disciplines; and 3) training organizers utilized a

survey evaluation tool for assessment. These three criteria capture the complexity of interdisciplinary collaboration in the field of green infrastructure.

3.3.3. Interviews

A semi-structured interview protocol was designed to gain insight into how provider organization representatives evaluated the program *themselves*. Interview questions were reflective in nature, and included: 1) asking providers to share general to specific constraints and benefits to offering the training to an interdisciplinary audience with a range of expertise and experience; 2) what they would or have changed to make the training(s) more successful; and, 3) what evaluation tools for measuring training success were applied.

Provider organization representatives that met the above criteria were contacted for a phone interview via email or telephone. Representatives included academic professors, municipality staff, extension officers and private consultants. Data from interviews were transcribed and thematically coded in Nvivo. This qualitative analytical software does not perform analysis, but rather organizes the data to aid in theme analysis (Leedy & Ormrod, 2013; p.159; Bazeley & Jackson, 2013). Thematic analysis was conducted by highlighting segments of narrative data representing a pattern or theme (coding), sometimes annotating thoughts associated with the data, and then later gathering the data to be analyzed. Interview data was coded for 1) the types of activities performed--which often have a measurable or test-like element to them; 2) statements of reflection or observation about successful and unsuccessful modules of a program; and, 3) explanations of the survey evaluation tool implemented. Nvivo qualitative software allowed for flexibility in coding, ensuring that all reflective thoughts and observations stated by the training providers could be captured throughout the entire interview process. Data from interviews are embedded within the results narrative and with thematic tables

that include key quotes, along with interview and reference counts. The interview count represents how many interviews contained the theme. The reference count represents how many times the theme was coded.

3.3.4. Survey evaluation tool content analysis

While surveys are only one tool of evaluation, they are arguably the most common tool organizations use to assess program success. A content analysis was used to investigate the level of evaluation reached by provider organizations, resulting in a mixed-mode study where qualitative narrative data is accompanied by quantitative frequency data. Content analysis applies a systematic and replicable procedure to identifying patterns, themes or biases in a set of material (Leedy & Ormrod, 2013. p.148). To understand trends and preferences in proctoring survey evaluation tools, representatives were asked if the survey evaluation tool was distributed to students onsite through paper-based methods or online via a commercial electronic survey software.

After an initial review of the survey evaluation tools collected, patterns and themes were identified and a procedure was established. Each question was assigned two attributes. To better assess the level of evaluation reached, questions were first categorized into one of four *question types*: demographic, reaction (Level One), learning (Level Two), behavior (Level Three), or solicit. Results (Level Four) was not included as a possible question type because none of the survey evaluation tools examined did had any result-oriented questions. Next, questions were categorized by *question format*: multiple choice, rank, scale, or open-ended. Question format was recorded to illustrate how the evaluation surveys were structured. Table 3.2. provides definitions for all categories and examples. This procedure provides a snapshot of the level of evaluation being measured based on Kirkpatrick's first three levels.

Table 3.2. Content analysis categories for question type and question format

Question type	Examples
<i>Demographic (D)</i> Asked participants about their profession, organization, role, race and ethnicity, or motivation for attending the training. These types of questions gather information on the participant and are often used to create a participant profile.	Which of the following best describes your primary role? Why did you attend? Please tell us how you heard about this course.
<i>Reaction (R)</i> Questions that pertained to the training's organization, instruction, and content presented. Includes initial reactions to the experience. Kirkpatrick Level One.	How well were the following objectives met? Which sessions were most useful to you? Rate the overall conference.
<i>Learning (L)</i> These questions attempted to measure how much learning occurred as a result of the training. Learning attempts to measure the level of understanding of material. Kirkpatrick Level Two.	How well did you master the following objectives? After this course, what is your level of understanding of the material covered?
<i>Behavior (B)</i> Questions were classified as 'behavior' if they attempted to measure a future change in behavior in response to the workshop. Kirkpatrick Level Three.	I plan to make the following changes when I return to work.
<i>Solicited (So)</i> Requests suggestions for improving the training, topics for future trainings, and other general comments.	What aspects of the training could be improved? How important are these topics to include in future events?
Question format	Examples
<i>Multiple choice (M)¹</i>	Select from a list Yes/No
<i>Rank (Ra)</i>	Label responses in order of importance
<i>Scale (S)²</i>	Excellent, Average, Poor Strongly Disagree – Strongly Agree Not important – Essential
<i>Open-ended (O)</i>	Text box Blank lines

¹Questions that were repetitive in nature, such as asking for the same question for all sessions of a program or rating all instructors were considered one question.

²For multiple choice question format, 'other' was often an option. Despite the open-ended option these questions were classified as multiple choice.

²For scale question format, 'comments' were often solicited so that participants may expand upon their answers. Depending upon the context of the question, these questions were sometimes classified separately.

3.4 Results

Nine trainings met study criteria and 15 interviews were conducted with provider organization representatives who organized and collaborated on the trainings. Interviews ranged from approximately 20 to 70 minutes in length. All but one interview was conducted over the phone and audio recorded with the consent of the provider organization representative. The additional interview was conducted over email due to scheduling conflicts. Representatives interviewed varied across the green infrastructure professional landscape and are in general representative of the diverse population of green infrastructure practitioners carrying out interdisciplinary CPE trainings. Academic institutions, private consulting firms specializing in environmental training, and nonprofits were equally represented with three interviews each. The remaining six interviews included one each of the following organization types: business association, private engineering and environmental consulting firm, municipality, designated management agency, and state and federal government agencies. Table 3.3. provides a summary of the trainings, provider organizations, and representatives interviewed.

The following results are organized into three sections. First, an overview of the interview data describing representative's evaluation and perceptions of their workshops are presented. This data is accompanied by the content analysis of the survey evaluation tools applied by provider organizations. Results from the survey evaluation tool content analysis are be examined by question type and question format. Themes associated with both analyses are measured against Kirkpatrick's four levels. Second, informal evaluation tools employed by representatives are examined: observation and reflection, discussion, attendance, and desire for additional training. Qualitative data from interviews are referenced to support thematic findings, provide additional context, and to further communicate personal relevance.

Table 3.3. Summary of interdisciplinary green infrastructure CPE trainings

Interdisciplinary green infrastructure CPE training <i>Date, state, size^d</i> Purpose		Provider organizations	Number of provider organization interviewed
Fall 2016 Stormwater Stars - Landscape Best Practices for Water Quality <i>September 2016, OR, 20-40 participants</i> Train and foster a community of environmental stewards on stormwater reduction best management practices at the residential scale; promote social learning and volunteerism.		<ul style="list-style-type: none"> Green Girl Land Development Solutions Independence Gardens Southwest Watershed Resource Center Stamberger Outreach Consulting* West Multnomah Soil and Water Conservation District* 	2
Green Gardening Workshop 2015 - Resilient Landscapes for Our Changing Urban Environment <i>October 2015, WA, 100-250 participants</i> Provide relevant and timely information to land care professionals on sustainable landscaping practices with particular focus on reducing urban runoff and pesticide application; offer continuing education units.		<ul style="list-style-type: none"> Cascadia Consulting* Local Hazardous Waste Management Program Seattle Public Utilities 	1
Introducing Green Infrastructure for Coastal Resilience <i>February 2016, OR, 40-60 participants</i> Connect coastal decision-makers with basic information about green infrastructure; initiate conversation about green infrastructure facilities and resiliency planning and their connection to disaster preparedness.		<ul style="list-style-type: none"> National Oceanic and Atmospheric Administration(NOAA) Office for Coastal Management*.³ Oregon Coastal Management Program South Slough National Estuarine Research Reserve* University of Oregon's Partnership for Disaster Resiliency 	2
Managing Stormwater in Oregon - The Business of Stormwater Regulation and Compliance <i>May 2016, OR & WA, 100-200 participants</i> Share relevant and timely information from leading industry experts and regulators to a diverse range of industry professionals; promote networking opportunities; offer continuing education units.		<ul style="list-style-type: none"> Clean Creek Systems Inc. Clean Water Services Clean Way DJC Oregon Empurion Farallon Consulting Fitrex Sustainable Technologies Geosyntec Consultants GSI Water Solutions, Inc. Herrera Integral Consulting Inc. Kennedy/Jenks Consultants Landau Associates*² Lane Powell Attorney and Counselors Northwest Environmental Business Council* Pace Analytical PBS Engineering + Environmental Perkins Cole River City Environmental Inc. Sound Earth Strategies Stormwater Rx The Water Report 	2

Oregon Water and Wastewater Infrastructure Finance Workshop
July 2015, OR, 40-60 participants

Provide relevant and timely information for decision makers, city staff, and facility operators regarding funding programs and resources available for rural communities to support water infrastructure; offer continuing education units.

- Business Oregon, Infrastructure Finance
- Indian Health Services
- League of Oregon Cities
- Oregon Association of Water Utilities
- Oregon Department of Environmental Quality
- Oregon Health Authority
- Rural Community Assistance Corporation*
- USDA Rural Development

1

Pacific Northwest Pretreatment Workshop

September 2016, OR & WA, 50-100 participants

Provide relevant and timely information to new and experienced pretreatment professionals; promote networking opportunities; share operation strategies.

- City of Bend
- City of Eugene
- City of Klamath Falls
- City of Portland
- City of Vancouver*
- Clackamas WES
- Clark Regional Wastewater District
- Clean Water Services
- Oregon Association of Clean Water Agencies

1

Portland Ecoroof Symposium

October 2016, OR & WA, 100-150 participants

Elevate green roof knowledge across range of industry sectors, addressing main concerns and opportunities; promote networking opportunities; offer continuing education units.

- Audubon Society of Portland
- Diaden
- East Multnomah Soil and Water Conservation District
- Eiera
- Firestone Building Products
- Green Feathers
- Green Roof Think Tank*
- Mahlum
- Portland State University*
- Professional Roof Consultants
- Tremco

2

**University of Washington Extension ProHort Class:
Reconstructing Natural Areas in the Built Environment**
January 2016, WA, 75-150 participants
Build community around urban restoration projects; promote
networking opportunities; offer continuing education units.

- Seattle Parks and Recreation
- Urban Forestry Services, Inc.*
- University of Washington
- University of Washington Botanic Gardens*
- Washington State University
- Washington Department of Natural Resources Urban and Community Forestry Program
- USDA Forest Service Pacific Northwest Research Station

2

Vegetated Private Water Quality Facilities Management Training

May 2016, OR, <50 participants
Develop a skilled workforce of trained contractors, maintenance
workers, and other land care professionals on what LID facilities are,
why they are required, how to properly maintain and inspect them,
and how to communicate with private landowners; offer continuing
education units.

- Clean Water Services*
- Portland Community College*

2

* Provider organizations interviewed.
1 Attendance is an approximate range if workshops were conducted more than once between 2013 – 2016.
2 Interview conducted over email.
3 Interview conducted with two representatives.

3.4.1. Formal Evaluation Tool: Surveys

Survey evaluations were used by all provider organizations as the primary method of evaluation. Of the nine trainings, four applied survey evaluation tool onsite via paper-based methods. The remaining five were conducted electronically through SurveyMonkey® (n=4) and Catalyst Web Tools® (n=1). The evaluation surveys primarily measured reaction, with few exhibiting the ability to effectively measure learning and anticipated change in behavior. Table 3.4. provides a summary of the content analysis counts.

3.4.1.1. Survey Evaluation Tool: Content Analysis

Reaction (Level One)

Of the five question types, reaction, the first level of Kirkpatrick's four-level framework was the most prevalent. Half of all questions, 51 percent, were categorized as reaction, assessing participants' satisfaction with the quality of instruction, content, facilities, and satisfaction with the training. Individual surveys also focused a majority (54 percent) of their questions to reaction. Questions measuring reaction are easily transferrable to a quantifiable scale format (e.g., 5 = Strongly Agree, 1 = Strongly Disagree) and are likely chosen to provide a snapshot of how successful trainings are at reaching training objectives.

Learning (Level Two)

Questions asking students to measure their learning were absent from all but one survey. The survey that did have this question asked students to rate their ability to perform certain tasks before and after the workshop, attempting to measure mastery of a skill. This is known as a retrospective self-assessment.

Table 3.4. Survey evaluation tool content analysis counts

Green Infrastructure CPE Training	Survey type	Demographic	Reaction (L1)	Learning (L2)	Behavior (L3)	Solicit	Multiple choice	Rank	Scale	Open-ended	Total
Fall 2016 Stormwater Stars - Landscape Best Practices for Water Quality ^A	Electronic (SurveyMonkey)	3	5	-	4	2	3	1	6	4	14
Green Gardening Workshop 2015 - Resilient Landscapes for Our Changing Urban Environment ^A	Onsite (paper)	2	2	-	-	1	2	-	2	1	5
Introducing Green Infrastructure for Coastal Resilience	Onsite (paper)	3	12	7	-	2	3	-	17	4	24
Northwest Environmental Conference and Tradeshow – Managing Stormwater in Oregon: The Business of Stormwater Regulation and Compliance	Electronic (SurveyMonkey)	5	8	-	-	4	5	-	8	4	17
Oregon Water and Wastewater Infrastructure Finance Workshop	Onsite (paper)	3	13	-	1	5	-	-	13	9	22
Pacific Northwest Pretreatment Workshop	Electronic (SurveyMonkey)	2	10	-	-	3	1	-	8	6	15
Portland Ecoroof Symposium	Electronic (SurveyMonkey)	2	10	-	-	12	3	-	19	2	24
University of Washington Extension ProHort Class: Reconstructing Natural Areas in the Built Environment	Electronic (Catalyst web tools)	3	2	-	-	2	2	-	1	4	7
Vegetated Private Water Quality Facilities Management Training	Onsite (paper)	1	11	-	-	2	1	-	11	2	14
Percent of total (%)		17	51	5	4	23	14	1	60	25	

^A Additional post-workshop survey sent months after initial training evaluation.

Behavior (Level Three) and Results (Level Four)

Questions aiming to measure a change in behavior was equally as absent. A minority of the survey evaluation tools, two of nine, appropriately tapped into well-known barriers to green infrastructure implementation and asked participants to anticipate a change in behavior as a result of what they learned in the training. These questions used verbs like “use” and “share” to describe future actions (Figure 3.3.).

4. Please select the response that best describes your agreement with the following statements (Agree Strongly, Agree, Neutral, Disagree, Disagree strongly):		
The workshop increased my understanding of clean water practices.	Reaction (R1) - Scale (S1)	
I understand which clean water practices are appropriate for my site.	R2 - S2	
I have enough knowledge and experience to install practices at home.	R3 - S3	
I am likely to use information from this class at my home/business.	Behavior (B1) - S4	These questions anticipate a change in behavior as a result of the class.
I am likely to share information from this class with others.	B2 - S5	
I am already using the techniques described in class.	B3 - S6	

Figure 3.3. Example of questions coded as behavior (level 3)

Missing from all survey evaluation tools was result questions or assessments (see Table 3.1. for examples). This finding suggests that organizations struggled to translate result-oriented questions into a survey, or that results achieved at the organizational or environmental level were not a training objectives. Another possibility could be that effective measurement of results occurs well after, rather than immediately after, the training. In which case the survey evaluation tool applied would need to be delayed.

Demographic and Solicit Questions

Survey evaluation tools were also used to gather recruitment data and ideas for future trainings. Demographic questions represented 17 percent of all questions, averaging 25 percent of each survey. These questions focused mainly on the participants’ job function, motivations for attending the training, and how they heard about the opportunity (i.e., recruitment and outreach). When considered together, these questions can generate a ‘participant profile’ of sorts, informing

event organizers of who is attending, their motivations for attending, and which method of recruitment reached their demographic. Answers to these questions guide training organizers in appropriate directions as audiences expand and mature. Roughly a quarter of all the questions (23 percent) were categorized as solicit. All surveys welcomed comments about the workshop and solicited ideas for future topics and speakers.

Question format

The content analysis of the evaluation surveys show a preference for scale, open-ended, and multiple choice questions. Representatives and students alike are familiar with these question formats. Questions in scale format (60 percent of all questions), are easily averaged and translated to comprehensible measures of success. Open-ended questions (25 percent of all questions) typically complimented solicit questions, giving students the opportunity to freely criticize and/or make suggestions.

These findings suggest that survey evaluation tools are limited in their ability to assess training success beyond the level of reaction. Furthermore, representatives used question formats that can deliver quick numeric results. Survey evaluation tools provided representatives with information about overall satisfaction and future workshop needs, but failed to adequately measure learning, behavior, or results.

3.4.1.2. Survey Evaluation Tool: Qualitative Themes

Qualitative analysis revealed that representatives chose to use surveys as their evaluation tool because they are **familiar and standardized**, and they easily capture information for planning **future trainings** (Table 3.5.). The theme **familiar and standardized** suggests that representatives elected to use surveys because that is what has historically been done in their

organization. Several representatives alluded to organizational capacity to develop evaluation tools, mentioning that previous tools were referenced or adopted:

Yeah, and we are in luck because we've got an established system....And through the [academic institution] we just slightly adjust the survey and out it goes.
– Organization Representative (OR) 1

Preexisting survey evaluation tools can be formulated by professionals with evaluation training and therefore have credibility. However, overtime these standardized surveys may become outdated and unreliable at measuring training objectives.

The **future trainings** theme coded references to using survey evaluation results to plan for future trainings. Several of the trainings included in the study are held annually and had the opportunity to respond to student needs overtime. Representatives from those organizations commented that typical classroom activities (i.e., passive learning) became replaced by more hands-on interactive activities because students responded better to that instructional design. Hence, they used evaluation survey tools to drive future decisions.

Now we mix it up, introductory material is mixed with a speaker, who brings some more depth, [and then also] mixed with an activity. So, we go through that throughout the day and that seemed a better mix that I could tell just by our evaluations, people were happier – OR 2

We wanted to know specifically for next year what everybody wanted to see and so we put some questions in there to help us plan for next year. - OR 3

This is one of the key reasons of having an evaluation tool – to understand where improvements to the program can be made.

A third qualitative theme relates to the **advantages of electronic survey evaluation tools** (eSET) (Table 3.5.). Provider organizations that used electronic survey evaluation tools commented on the advantages of having less data entry at the cost of lower response rates. They also praised the tool as being easy to use, efficient, and adaptable to long-term evaluation needs.

Two of the five representatives that used the software are delaying surveys to evaluate learning and behavior.

About six months after the workshop, we are going to be sending out a post-survey. We will ask about those same [behavior questions] ... Then we are going to see if there was a significant change in the practices that people had, if they retained what they learned at the workshop. – OR 4

The ability for representatives and their respective organizations to connect with students months after the training has ended can expand Level Three and Level Four evaluation opportunities.

Surveys are the familiar and preferred evaluation tool for training to evaluate training success. Organizations likely have standardized surveys available from past trainings. Additionally, survey evaluation tools provide valuable insight into possible future training topics, making them an integral part of the program planning process. Electronic survey tools were found to be advantageous, saving representatives time and resources while also enabling them to extend evaluation beyond the boundaries of the workshop.

Table 3.5. Survey evaluation tool: Qualitative themes and key quotes

Theme	Counts	Key quotes
Familiar and standardized Historical organizational use of SET.	Interviews: 4 References: 5	We have a pretty standard evaluation that we do for all of our courses that are tailored for the specific learning objectives. – OR 2 Most of the questions came from previous evaluations, from previous years. - OR 3
Future planning SET aid in future planning.	Interviews: 6 References: 6	Once we are done with the training we collect [the surveys] and go over them and see if there are any trends or anything we can improve upon or change. - OR 5 We survey the attendants to get feedback on what they liked about the previous years' topics and speakers and what they would like to see in the coming year. I think we get enough feedback to help us guide planning for the next year. - OR 6
Advantages of eSET eSET are preferred over paper-based methods.	Interviews: 4 References: 6	I take the paper versions home; I enter them into SurveyMonkey because I really like the statistics it does for me. - OR 7

3.4.2. Informal Evaluation Tools

Representatives also used informal evaluation tools to measure success: **observation and reflection, discussion, attendance, and desire for additional training**. These themes surfaced from interview data as representative commented about successful approaches, activities, or interactions. Representatives did not necessarily include these informal evaluation tools as a factor when answering how they measured success.

3.4.2.1. Observation and Reflection Theme

Interviews with program representatives often revealed informal evaluation tools that were used to evaluate training activities at Levels One (reaction) and Two (learning) in addition to the survey evaluation tool. The first theme - **observation and reflection** - is directly related to how students responded to active learning activities such as field inspections, site design simulations, infiltration tests, or guided discussions in interdisciplinary small groups. These activities bring classroom content to the field and promote experiential learning. Representatives would then observe, interpret and evaluate student responses by remarking that certain activities were **enjoyable** or **effective**. Table 3.6. illustrates these two sub-themes that describe student responses and reactions to active learning activities. The sub-theme enjoyment is related to content from interviews reflecting on how attendees enjoyed the hand-on learning activities:

The students really enjoyed actually getting a chance to go out and look at these facilities and getting a chance to see them first-hand and touch them and walk through them and see how the different observations they made may impact how they assess and rate the condition of these facilities. OR 8

Representatives remarked that students enjoyed hands-on activities and observed that they were more effective at achieving learning outcomes. Yet few representatives complemented these apparently effective and enjoyable activities with a tangible evaluation mechanism outside of the survey evaluation tool given at the end of the training. One training did apply this

methodology to teach students about site inspections. For this activity students individually performed a mock site inspection and facilitators provided feedback on what the students correctly identified or overlooked.

It is interesting to note that these positive reflections were only associated with active learning activities, not passive learning activities (i.e., presentations). In other words, students did not react or respond to presentations in the same positive manner that they did to active learning activities.

The seminars were great, but those roundtables – that is where the rubber hit the road. – OR 9

3.4.2.2. Discussion

Representatives alluded to discussions with students and fellow event organizers as an informal evaluation tool. Casual conversations in professional training environments can foster productive discussion about training topics – increasing communication and analytical skills. While discussion with students are not formal per se, they still offer value to the training providers and influence future decision making.

Let's have some discussion and dialogue about things that they've seen and what maybe works for them and what maybe doesn't work. - OR 5

We sat down and we talked about what we all heard and what we wanted to make note of to plan another one, while things were fresh and we just kind of sat down and talked... and it was really good for us because the adrenaline was kind of high at the end of the day for us. – OR 9

The information discussed in these meetings set the trajectory for future trainings, likely learning mostly on reaction to steer decisions. Discussion also revealed elements of activities that failed or succeed, allowing representatives to infer a certain amount of learning that likely occurred.

Table 3. 6. Information evaluation tool themes, subthemes, counts and key quotes

Theme	Subtheme	Counts	Key quotes
Observation and reflection Comments about experiential learning activities being effective and enjoyable		Interviews: 8 References: 8	Nobody has said that that part of it wasn't helpful. There are enough questions there and uncertainty there that those activities really reached everyone. - OR 5
Discussion Conversations about the training with peers.	Students	Interviews: 3 References: 3	We have breaks and we have lunch with these folks too and we've got things that just come out in conversation where we are able to take notes on things. – OR 10
	Event organizers	Interviews: 5 References: 5	And then also as the organizers we got together after the [event] and debriefed about our own separate experiences. - OR 11
Attendance Attendance exceeded expectations.		Interviews: 3 References: 4	For each session and for each track we do a room count and then we determine the percentage of that session total...we want to know out of which ones had the most people, which ones got the highest scores... - OR 10
Desire for additional training Students requested additional training.		Interviews: 4 References: 5	One of the things that happened at lunch time, people were walking up to [representative] with ideas for next year's program... We were just blown away! The whole day really exceeded what we thought we would accomplish. So, we were all kind of buzzing. - OR 9

3.4.2.3. Attendance

Attendance, or turnout, was mentioned by four representatives as an attribute of training success. Some representatives translated high attendance to addressing a gap in training meeting their students' needs. Other representatives labeled trainings as successful if they had more participants than anticipated, or if they training met capacity.

I think it, based on attendance, it has been a success. - OR 5

Evaluating training success on training size may be a more reliable indicator of interest rather than measure of success. Attendance does not evaluate student satisfaction, newly acquired knowledge or skills, nor does it measure behavior or results. Attendance may be considered a measure of success because it illustrates that the organizers are filling a need of the audience.

3.4.2.4. Desire for Additional Training

Provider organizations also included requests for additional trainings as a sign of success. Trainings were often described as having talkative and engaged audiences that were anxious to share ideas for future trainings with even organizers:

That is when we just go 'Ah! It and worked!' They wanted something else afterwards. - OR 2

This theme cannot directly relate to any of the four levels; however, it may indirectly relate to all four levels. If students want more, they are likely satisfied with the training they just experienced (Level One). Students requesting additional information suggests that they are motivated to continue learning and are likely to apply new knowledge or skills at their place of work (Levels Two and Three). Finally, Level Four assesses whether the training made an impact

at the organization level or beyond. If the consensus from students is “we want more,” it could be argued that the training ignited shifts in thinking.

Although informal evaluation tools are filtered through representative’s thoughts and opinions, they can still offer valuable information on training success. Representatives integrate results from the formal survey evaluation tool with their own perceptions to ultimately measure training success.

3.5. Discussion

Organizations providing interdisciplinary green infrastructure CPE trainings rely heavily on familiar survey evaluation tools to formally measure success; however, they also apply other informal methods of evaluation such as observation and reflection, discussion, attendance and desire for additional training. Content analysis of the survey evaluation tools provided suggest that provider organizations struggle to formally evaluate programs beyond reaction. Organization representatives compiling these tools lean on insufficient standardized evaluations. Despite these evaluation shortfalls, there are opportunities for provider organizations to expand evaluation tools.

Behavior and results were challenging for provider organizations to measure. To truly measure a change in behavior, evaluations need to include factors from the individual, organization and environment that could influence adoption. For this reason, survey evaluation tools can be a particularly ineffective tool to measure change in behavior because there is a diverse audience with potentially limitless influences. One of the provider organizations that did reach this level with their survey listed barriers to green infrastructure implementation (e.g., expense, physical labor, site selection) to capture the influence from of the environment. Other organizations could replicate this approach if they fully understand the potential barriers.

Delayed surveys or interviews may provide the best information about a student's change in behavior.

Noticeably absent from the findings are measures taken to assess results (Level Four). Incorporating tangible or hard results, such as correctly completed permits or properly maintained facilities, into the evaluation of the program is one opportunity to assess the true value of the training. Did letters of non-compliance decrease after the training? If so, one could credit the training for achieving that goal or objective. Results may take time to accrue, but they also provide powerful insight into effective education practices.

Hands-on learning activities were observed as being enjoyable, effective and impactful. These activities can be adapted to assess student competence with the simple addition of a checklist or guided discussion. The addition of a checklist or other reference document can provide a tangible tool to evaluate whether students retained training objectives (e.g., students can correctly identify LID facilities that are non-compliant). A guided discussion can identify where clarification needs to be made. Discussions also provide an opportunity for students to share experiences and local knowledge.

While not a surprising measure of success, the concept of attendance deserves further discussion. Is attendance truly a measure of success? Strong attendance can be a function of many factors, such as grant requirements, continuing education credits offered, presenters, etc. If objectives are focused on promoting a resource, attendance size may be a reliable measure of success. However, high attendance may not equate to increased competency. If the objective is to teach porous pavement installation techniques, a small class may allow for onsite demonstration. Learning objectives should help determine the optimal course size.

Survey evaluation tools will continue to be applied in formal education platforms because they are familiar, standardized and accessible. The survey evaluation tools analyzed in this study indicate that there are areas for improvement with both the types of questions asked and how surveys are proctored. Electronic survey tools offer provider organizations a flexible and cost-effective method of evaluation that allows for quick measurements. Additionally, electronic survey tools allow provider organizations to reach participants after trainings are complete. This allows providers to probe participants about knowledge application, changes in behavior, continued challenges and achieving desired results. By spreading evaluation tools and approaches across the evaluation spectrum, numerical data is balanced with tangible narrative data, providing more insight into how the program performed. Narrative data provided in open-ended questions solicit participants to share their thoughts freely and openly, and can serve as testimonials to program success. This study has demonstrated this evaluation methodology, bolstering numerical data with thematic findings and offering insight into provider organization practices.

3.5.1. Directions for Future Research

As evidenced by this study, trainers themselves may need training on evaluation. Professional associations, such as the American Evaluation Association and American Educational Research Association could be tapped to fill this void. The University of Wisconsin Extension Service, where Donald Kirkpatrick completed much of his research, also offers robust program development resources. Guidance documents from NOAA - *Designing Education Projects* (2009) - and USDA and EPA's 2013 publication *Workshop in a Box* are relatively unknown to adult educators. Future research could apply these tools to interdisciplinary CPE

trainings. It may also be worthwhile for researchers to study the advantages and disadvantages of electronic survey tools for the purpose of CPE training evaluation.

3.5.2. Limitations

This study can be interpreted as a case study, limiting the scope of inference to provider organizations in Oregon and Washington which plan, implement and evaluate interdisciplinary green infrastructure CPE trainings. Guidance provided on effective application of evaluation tools may be applicable outside of this scope to areas of interdisciplinary adult education that aim to provide collaborative experiential learning opportunities. The small sample size of interviews and documents analyzed make findings specific to the region and organizations interviewed.

Although not a focus of the study, some providers did implement secondary post-training surveys. These surveys were distributed several months after the training and aimed to capture changes in behavior, commitments, and attitude as a result of the training. The two surveys were excluded from the content analysis because one was not ready to be shared and the other closely resembled the evaluation survey that was proctored directly after the training.

3.6. Conclusion

This study applied Kirkpatrick's Four-Levels of Training Evaluation to interdisciplinary green infrastructure CPE trainings in the Pacific Northwest. The study found that if evaluators recognize its' flexibility, Kirkpatrick's four levels can serve as an appropriate framework for evaluation. Evaluation should be considered at the onset of program planning and should relate back to learning objectives. Just as each green infrastructure site or facility is specific, each training is unique and deserves an evaluation approach tailored to its purpose and goals. What do constituents want to know about the training? What do they want students to learn? If objectives

are clearly defined at the onset of program planning, the planning team can use them to guide evaluation tools. In doing so, they may notice their activities have an evaluative component that can reinforce a learning objective in a more meaningful or impactful manner than a question on a survey. Depending on what providers want to know and subsequently measure, it may be appropriate to instill a mixed-mode method of evaluation. Survey evaluation tools are a cost-effective approach that may be desired by funders, and complementing survey data with narratives from workshop participants may offer powerful insight and depth to final reports.

4. General Conclusion

Trends towards inclusive and integrative management in the urban environment suggest that skills in interdisciplinary collaboration will be necessary to achieve success. Green infrastructure requires collaborative cooperation across a multitude of disciplines and stakeholder groups to be planned, implemented, and managed effectively. Interdisciplinary green infrastructure CPE trainings can enhance technical skills and interpersonal skills of all green infrastructure practitioners, fulfilling the education void in an emerging and evolving field.

4.1. Research Summary

The goal of this of this research is to understand how interdisciplinary green infrastructure CPE trainings are being planned, delivered and evaluated. A mixed-mode approach of interviews and content analysis was used to address the following five research questions:

1. Why are organizations offering continuing professional education to interdisciplinary audiences;
2. How do organizations structure their curriculum to meet the interdisciplinary needs of their audience;
3. What makes interdisciplinary green infrastructure continuing professional education trainings valuable for all practitioners of green infrastructure;
4. How do CPE providers evaluate the success of their trainings; and,
5. What evaluation tools do they apply to measure success?

Study design incorporated five criteria to capture trainings that reflect the diversity of green infrastructure topics and stakeholders. Trainings were eligible for the study if they occurred in Oregon or Washington between September 2013 and December 2016; focused on

topics associated with green infrastructure; had more than two provider organizations collaborate on the training curriculum; and, invited an interdisciplinary audience of practitioners.

Thirteen trainings met study criteria. Among the thirteen trainings, 24 provider organizations were interviewed. Interviews were transcribed and thematically coded via Nvivo qualitative software. Coding analysis organized patterns and guided data analysis. Content analysis was also performed on nine survey evaluation tools.

Institutional, social, and technical challenges associated with green infrastructure implementation drive organizations to offer CPE trainings to a diversity of stakeholder groups. Provider organizations aim to address knowledge gaps related to these challenges by offering trainings an interdisciplinary audience. An interdisciplinary audience reflects the reality of the environment and allows for valuable cross-disciplinary interactions to occur. Provider organizations are tasked with developing a balanced and thorough curriculum for students, a task that is easier said than done. Training agendas and activities are created by leaning on the planning committee's experiential knowledge and existing resources. Experiential learning activities are effective at reaching all practitioners of green infrastructure. These activities enhance technical and interpersonal skills, build rapport across disciplines, and prepare practitioners for future collaborative practice.

Survey evaluation tools are the main mechanism provider organizations apply to assess training success and solicit ideas for future trainings. Survey evaluation tools collect tangible feedback about student satisfaction; however, when measured against Kirkpatrick's Four-Levels of Evaluation, survey evaluation tools may not adequately measure learning, behavior or results. Other informal assessments, such as provider organization observations and reflections, discussion, attendance, and desire for additional training are less acknowledged measures of

success. These measures offer insight into student reactions, learning preferences and future needs.

The two studies presented in this manuscript intersect at the junction of theory and practice. Educational theory can inform and guide provider organizations on how to implement “best training practices,” yet few provider organizations understand and utilize such theories. Herein lies the opportunity for provider organizations to become more informed about theories applicable to interdisciplinary green infrastructure CPE trainings.

4.2. Grounded Theory Approach

Grounded theory is a systematic approach to research that generates theory through the analysis of data (Leedy & Ormrod, 2013, p. 146). While this study was not entirely independent from theoretical frameworks (recall organizational typologies by Kowalski (1988) and Darkenwald & Merriam (1982), and Kirkpatrick’s Four-Level Training Evaluation Framework (1994)), it was pragmatic in its approach to answering research questions. Findings from this grounded theory study can be reinterpreted into theories associated with the environment, provider organization and student (Figure 4.1.). This section defines and explains three theories as they relate to interdisciplinary green infrastructure CPE trainings and links the environment, provider organization, and student, to the training experience.

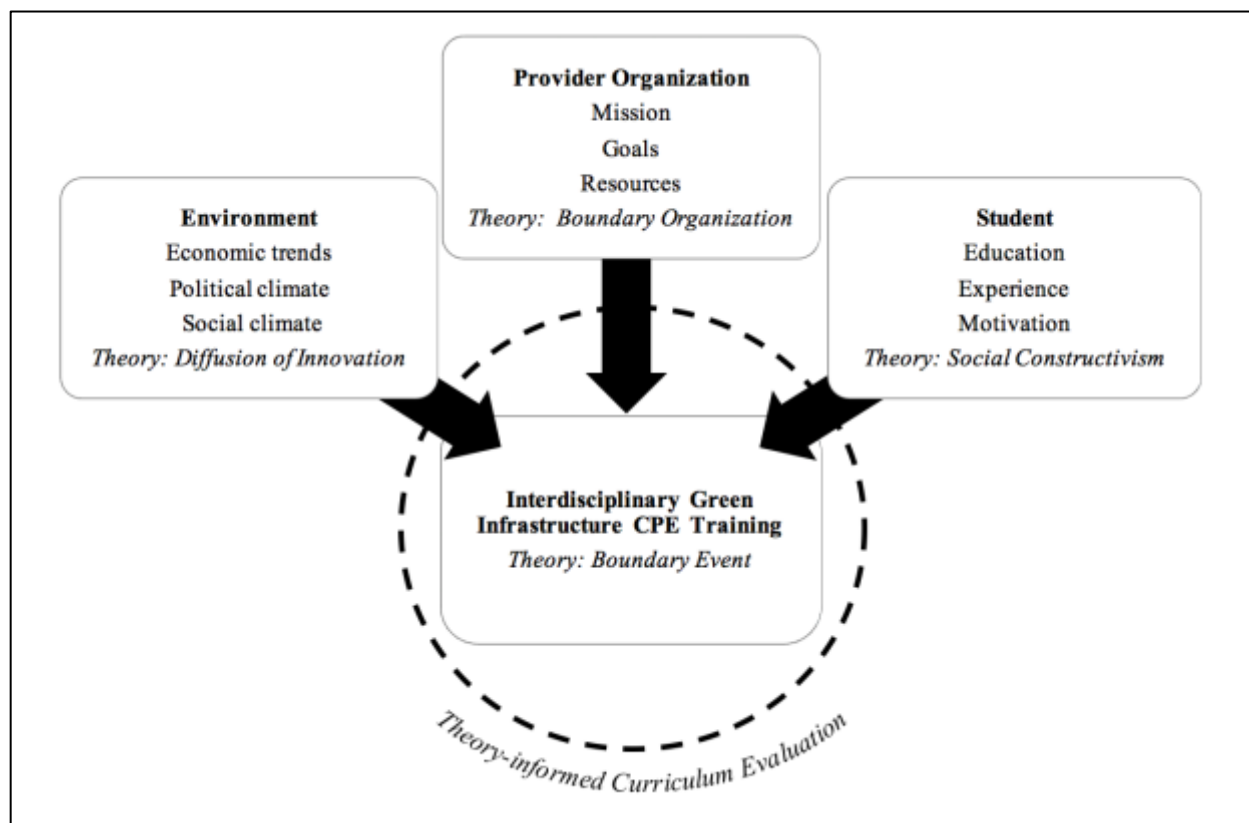


Figure 4.1. Theory-informed model for planning interdisciplinary green infrastructure CPE trainings. Adapted from Kowalski (1988, p.77)

4.2.1. The Environment: Diffusion of Innovation Theory

The Diffusion of Innovation Theory conceptualizes the process through which new innovations are shared and adopted across society. Katz, Levin, and Hamilton (1963) introduced the construct:

The process of diffusion is defined as the (1) acceptance, (2) over time, (3) of some specific item –an idea or practice, (4) by individuals, groups or other adopting units, linked to (5) specific channels of communication, (6) to a social structure, and (7) to a given system of values, or culture.

Theorists from sociology, anthropology and economics have formulated a framework of three classifications: continuous innovations, dynamically continuous innovations and discontinuous innovations (Robertson, 1967). The third label, discontinuous innovations, shifts traditional practices and patterns in a different direction (Robertson, 1967). The adoption of green infrastructure practices is an example of discontinuous innovation; it interrupts the traditional approach to stormwater management and land-use planning. The diffusion process is exacerbated by the necessary involvement of multiple stakeholders. Findings from the study suggests that provider organizations may have recognized, either directly or indirectly, that in order to facilitate acceptance of green infrastructure, they needed to provide a ‘channel of communication’ that addressed technological barriers alongside social and institutional barriers. Interdisciplinary green infrastructure CPE trainings are then acting as a vehicle for the diffusion of a discontinuous innovation.

4.2.2. The Provider Organization: Boundary Organizations

A popular theoretical concept in social practice theory is that of the boundary object. A boundary object is defined as an adaptive resource that is flexible in application, accessible by multiple disciplines and practical across sites (Star & Griesemer, 1989). Boundary objects can be events, landscapes, or organizations. In management, boundary objects are utilized as a mediating tool for interdisciplinary fields such as landscape ecology and public policy (Feldman & Khademian, 2007; Opdam et al., 2013; Castella, Bourgoin, Lestrelin, & Bouahom, 2014). Effective boundaries are successful at disseminating knowledgeable action by providing a shared platform for stakeholders to communicate goals and objectives, transfer technical information, and engage in adaptive local management.

Provider organizations, and more specifically informal education organizations (agencies, nonprofits, environmental education consulting firms) play a vital role in interdisciplinary green infrastructure CPE trainings. Strong insight from informal education organizations suggest that they are boundary organizations – actively facilitating collaboration between stakeholders and sharing information. Incorporating the concept of a boundary organization within diffusion of innovation theory and can provide further understanding of how innovation travels or progresses overtime through the use of a mediating organization.

4.2.3. The Learner: Social Constructivist Theory

Social Constructivist Theory justifies the importance of social learning environments for effective education. Social Constructivism argues that exploration of new information through social interaction leads to greater retention and reasoning (Paour, 1990; Piaget, 1976). Furthermore, social constructivists argue that reality is created through peer interaction (Kim, 2001). Green infrastructure has a dynamic and evolving reality. The perception and acceptance of green infrastructure as a sustainable approach to stormwater management is ridden with cultural and societal challenges that need to be discussed among key constituents.

Incorporating the theory of Social Constructivism into the training environment fosters the diffusion of green infrastructure. It enables individuals from different disciplines to converge and negotiate new perspectives, constructing meaningful new knowledge from their interaction. In turn, historically cross-disciplinary consultations evolve into interdisciplinary collaborations, driving successful implementation forward.

4.2.4. The Training: Boundary Event & Theory-Driven Curriculum Evaluation

At the center of the model is the training, a boundary event supported by theories and reinforced with theory-driven curriculum evaluation. Trainings are communal learning

environments consisting of shared experiences. Provider organizations mediate these experiences across disciplines. Trainings are then boundary events, independently interpreted by each student, but experienced by all.

Theory-driven curriculum evaluation incites tailored curriculum evaluation based on theory. Interdisciplinary green infrastructure trainings exist in a diversity of learning environments with varying objectives, making it difficult to identify a single approach to evaluation. Kirkpatrick's Four-Level Training Evaluation Framework can be used to assess reaction, learning, behavior, and results (Kirkpatrick, 1994); however, the tools used to measure each level should be based on theory. For instance, if a training objective is to decrease noncompliant LID facilities, there should be an evaluation tool that measures the change in noncompliant LID facilities since the training occurred. This is an assessment of results. Evaluation of this training objective should also measure what tactics lead to this result, which would likely involve leaning on Social Constructivism to understand why the training led students to change their behavior.

Provider organizations inexperienced with CPE trainings can, and should, look to the theories above for guidance. In doing so, provider organizations can capitalize on opportunities to lead students beyond acquiring new skills or knowledge and into a collaborative atmosphere conducive to social learning. For instance, if a new resource is being promoted, provider organizations could use a social constructivist approach to create a simulation on how to use the new resource. The simulation could require students to explore the new resource in small groups, working through a checklist of sorts. This simulation would make the students experience the new resource themselves, whilst learning alongside their peers. Level Two evaluation could

occur by observing how students navigate the resource and how many items on the checklist are completed.

4.3. Recommendations

Sustained investment in CPE for green infrastructure practitioners is an efficient use of provider organization resources. States aiming to improve water quality through green infrastructure should consider adapting current social and institutional infrastructure to meet demands. The Washington Stormwater Center (www.wastromwatercenter.com) is an example of institutional infrastructure that appears to meet the demands of the environment, organizations and practitioners.

Findings from this study can be translated into eight “best training practices” for interdisciplinary green infrastructure CPE trainings.

1. **Representative planning committee.** A representative planning committee ensures that ensure that all disciplines are represented when setting the training schedule, leading to a balanced [topical] agenda. It will also ensure that the desired audience is reached during the recruitment process.
1. **Pool Resources.** Collaborative planning committees can make previously inaccessible resources and tools available. At the onset of program planning, committee members should brainstorm resources: printing and marketing services, special interest listservs, professional organization membership, Continuing Education Unit (CEU) connections, technology, etc. Exploring these resources upfront may increase training capacity and support training objectives.

2. **Set clear training objectives.** Clear training objectives provide direction to planning committee members. When clear training objectives are used in conjunction with theory-informed curriculum evaluation, trainings can be
3. **Targeted recruitment.** Student and presenter recruitment should be targeted. Provider organizations need to collaborate to make sure the right people attend. The learning environment will be more “rich” if it contains practitioners who benefit from one another’s company.
4. **Be local.** Ask local experts or champions of green infrastructure to present. Presenters not familiar with the local context should be provided with information beforehand so they can cater their presentations to the local audience.
5. **Be social.** Social learning activities facilitate learning, understanding and camaraderie. Provider organizations should incorporate formal or informal networking opportunities to encourage social interaction across and within disciplines.
6. **Incorporate experiential learning activities.** Experiential learning activities are essential for green infrastructure practitioners. Demonstration site tours, simulations, games and guided discussions should be incorporated into training agendas. These activities may be best incorporated alongside online courses, creating a blended learning environment. Most material can be taught online; however, mastery of new knowledge requires application.
7. **Evaluate with purpose.** Evaluation should not be performed for superficial reasons; rather, it should guide program planning and reinforce training objectives. Trainings are unique, thus no single approach to evaluation is applicable for every training. However, for trainings aiming to increase skills, provider organizations should complement

experiential learning opportunities with assessments that can be reviewed and critiqued.

This method of evaluation enables training providers to better assess the learning that occurred at the training. Additionally, there are ample alternative evaluation tools such as interviews, checklists and focus groups that can be used to assess success. Having interactive discussions with students and fellow training collaborators may reveal valuable information about training effectiveness and future needs.

4. 4. Directions for Future Research

The demand for developing a competent green infrastructure workforce dictates continued research on interdisciplinary CPE trainings. Future research should focus on the efficacy of online and blended learning approaches. Online videos and presentations are gradually supplementing CPE opportunities, giving students the option to review training materials at their convenience. Blended learning combines online media with the traditional classroom training. A blended learning approach may enable hard to reach audiences (e.g., contractors, rural practitioners) the flexibility they need to participate in CPE opportunities. Additionally, blended learning opportunities may offer the best balance of resources and learning, shifting passive activities to the internet and using the live classroom for experiential learning activities.

Researchers, educators, and practitioners should also consider investing in Train the Trainer (TTT) programs. TTT programs train inexperienced instructors on presentation and training skills (Russo, 2016). Investment in a train the trainer program could assist in identifying and leveraging champions of green infrastructure. Research on the effectiveness of TTT programs for green infrastructure professionals may also reveal how knowledge is best transferred in an emerging and evolving field.

Additional research on evaluation tools for provider organizations is also warranted. As this study outlines, provider organizations are not typically equipped to adequately evaluate trainings beyond satisfaction. Research on flexible and effective evaluation tools may enable provider organizations to more accurately evaluate training success. These tools could be a series of transferable interview questions, a list of possible results to measure (e.g., what statistics could be tied to these sorts of trainings), or even how to conduct delayed surveys.

Finally, green infrastructure needs social and institutional infrastructure (e.g., community organizations, website clearinghouses) equipped to disseminate best available knowledge and practices to target audiences. Researchers could look to other disciplinary groups, such as medicine and teaching, to see how they ensure licensed professionals stay current. Best practices may be transferrable to green infrastructure.

4.4. Limitations

Limitations of this study are associated with the small and localized sample of interdisciplinary green infrastructure CPE trainings. The scope of influence should be restricted to similar trainings in the Pacific Northwest, though findings are likely transferable outside of the region if similar social, political and environmental factors exist. Another study limitation is coder reliability. Coding and thematic analysis was completed by one researcher and may be influenced by confirmation bias.

4.5. Conclusion

Green infrastructure practitioners are still learning how to collaborate with one another across traditional boundaries. Interdisciplinary CPE trainings become a shared boundary for practitioners to increase technical and interpersonal competency in an emerging field. Although provider organizations are challenged with developing curriculum for an interdisciplinary

audience, the benefits accrued from experiential learning activities far outweigh procedural challenges.

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Appendices

Appendix A. Questionnaire



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Oregon State University, 104 CEOAS Administration Building, Corvallis, Oregon 97331-5503
T 541-737-3504 | F 541-737-2064 | <http://ceoas.oregonstate.edu>

Study A: Continuing Professional Education Providers Interview Protocol

General information

1. Could you tell me generally about the Stormwater Conference?
2. What was your involvement in the Stormwater Conference?
3. What was the purpose of the Stormwater Conference?
Prompts: Dissemination of knowledge, skills, change behavior, promote a resource, networking
4. What was going on that motivated your organization to provide or sponsor the Stormwater Conference?
5. Who else was involved with the training (e.g., other organizations that sponsored or supported the program) and what did they do?
Prompts: Provided financial support, presented, set the agenda
6. What were your methods of recruitment or outreach strategies?

Program development

Let's move on to preparing for the Stormwater Conference ...

7. Were any training models or adult education resources referenced to assist in designing or developing the Stormwater Conference?
8. One thing I noticed about the Stormwater Conference is that it was offered to professionals from different disciplines (e.g., engineering, landscape architecture, construction, etc.). Why was it decided to offer the program to an interdisciplinary audience?
9. How much did that (the diverse audience) come into play when deciding upon the *content* or *curricula* presented? Could you give me some examples?
10. Did the diverse audience influence the format of the program, such as the types of activities or presentations? Could you give me some examples?
Prompts: Site tour, testimonials, games, scenarios, speakers, facilitators



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11. How did different levels of experience influence the training?

Evaluation/Reflection

12. Looking back on training, how do you think it went?

13. Were there any *benefits* you observed by having a diverse group of professionals in the training (as opposed to just one profession)?

14. Were there any *challenges* you experienced by offering the Stormwater Conference to a diverse group of professionals?

15. What would help you be more interdisciplinary in your approach?

16. How did you evaluate the success of the Stormwater Conference from the audience's perspective?

16a. [if they use an evaluation tool such as a survey] Would you be willing to share that evaluation tool with me over email?

17. Looking back now, would you change anything? If so, what would you change and how might you approach it differently?

18. Those are all of my questions, do you have any questions for me?

Appendix B. Coding Scheme used for Qualitative Analysis

Table B.1 Coding scheme used for qualitative analysis

Theme	Definition	Interviews	References
Audience	Describes the participant audiences of the workshops.	21	46
CEUs offered	Trainers explicitly state that CEUs were offered. Or it is posted on their flyer.	8	9
Future	Future research ideas	16	27
Interdisciplinary Audience Interactions	Describes the interactions among participants in workshops. Can include anything related to Social Learning.	20	42
Improve – Interdisciplinary audience interactions	Answer to "What would help you be more interdisciplinary in your approach?" May be a change in their approach, instructional design, the types of activities, or simply related to resources.	11	11
Org collaboration	How the organizations collaborating on the workshop interact. May also include what each organization are doing or how they are contributing to the workshop.	23	65
Program Development - Curriculum	Description of how the curriculum was developed. Likely built off existing resources AND/OR experiential knowledge from attending not only other trainings but also from their experiences in the field.	21	31
Existing Resources	Previous training resources were used to assist with instructional design.	7	7
Experiential Knowledge	The trainers relied on their experiential knowledge to develop the program.	8	14
Program Development - IDA	Answer to the question "how did an IDA influence curriculum or content presented?"	16	21
Trainer - Background	Trainer/Interviewees' background	14	18
Trainer - Role & Responsibilities	Codes what the trainers did for the workshop AND may also code what other organizations did as well.	22	35

VALUE		Value to all practitioners of green infrastructure	
Peer-to-peer learning		Students interact with one another through a guided discussion or activity.	11 19
Interpersonal skills		Communication, listening, and mediation skills.	10 13
Networking		Students make professional connections with peers.	11 20
Workshop - Activities		Types of activities at workshops	19 55
ACTIVE		Includes activities of active learning: Site tours, hands on, 1 on 1.	0 0
1 on 1		offer 1 on 1 meetings with agency to public entities	1 1
Breakout		round tables, small group activities, or a specific track within a conference.	5 8
Hands on		Hands on activities - soil tests, filling out a checklist, designing a facility, testing a calculator.	11 20
Networking		networking opportunities at conferences and within small group activities. May be a larger theme than a specific "activity"	8 10
Panels		Panels of professionals fielding questions from the audience.	2 2
Tours		Includes demonstration sites	14 21
PASSIVE		Includes presentations and videos	0 0
Presentations		Classic ppt presentations, in a classroom, sitting.	14 20
Video		Use of videos to train participants (flipped classroom format), does not include videos that are included in presentations.	3 3
Trade		Trade organizations had tables and shared materials/resources	2 2

Workshop - Background	Parent node for workshop background information.	24	55
Fund	Source of funding.	13	18
Motivation	Motivation for the training	20	34
Exp or Obser	Trainers/providers noticed a gap in knowledge or had an observation.	11	15
Regulatory	A new regulation or potential for a new regulation prompted training;	8	8
Purpose	"What was the purpose of the program" Can include things like skills, dissemination of knowledge, promoting a resource, addressing an issue or observation in the field, etc.	21	42
Workshop - Benefits	Answers to "Were there any benefits you observed by having a diverse group of professionals in the training as opposed to just one profession?" AND "...Also levels of experience" So benefits from interactions of the workshop	20	30
Workshop - Challenges		18	58
Challenge - G	General challenges associated with workshop planning. Can be related to working with other people.	16	31
Challenge - IDA	Answers to "Were there any challenges you experienced by offering a CPE training/course to a diverse group of professionals?"	14	20
Balance	Provider organizations struggled to strike a balance on level and type of content	12	17
Workshop - Change	Answers to "Would you change anything?" AND "What would you change and how might you approach it differently?" Also, used to track things that the programs have changed over the years; adjustments they have made based on feedback	17	27
Workshop - Evaluation	Answers to "How did you evaluate the success of the training from the audience's perspective?" and any other evaluation methods (e.g., debrief meetings, own observations and reflections) Includes how they define success... "Looking back on the training now, how do you think it went?"	19	41
Formal (survey) Evaluation			

Familiar/Standardized	Historical organizational use of SET.	4	5
Future Planning	SET aid in future planning.	6	6
Advantages of eSET	eSET are preferred over paper-based methods.	4	6
Informal Tools			
Observation/Reflection	Comments about experiential learning activities being effective and enjoyable	8	8
Discussion	Conversations about the training with peers.	8	8
Students	Conversations with students about the training	3	3
Event Organizers	Conversations with fellow event organizers about training	5	5
Attendance	Attendance exceeded expectations.	3	4
Desire for additional training	Students requested additional training.	4	5
Workshop - Recruitment	Recruitment and Promotional Activities to get the word out.	15	22
Flyers	Flyers were created and posted (may include online forum or in a physical setting). This is kind of a supporting recruiting document.	4	4
Mail	The use of snail mail to send a postcard or letter to potential training participants	1	1
Online	Online organization websites and calendars; may also include press releases posted online; Covers listservs/email blasts to past participants, etc.	11	18
Targeted	Specific targeted recruitment strategy. Like phone calls or emails to specific individuals.	6	8
Word of Mouth	Have partners and planning committee spread the word; include past participant anticipation of the event happening.	5	5

Workshop - Why interdisciplinary audience	Answer the question "Why did you invite an interdisciplinary audience?" Answers include motivations, reasoning, purpose, etc.	18	18
Address Gaps	Professionals from different disciplines need to learn from one another to address gaps in practices across disciplines.	7	9
Impact	Green infrastructure impacts a lot of people from different disciplines; therefore, a large audience pool is used.	8	8

Appendix C. Geographic Distribution of Interdisciplinary Green Infrastructure CPE Trainings

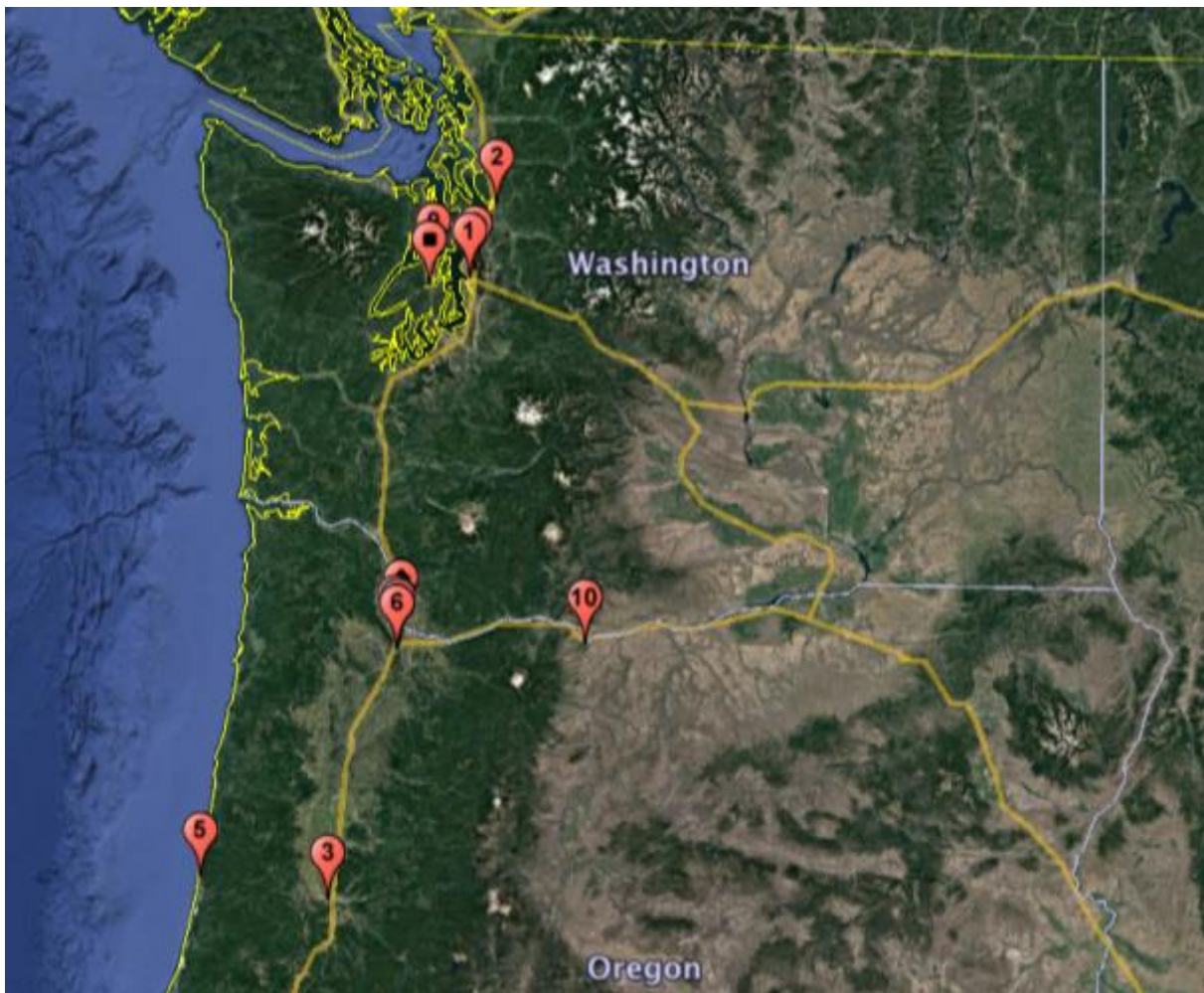



Figure C.1. Geographic distribution of interdisciplinary green infrastructure continuing professional education trainings. Map generated by Google Earth

Appendix D. Evaluation Survey Supporting Materials

Demographic																			
<p>3. Are you of Hispanic, Latino, or Spanish Origin? Demographic (D1) - Multiple choice (M1)</p> <div style="display: flex; justify-content: space-around;"> <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Decline to answer </div> <p>4. What is your race? (Select all that apply) D2 - M2</p> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <input type="checkbox"/> White <input type="checkbox"/> Black or African American <input type="checkbox"/> Asian </div> <div style="width: 45%;"> <input type="checkbox"/> Don't know <input type="checkbox"/> Decline to answer <input type="checkbox"/> Other (describe below) </div> </div>																			
Reaction (Level One)																			
<p>1. Overall, how useful did you find today's workshop? Reaction (R1) - Scale (S1)</p> <div style="display: flex; justify-content: space-around;"> <input type="checkbox"/> 1- Not at all <input type="checkbox"/> 2 - Slightly <input type="checkbox"/> 3 - Moderately <input type="checkbox"/> 4 - Very <input type="checkbox"/> 5 - Extremely </div>																			
Learning (Level Two)																			
<p>4. How well were the following objectives met? (Check one box for each objective)</p> <div style="display: flex;"> <div style="flex: 1; padding-right: 10px;"> <p>This question attempts to measure how much learning occurred as a result of the course, elevating the question to Level 2 - Learning.</p> <p>How well did you master the following objectives?</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="text-align: left; padding: 5px;"> <div style="background-color: yellow; display: inline-block; width: 100%; text-align: left; padding: 2px;">How well did you master the following objectives?</div> </th> <th style="padding: 5px;">I am not able to do this.</th> <th style="padding: 5px;">I was able to do this before the course. This course did NOT improve this ability.</th> <th style="padding: 5px;">I was able to do this before the course, but the course DID improve this ability.</th> <th style="padding: 5px;">I am able to do this because of this course.</th> <th style="padding: 5px;">Not applicable (cannot rate).</th> </tr> </thead> <tbody> <tr> <td style="padding: 5px;">Recognize green infrastructure terms and concepts Learning (L1) - Scale (S1)</td> <td>•</td> <td>•</td> <td>•</td> <td>•</td> <td>•</td> </tr> <tr> <td style="padding: 5px;">Understand ecological, economic, and societal benefits of green infrastructure</td> <td>•</td> <td>•</td> <td>•</td> <td>•</td> <td>•</td> </tr> </tbody> </table> </div> <div style="flex: 1; padding-left: 10px; color: red; font-size: small;"> <p>L2 - S2</p> </div> </div>		<div style="background-color: yellow; display: inline-block; width: 100%; text-align: left; padding: 2px;">How well did you master the following objectives?</div>	I am not able to do this.	I was able to do this before the course. This course did NOT improve this ability.	I was able to do this before the course, but the course DID improve this ability.	I am able to do this because of this course.	Not applicable (cannot rate).	Recognize green infrastructure terms and concepts Learning (L1) - Scale (S1)	•	•	•	•	•	Understand ecological, economic, and societal benefits of green infrastructure	•	•	•	•	•
<div style="background-color: yellow; display: inline-block; width: 100%; text-align: left; padding: 2px;">How well did you master the following objectives?</div>	I am not able to do this.	I was able to do this before the course. This course did NOT improve this ability.	I was able to do this before the course, but the course DID improve this ability.	I am able to do this because of this course.	Not applicable (cannot rate).														
Recognize green infrastructure terms and concepts Learning (L1) - Scale (S1)	•	•	•	•	•														
Understand ecological, economic, and societal benefits of green infrastructure	•	•	•	•	•														
Behavior (Level Three)																			
<p>4. Please select the response that best describes your agreement with the following statements (Agree Strongly, Agree, Neutral, Disagree, Disagree strongly):</p> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 60%;"> <p>The workshop increased my understanding of clean water practices.</p> <p>I understand which clean water practices are appropriate for my site.</p> <p>I have enough knowledge and experience to install practices at home.</p> <p>I am likely to use information from this class at my home/business.</p> <p>I am likely to share information from this class with others.</p> <p>I am already using the techniques described in class.</p> </div> <div style="width: 35%; color: red; font-size: small;"> <p>Reaction (R1) - Scale (S1)</p> <p>R2 - S2</p> <p>R3 - S3</p> <p>Behavior (B1) - S4</p> <p>B2 - S5</p> <p>B3 - S6</p> <p style="margin-top: 10px;">These questions anticipate a change in behavior as a result of the class.</p> </div> </div>																			
Solicit																			
<p>One thing that can be done to improve the overall training experience:</p> <div style="border: 1px solid black; height: 30px; margin-top: 5px;"></div> <p style="text-align: center; color: red; font-size: small;">Solicit (Sot1) - O4</p>																			

Figure D.1. Example of content analysis procedure for each question type

Appendix E. Evaluation Surveys with Content Analysis Itemized



2016 PNW Pretreatment Workshop Evaluation

Thank you for taking our workshop evaluation. To get started, tell us about yourself.

*** 1. Number of years of pretreatment experience:** *Demographic (D1) - Open-ended (O1)*

*** 2. What states have you worked in:** *D2 - Multiple choice (M1)*

☐ Oregon

☐ Washington

☐ Alaska

☐ California

☐ Idaho

☐ Other (please specify)



2016 PNW Pretreatment Workshop Evaluation

* 3. Rate our overall performance on the following:

Scale (5-Excellent, 3-Average, 1-Poor)

		5	4	3	2	1
Organization of workshop	Reaction (R1) - Scale (S1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Topic selection	R2 - S2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Networking opportunity	R3 - S3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Audience participation	R4 - S4	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Length of presentations	R5 - S5	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Choice of Venue	R6 - S6	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Food	R7 - S7	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Comments Solicit (So1) - Q2



2016 PNW Pretreatment Workshop Evaluation

NOTE: Questions 4 - 6 are the same question (rate the speakers and topics) that is expanded to cover all of the possible presentations. Because the purpose of this analysis is to understand the evaluation methodology these three questions are considered to be and are thus considered as one question in their entirety.

* 4. Please rate the speakers and topics you attended. R8- S8

Scale (5-Excellent, 3-Average, 1-Poor, N/A-Did not attend).

MONDAY, September 12, 2016

	N/A	5	4	3	2	1
EPA Update	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mercury Minimization Plan	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Enforcement Case Study: Klamath Falls	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Enforcement Case Study: Portland	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
What's Up With Wipes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Industrial User Survey	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
An Idiots Guide to Reading a Lab Report	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tacoma's Environmental Compliance Support: A Melding of Programs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Comments S02 - Q3

* 5. TUESDAY, September 13, 2016

OMIT - See NOTE on page 3.

	N/A	5	4	3	2	1
PT 101 TRACK: Permit Essentials and Pitfalls	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Septage Receiving at the POTW	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Developing Enforceable BMPs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
EPA Electronic Reporting Rule	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Developing Extra-Strength Surcharge Program: Design Through Implementation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Salem's Homegrown Improved Industrial Database and Incident Tracking System	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Comments

* 6. WEDNESDAY, September 14, 2016

OMIT - See NOTE on page 3.

	N/A	5	4	3	2	1
PT 101 TRACK: Conducting Enforcement Things to Do and Not to Do	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The What, How and Why of Electronic Reporting	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A Tale of Two Cities and One Awful Smell	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Comments



2016 PNW Pretreatment Workshop Evaluation

7. What was the most useful topic? Please explain why:

R9 - O4

8. What was the least useful topic? Please explain why:

R10 - O5

9. What topics or speakers would you like to see in the future?

So3 - O6

Question type: D - 2; R - 10; So - 3
Question format: M - 1; S - 8; O - 6



RCAC Workshop Evaluation Form

Instruction to Trainer: Before copying this form for a workshop, enter the date, title, and sponsor(s) of the training on page 1 and the name(s) of the instructor(s) on page 2.

Date of Training: _____ OMIT _____ Name (optional): _____ OMIT _____

Workshop Title: _____ OMIT _____

Workshop Sponsor(s): _____ OMIT _____

Two of my personal learning goals for this training were: Demographic (D1) - Open-ended (O1)

1. _____

2. _____

To what extent did you achieve your goals? Reaction (R1) - Scale (S1)

- ☐ Exceeded my goals
☐ Fully achieved my goals
☐ Partially achieved my goals
☐ Did not achieve my goals

The information I found most useful was: _____

R2 - O2

The way that I will most benefit from this training is: _____

R3 - O3

One thing that can be done to improve the overall training experience:

Solicit (So1) - O4

I plan to make the following changes when I return to work:

Behavior (B1) - O5

NOTE: This question attempts to measure a change in behavior that has occurred. While this question may not be an accurate predictor of a change in behavior taking place, it still attempts to reach that level of evaluation.

I would like additional training on the following topics:

So2 - O6

(continued on back)

Indicate your level of agreement with the following statements. Please feel free to use an additional sheet of paper for comments if necessary.

Content		Strongly Agree				Strongly Disagree
		5	4	3	2	1
1. I found value in the resource materials.	R4 - S2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. The layout and design of the materials was effective.	R5 - S3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. The design and use of the visual aids was effective.	R6 - S4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. The skills I learned from this training will enable me to do my job better.	R7 - S5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comment(s): S03 - O7						

The Instructor(s)		Strongly Agree				Strongly Disagree
		5	4	3	2	1
Instructor #1:						
1. Demonstrated knowledge of the content.	R8 - S6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Involved the participants.	R9 - S7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Answered questions thoughtfully.	R10 - S8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Followed the advertised agenda.	R11 - S9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Instructor #2:						
1. Demonstrated knowledge of the content.	These four questions (Instructor #2) are the same as the above and are therefore omitted.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Involved the participants.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Answered questions thoughtfully.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Followed the advertised agenda.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comment(s): S04 - O8						

You, the Participant & Your Environment		Strongly Agree				Strongly Disagree
		5	4	3	2	1
1. I was fully present and actively participated.	D2 - S10	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. I was open to learning something new.	D3 - S11	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. My co-participants were actively involved and supported the learning process.	R12 - S12	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. The room/environment supported my training experience.	R13 - S13	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comment(s): S05 - O9						

Thank you for your comments! We appreciate the opportunity to improve our training and better meet the needs of RCAC clients.

Green Gardening Program Fall Workshop 2016

Please complete and return this questionnaire before you leave the workshop.

1. Overall, how useful did you find today's workshop?

Reaction (R1) - Scale (S1)

- ☐ 1 - Not at all ☐ 2 - Slightly ☐ 3 - Moderately ☐ 4 - Very ☐ 5 - Extremely

2. Which two sessions were most useful to you? (Please choose only two)

R2 - S2

- ☐ Outside Our Doors: The Benefits of Cities Where People and Nature Thrive (Erin House)
☐ MSU: Strategies for Addressing Conservation, Stormwater, and Pesticide Reduction Goals (E.J. Hook)
☐ Trilogy: Transitioning from Traditional to Sustainable Lawn Care (David McDonald and others)
☐ Permaculture and Adaptive Practices from a Landscape Design Perspective (Keith Mastenbrook)
☐ Improving Water Quality Through Permeable Pavement (Lisa Rozmyn)
☐ TRACK A: Weed Management: Noxious Weeds, the Roundup Controversy, & IPM Strategies
☐ TRACK B: Trees and Green Stormwater Infrastructure
☐ TRACK C: The Business Case for Irrigation Technologies
☐ TRACK D: Identificación y control de los insectos

The following demographic questions are intended to measure how well the Green Gardening Program provides equitable services. This information is completely confidential and will be aggregated with responses from all other attendees during analysis. Your participation is voluntary.

3. Are you of Hispanic, Latino, or Spanish Origin?

Demographic (D1) - Multiple choice (M1)

- ☐ Yes ☐ No ☐ Decline to answer

4. What is your race? (Select all that apply)

D2 - M2

- ☐ White ☐ Don't know
☐ Black or African American ☐ Decline to answer
☐ Asian ☐ Other (describe below)

5. Do you have any comments or suggestions for improving the workshop?

Solicit (So1) - Open-ended (O1)

Question type: R - 2; D - 2; So - 1
 Question format: S - 2; M - 2; O - 1

Thank you!

Reconstructing Natural Areas in the Built Environment

Monday, January 25 and Tuesday, January 26, 2016

Page 1 of 1

Question 1.

What is your occupation? *Demographic (D1) - Open-ended (O1)*

Required.

Question 2.

How did you learn about this program? *D2 - Multiple choice (M1)*

Required.

- E-Flora or other email from UW Botanic Gardens
- Word of Mouth
- Other (please specify)

Question 3.

Why did you attend? *D3 - M2*

Required.

- Improve work skills/knowledge
- Instructor expertise
- General/personal interest
- Networking opportunities
- Professional Credits
- Other (please specify)

Question 4.

Overall, how was the event? *Reaction (R1) - Scale (S1)*

Required.

- Excellent
- Good
- Fair
- Poor

Question 5.

Which topics, speakers, or discussions did you like? *R2 - O2*

Question 6.

What improvements could be made? *Solicit (So1) - O3*

Question 7.

What seminar topics or speakers would you like to see in the future? *So2 - O4*

*Question type: D - 3; R - 2; So - 2
Question format: M - 2; O - 4; S - 1*

Post survey (directly after)

Please answer the following questions to the best of your ability. This survey is voluntary and anonymous. Thank you for answering honestly. Your honest answers will help make our programs better and more useful.

1. The fall 2016 workshop series included three workshops: one introductory workshop and two hands-on build workshops. How many of the fall 2016 workshops did you attend? *Demographic (D1) - Multiple choice (M1)*

1

2

3

0 - I did not attend any
Other (please specify)

2. Did you attend the introductory workshop at PCC on September 18, 2016? *D2 - M2*

Yes

No

3. If you did not attend the introductory workshop, did you watch the online video of the introductory workshop before attending the build workshop/s? *D3 - M3*

Yes

No

Any comments about the video?

4. Please select the response that best describes your agreement with the following statements (Agree Strongly, Agree, Neutral, Disagree, Disagree strongly):

The workshop increased my understanding of clean water practices.
I understand which clean water practices are appropriate for my site.
I have enough knowledge and experience to install practices at home.
I am likely to use information from this class at my home/business.
I am likely to share information from this class with others.
I am already using the techniques described in class.

Reaction (R1) - Scale (S1)

R2 - S2

R3 - S3

Behavior (B1) - S4

B2 - S5

B3 - S6

These questions anticipate a change in behavior as a result of the class.

5. Rank the following things that will continue to limit your ability to implement clean water practices at home, after this workshop series. Label them 1 to 5, 1 being the most important barrier and 5 the least important. If something is not a barrier to you, please leave it blank.

Don't know much about them
They are too expensive
They are too physically involved

B4 - Rank (Ra1)

Post survey (directly after)

I don't have time

Know about them, but not sure what's best for my site.

6. Would you like to say more about any barriers keeping you from installing practices? *So1c1 (So1) - Open-ended (O1)*

7. What did you like best about the Stormwater Stars series? *R4 - O2*

8. What did you like least about the Stormwater Stars series? *R5 - O3*

9. Any other comments or suggestions you'd like to share to help us improve this program? Thank you so much for your time! *So2 - O4*

Evaluation Form

Introducing Green Infrastructure for Coastal Resilience

The NOAA Coastal Services Center is committed to delivering timely and effective training to the coastal management community. We appreciate your feedback and rely on it to improve future courses.

1. Which of the following best describes your organization or company? (check one) *Demographic (D1) - Multiple choice (M1)*

- Federal government – NOAA (including contractors)
- Federal government – non-NOAA (including contractors)
- University/academic, excluding Sea Grant
- Sea Grant
- National Estuarine Research Reserve System
- National Estuary Program

- State coastal zone management agency
- Other state government
- Local government
- Military
- Private
- Nongovernmental organization/nonprofit
- International
- Other (please specify) _____

2. Which of the following best describes your primary role? (check one) *D2 - M2*

- Data management
- GIS
- Communication/outreach
- Extension/education
- Volunteer
- Program management
- Commercial use
- Recreational use
- Community planning
- Research/science/engineering
- Student
- Other (please specify) _____

3. Please tell us how you heard about this course. (check one)

D3 - M3

- NOAA Coastal Services Center website
- NOAA Coastal Services Center publication
- Local host
- Supervisor
- Conference
- Other (please specify) _____

4. How well were the following objectives met? (Check one box for each objective)

<i>This question attempts to measure how much learning occurred as a result of the course, elevating the question to Level 2 - Learning (see scale options to the right).</i>					
How well did you master the following objectives?	I am not able to do this.	I was able to do this before the course. This course did NOT improve this ability.	I was able to do this before the course, but the course DID improve this ability.	I am able to do this because of this course.	Not applicable (cannot rate).
Recognize green infrastructure terms and concepts <i>Learning (L1) - Scale (S1)</i>	•	•	•	•	•
Understand ecological, economic, and societal benefits of green infrastructure	•	•	•	•	•

*L2 - S2
L2 - S2
L2 - S1*

(over)

Understand the wide variety of contexts and scales of approaches referred to as "green infrastructure" today	*	*	*	*	*	L3 - S3
Identify new or existing planning processes suitable for integrating green infrastructure concepts and techniques	*	*	*	*	*	
Identify local green infrastructure activities and experts with additional information and resources	*	*	*	*	*	

Pace (circle best answer in questions 5 to 16 below)

5. The pace of the class was	1 Too slow	2	3 Just right	4	5 Too fast	Reaction (R1) - S6
6. The time allotted for discussion was	1 Too little	2	3 Just right	4	5 Too much	R2 - S7

Format

7. Presentation materials (slide shows, flip charts, overheads, etc.)	1 Detracted from understanding	2	3	4 Enhanced understanding	R3 - S8
8. Course manual or folder	1 Detracted from understanding	2	3	4 Enhanced understanding	R4 - S9
9. The presenters were	1 Poorly Prepared	2	3	4 Well Prepared	R5 - S10
10. The presenters communicated concepts and ideas	1 Poorly	2	3	4 Very Well	R6 - S11
11. There was a good balance between lectures and activities	1 Strongly Disagree	2	3	4 Strongly Agree	R7 - S12
12. I would recommend this course to colleagues	1 Strongly Disagree	2	3	4 Strongly Agree	R8 - S13

Value and Applicability

13. I gained knowledge and skills that I will apply in my job	1 Strongly Disagree	2	3	4 Strongly Agree	N/A	R9 - S14
14. Attending this course was a good use of my time	1 Strongly Disagree	2	3	4 Strongly Agree	N/A	R10 - S15
15. Prior to this course, what was your level of understanding of the material covered?	0% 20% 40% 60% 80% 100%					L6 - S16
16. After this course, what is your level of understanding of the material covered?	0% 20% 40% 60% 80% 100%					L7 - S17

17. What was the most valuable part of this course?

R11 - Open-ended (Q1)

L2 - S2

18. What was the least valuable part of this course?

R12 - Q2

(over)

19. Do you have suggestions for improving this training?

Solicit (So1) - O3

20. Other comments:

So2 - O4

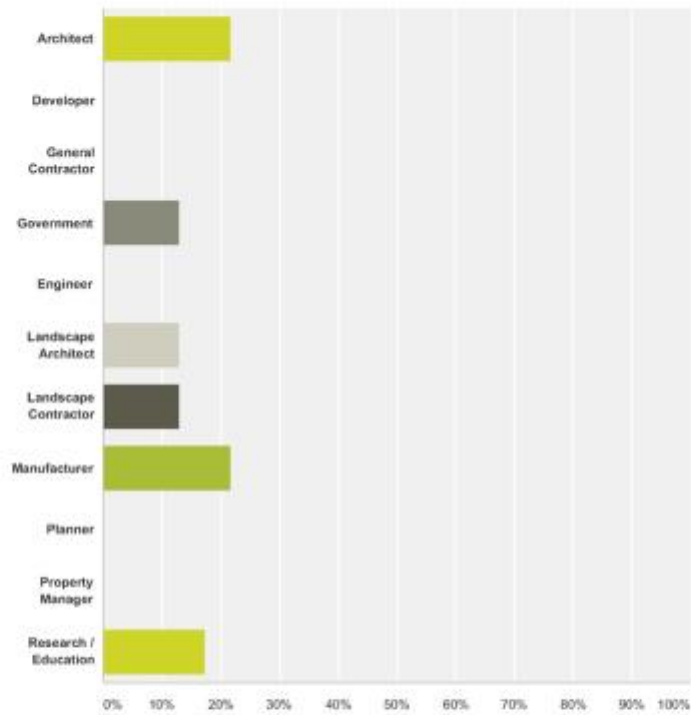
*Question type: D - 3; R - 12; L - 7; So - 2
Question format: M - 3; S - 17; O - 4*

(over)

Q1 Which of the following best describes your current occupation?

Demographic (D1) - Multiple choice (M1)

Answered: 23 Skipped: 5



Answer Choices	Responses
Architect	21.74% 5
Developer	0.00% 0
General Contractor	0.00% 0
Government	13.04% 3
Engineer	0.00% 0
Landscape Architect	13.04% 3
Landscape Contractor	13.04% 3
Manufacturer	21.74% 5
Planner	0.00% 0

2016 Ecoroof Symposium

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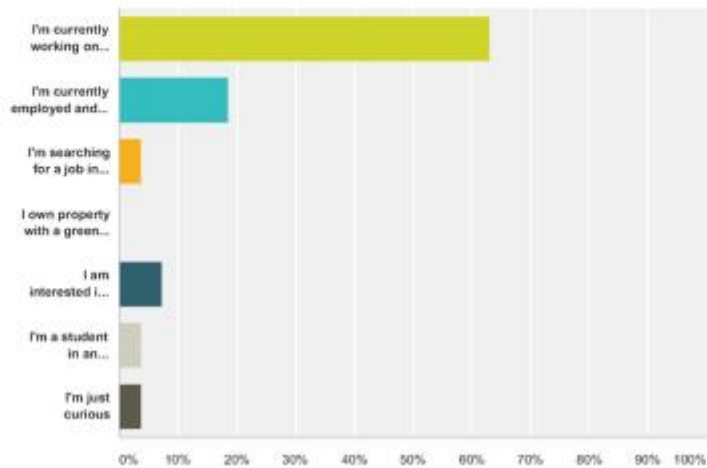
Property Manager	0.00%	0
Research / Education	17.39%	4
Total		23

#	Other (please specify)	Date
1	Grower	10/11/2016 3:47 PM
2	Green roof design/builder	10/11/2016 8:41 AM
3	Non-profit Nature Park Coordinator	10/10/2016 10:21 AM
4	Consultant	10/10/2016 8:34 AM
5	Plant supplier/vendor	10/10/2016 7:56 AM
6	I am more than one of the above... (a L/S Arch, a Gen Contr, and a Gov't rep (past))	10/9/2016 4:24 PM
7	Conservationist	10/8/2016 7:26 PM
8	Project manager and educator for a community center.	10/8/2016 10:59 AM
9	Eco Roof Owner	10/8/2016 9:37 AM

Q2 Which of the following best describes your involvement in the ecoroof industry?

Q2 - ME

Answered: 27 Skipped: 1

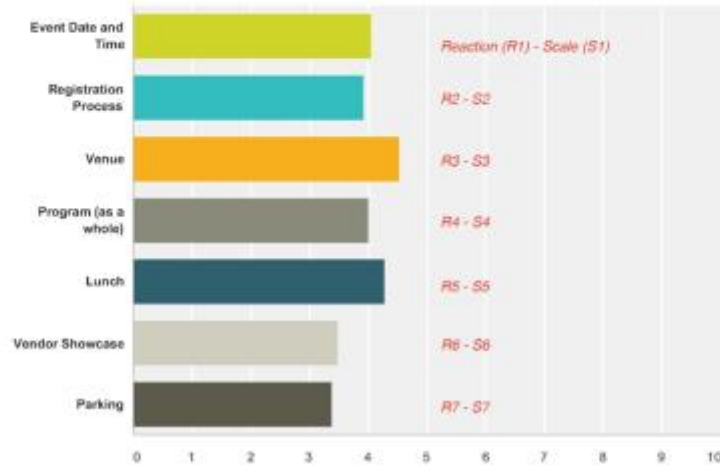


Answer Choices	Responses
I'm currently working on ecoroof projects	62.96% 17
I'm currently employed and hoping to expand my skill set to include ecoroofs	18.52% 5
I'm searching for a job in or related to the ecoroof industry	3.70% 1
I own property with a green roof	0.00% 0
I am interested in having a green roof on my property	7.41% 2
I'm a student in an ecoroof-related field	3.70% 1
I'm just curious	3.70% 1
Total	27

#	Other (please specify)	Date
1	Roof Consultant	10/10/2016 8:34 AM
2	Plant supplier/vendor	10/10/2016 7:56 AM
3	Need another option: "Some/ALL of the above"	10/9/2016 4:24 PM
4	I own property with a green roof, but it is in Portland, so I call it an eco roof. Need more than one box checkable...	10/8/2016 9:37 AM

Q3 In regards to your experience at the Ecoroof Symposium, please evaluate the event elements below:

Answered: 27 Skipped: 1

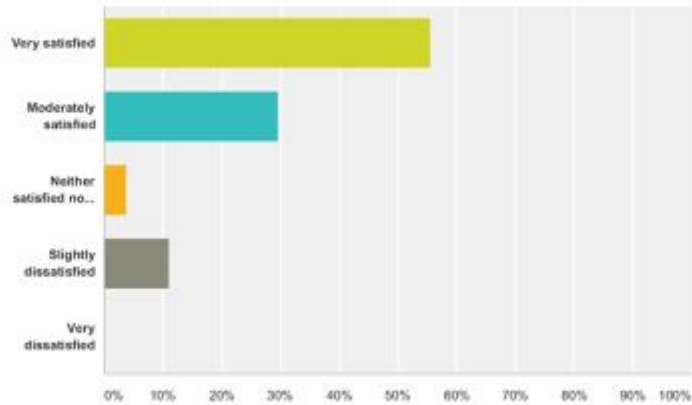


	Bad	Needs improvement	Sufficient	Pretty good	Great	Total	Weighted Average
Event Date and Time	0.00% 0	7.41% 2	22.22% 6	29.63% 8	40.74% 11	27	4.04
Registration Process	7.41% 2	3.70% 1	22.22% 6	22.22% 6	44.44% 12	27	3.93
Venue	0.00% 0	0.00% 0	14.81% 4	18.52% 5	66.67% 18	27	4.52
Program (as a whole)	0.00% 0	14.81% 4	11.11% 3	33.33% 9	40.74% 11	27	4.00
Lunch	0.00% 0	7.69% 2	7.69% 2	34.62% 9	50.00% 13	26	4.27
Vendor Showcase	0.00% 0	7.41% 2	44.44% 12	40.74% 11	7.41% 2	27	3.48
Parking	3.85% 1	15.38% 4	38.46% 10	23.08% 6	19.23% 5	26	3.38

Q4 Overall, how would you describe your satisfaction of the event?

R8 - S8

Answered: 27 Skipped: 1

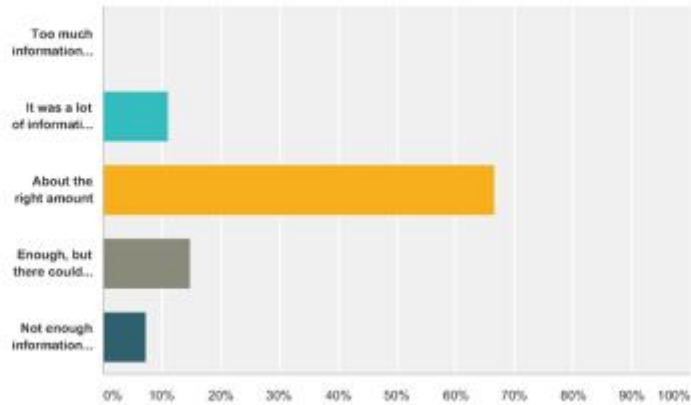


Answer Choices	Responses
Very satisfied	55.56% 15
Moderately satisfied	29.63% 8
Neither satisfied nor dissatisfied	3.70% 1
Slightly dissatisfied	11.11% 3
Very dissatisfied	0.00% 0
Total	27

Q5 How would you evaluate the information shared at the Ecoroof Symposium?

R9 - 59

Answered: 27 Skipped: 1



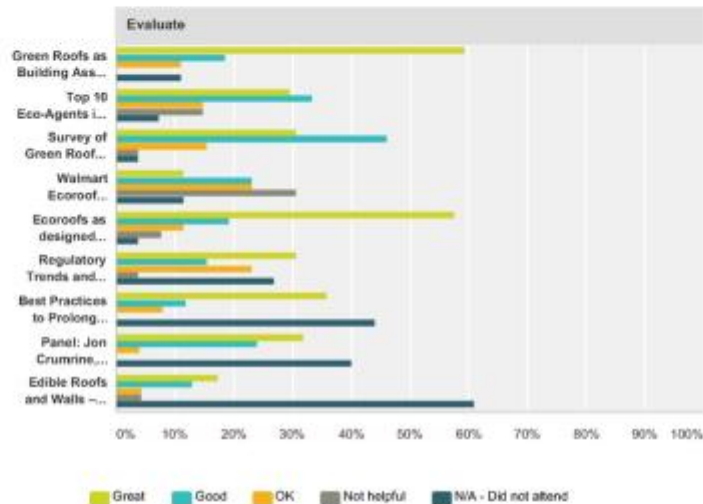
Answer Choices	Responses
Too much information covered	0.00% 0
It was a lot of information for one day	11.11% 3
About the right amount	66.67% 18
Enough, but there could have been more information	14.81% 4
Not enough information covered	7.41% 2
Total	27

#	Comment	Date
1	Good morning, my co-worker and I drove down from the Seattle area to attend the symposium and felt that this event could've been more informative in order to try and affect real change within the Green Roof community which, as you know, starts at the City leadership level then moves directly to the owners/developers. From a company that has installed more Green Roofs than anyone in the PNW over the past 15-20 years, we felt the symposium could've offered more practical application/knowledge in order to help educate those not as familiar with this type of application/installation to ensure success and longevity of all Green Roofs. The breakout session at the end (Green Roof Failures) could have been a very informative platform for everyone involved but felt it was very short with only a couple of questions from the audience allowed before time was up. The idea of the symposium is great and really appreciate the efforts of those who helped organize this event. If interested I would be more than happy to share additional thoughts and am available by phone 206-375-4633	10/10/2016 8:50 AM
2	Need more specific break out sessions for different topics	10/10/2016 7:58 AM
3	LOTs of info is GOOD!important! Let us decide how to engage and digest!	10/9/2016 4:27 PM
4	Nothing of utility for practitioners unlike the previous summits I've attended	10/9/2016 8:53 AM

Q6 We want to get an idea of which presentations you attended. Please evaluate each of the presentations you attended below. (If you did not attend, please indicate N/A).

R10 - S10

Answered: 27 Skipped: 1



Evaluate	Great	Good	OK	Not helpful	N/A - Did not attend	Total
Green Roofs as Building Asset - Dusty Gedge, European Federation of Green Roof Associations, and founder of livingroofs.org	59.26% 16	18.52% 5	11.11% 3	0.00% 0	11.11% 3	27
Top 10 Eco-Agents in a Climate-Changing World - Linda Velazquez ASLA, founder of greenroofs.com global database	29.63% 8	33.33% 9	14.81% 4	14.81% 4	7.41% 2	27
Survey of Green Roof Design Criteria Affecting Stormwater Detention - Henry Stevens, Environmental Specialist, Portland Bureau of Environmental Services	30.77% 8	46.15% 12	15.38% 4	3.85% 1	3.85% 1	26
Walmart Ecoroof Performance Metrics - Aquila Veloria, Senior Associate, Cadmus Energy Service Division	11.54% 3	23.08% 6	23.08% 6	30.77% 8	11.54% 3	26
Ecoroofs as designed experiments- Oyssa Stairy, Assistant Professor, Portland State University	57.69% 15	19.23% 5	11.54% 3	7.69% 2	3.85% 1	26
Regulatory Trends and Pending Policy, Portland and San Francisco - Mindy Brooks, Planner, City of Portland Bureau of Planning and Sustainability; Anne Brack, Planner, San Francisco Planning Department; Dusty Gedge,	30.77% 8	15.38% 4	23.08% 6	3.85% 1	26.92% 7	26
Best Practices to Prolong Service Life and Avoid Concerns: Intro: Anna Thurston, Evergreen; Panel: Jon Crumrine, Pres. GRS; Larry Leffke, Field Advisor Tremco; Rick Kilo, Green Roof Tech.Coord, Hydrotech; Moderator, Elizabeth Hart, GRI Exec. Dir	36.00% 9	12.00% 3	8.00% 2	0.00% 0	44.00% 11	25

2016 Ecoroof Symposium

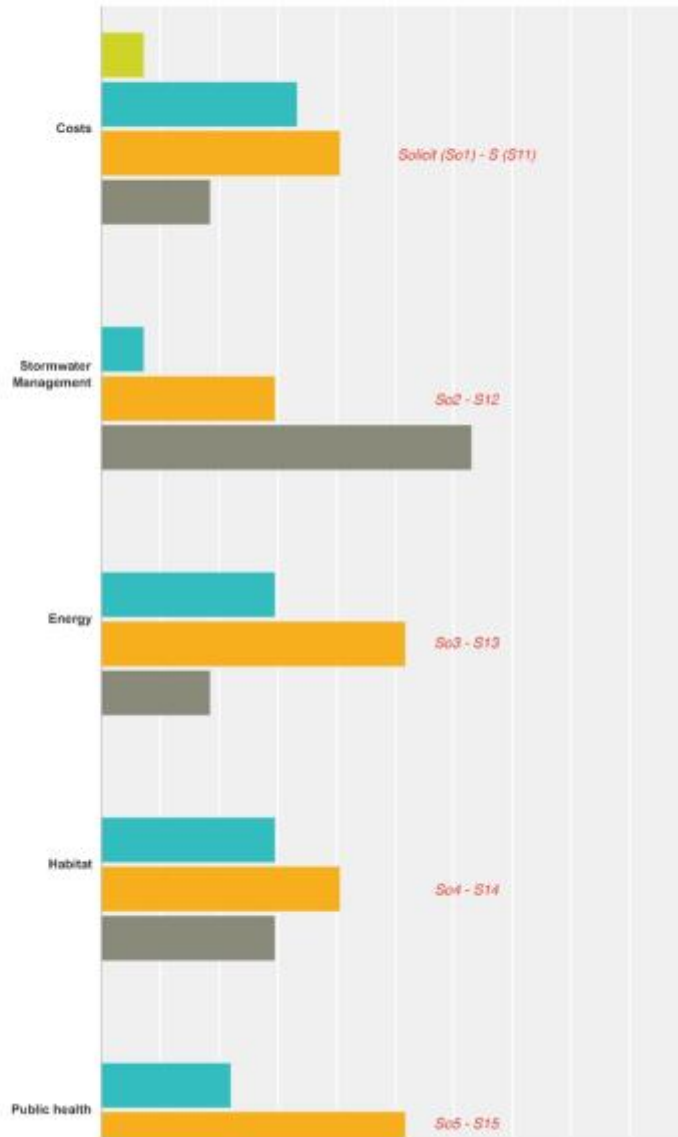
SurveyMonkey

Panel: Jon Crumrine, President GRS; Larry Lehrke, Field Advisor Tremco; Rick Kile, Green Roof Technical Coordinator, Hydrotech; Moderator - Elizabeth Hart, GRoT Executive Director	32.00%	24.00%	4.00%	6.00%	48.00%	25
	8	6	1	0	10	
Edible Roofs and Walls - George Irwin, President and Founder, Green Living Technologies; Marc Boucher-Colbert, Portland Rooftop Farmer for Noble Rot and Rocket Bldgs; Moderate - Alan Proffitt, Lead Project Manager of Multnomah County	17.39%	13.04%	4.35%	4.35%	68.87%	23
	4	3	1	1	14	

#	Additional Comments?	Date
1	See previous comments	10/10/2016 8:57 AM
2	Anna Thurston's presentation shouldn't be buried or mixed with other panel presenters.	10/9/2016 4:36 PM
3	This was the fourth summit I've attended previous events always had at least some useful content this one provided no new insights for me as a practitioner	10/9/2016 9:01 AM
4	Overall the selection of presenters was great. Dusty Gedge was fabulous - I would love to hear him talk at future events if he's available! I appreciated the diversity of topics covered. I would like to see more presenters with more options for break out groups in the future if possible. I felt that the stormwater survey and regulatory trends topics were not particularly relevant to me, I also was not impressed by George Irwin. I was hoping to hear more about how vertical edible gardens can be utilized by all design professionals, but instead we got a sales pitch for his product along with some ranting about hydroponics. Because of that, I didn't feel as though that topic was explored or discussed to the level it could have been. I loved hearing Marc Boucher-Colbert's parts of the talk though.	10/8/2016 6:10 PM

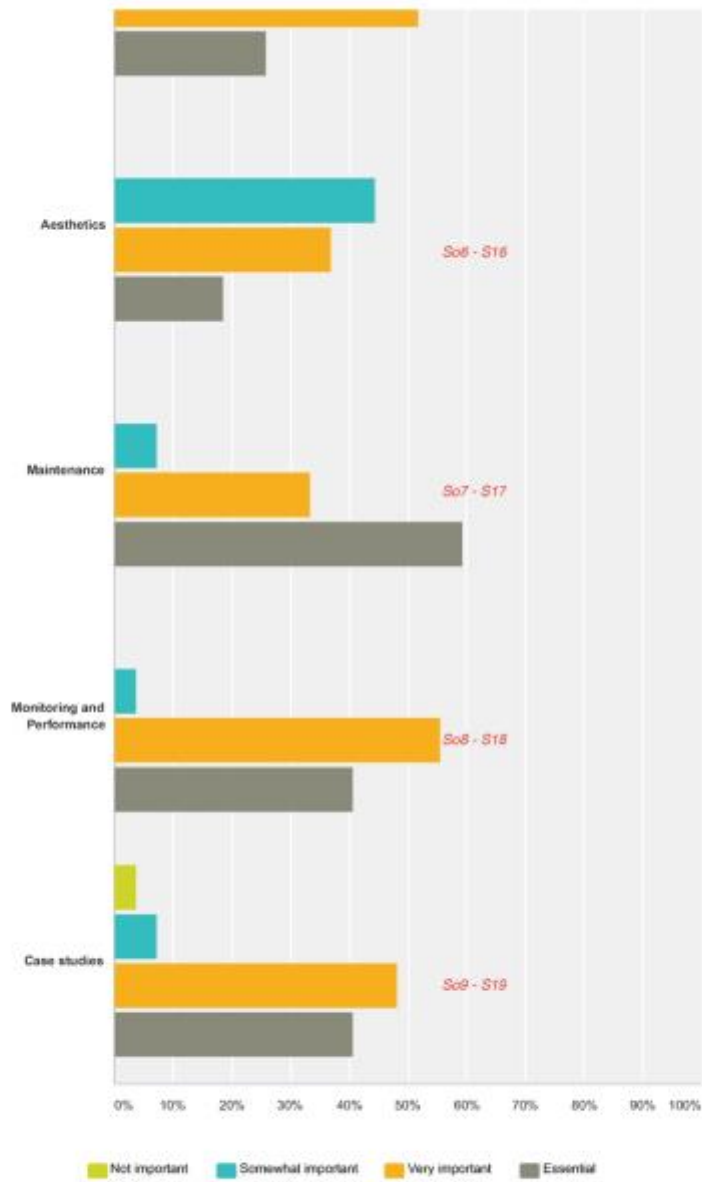
Q7 How important are these topics to include in future ecoroof symposiums?

Answered: 27 Skipped: 1



2016 Ecoroof Symposium

SurveyMonkey



Not important	Somewhat important	Very important	Essential	Total
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2016 Ecoroof Symposium

SurveyMonkey

Costs	7.41% 2	33.33% 9	40.74% 11	18.52% 5	27
Stormwater Management	0.00% 0	7.41% 2	29.63% 8	62.96% 17	27
Energy	0.00% 0	29.63% 8	51.85% 14	18.52% 5	27
Habitat	0.00% 0	29.63% 8	40.74% 11	29.63% 8	27
Public health	0.00% 0	22.22% 6	51.85% 14	25.93% 7	27
Aesthetics	0.00% 0	44.44% 12	37.04% 10	18.52% 5	27
Maintenance	0.00% 0	7.41% 2	33.33% 9	59.26% 16	27
Monitoring and Performance	0.00% 0	3.70% 1	55.56% 15	40.74% 11	27
Case studies	3.70% 1	7.41% 2	48.15% 13	40.74% 11	27

#	What other topics would you like included?	Date
1	Life cycle costs	10/11/2016 8:47 AM
2	I think if there was a Q&A session with a panel of people consisting of a well known local city planner, owner/developer, General Contractor, Building & Landscape Architects as well as a qualified Installer and Maintenance Person it could be a nice platform to hear/share real concerns/comments from the people who are intimately involved on a daily basis with helping this industry grow and sustain for years to come	10/10/2016 8:57 AM
3	More on the long term commitment + trade-off realities of potential owners!	10/9/2016 4:36 PM
4	I would recommend continuing to include urban agriculture.	10/8/2016 6:10 PM
5	More tours and practical and alternative methods details	10/8/2016 9:42 AM

2016 Ecoroof Symposium

SurveyMonkey

Costs	7.41% 2	33.33% 9	40.74% 11	18.52% 5	27
Stormwater Management	0.00% 0	7.41% 2	29.63% 8	62.96% 17	27
Energy	0.00% 0	29.63% 8	51.85% 14	18.52% 5	27
Habitat	0.00% 0	29.63% 8	40.74% 11	29.63% 8	27
Public health	0.00% 0	22.22% 6	51.85% 14	25.93% 7	27
Aesthetics	0.00% 0	44.44% 12	37.04% 10	18.52% 5	27
Maintenance	0.00% 0	7.41% 2	33.33% 9	59.26% 16	27
Monitoring and Performance	0.00% 0	3.70% 1	55.56% 15	40.74% 11	27
Case studies	3.70% 1	7.41% 2	48.15% 13	40.74% 11	27

#	What other topics would you like included?	Date
1	Life cycle costs	10/11/2016 8:47 AM
2	I think if there was a Q&A session with a panel of people consisting of a well known local city planner, owner/developer, General Contractor, Building & Landscape Architects as well as a qualified Installer and Maintenance Person it could be a nice platform to hear/share real concerns/comments from the people who are intimately involved on a daily basis with helping this industry grow and sustain for years to come	10/10/2016 8:57 AM
3	More on the long term commitment + trade-off realities of potential owners!	10/9/2016 4:36 PM
4	I would recommend continuing to include urban agriculture.	10/8/2016 6:10 PM
5	More tours and practical and alternative methods details	10/8/2016 9:42 AM

2016 Ecoroof Symposium

SurveyMonkey

Q8 The Ecoroof Symposium was focused on informing attendees on issues that should be considered regarding the inclusion of a greenroof requirement in the 2035 central city plan. In your opinion, what is the most pressing area of information still needed on this topic?

So10 - Open-ended (O1)

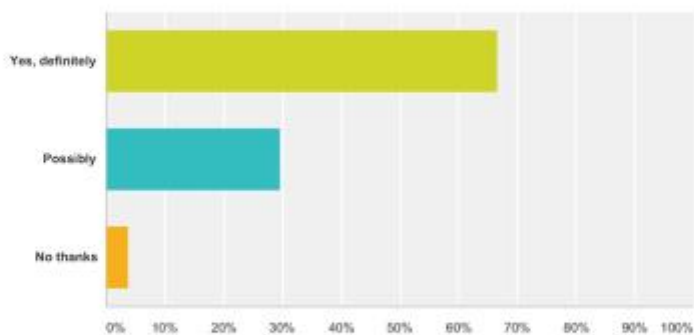
Answered: 15 - Skipped: 13

#	Responses	Date
1	Comprehensive life cycle costs including stacked benefits; neighbourhood-level analysis	10/11/2016 8:47 AM
2	what minimum requirements should be included to ensure that, if greenroofs are required, they perform as desired.	10/11/2016 7:48 AM
3	Explanation of available resources to the Portland design community would be nice. The San Francisco example was great in that they walked through the resources made available to developers and designers as the requirement was implemented. Portland will need to follow suit if the new mandate is to be a success. GRIT is in a prime position to take the lead on this and has a wealth of knowledge to share.	10/10/2016 8:01 PM
4	How to engage and inform the general community.	10/10/2016 10:24 AM
5	I attended from out of state. The 2035 Central City Plan was not a focus of our trip.	10/10/2016 9:44 AM
6	See above comments	10/10/2016 8:57 AM
7	Clarity about what is still open for changes.	10/10/2016 8:31 AM
8	To hear from developers about how the requirement may play out	10/10/2016 8:27 AM
9	Energy and Stormwater Benefits.	10/10/2016 8:09 AM
10	The tried and true designs of greenroofs that can be implemented into a document (specification) in a design/code requirement to set as a platform for designers to incorporate into their individual or unique greenroof projects.	10/10/2016 7:49 AM
11	Simplifying aesthetic designs to keep the maintenance simple later on. Show up options other than sedums, and what is the reality in creating these types of installations. Avoid ONLY selling the latest products!	10/9/2016 4:38 PM
12	Follow up on legislation	10/8/2016 7:31 PM
13	Community education and outreach was not strongly discussed, and I think that would have been a valuable topic to include. I also did not realize that was the focus of this symposium. Some of the presenters brought up the 2035 Central City Plan, but it was by no means a continual thread running through the presentations.	10/8/2016 6:10 PM
14	Trained and experienced installers and tech	10/8/2016 10:33 AM
15	I would like to see how the average home owner could afford an echo roof system and public information for them. It would be nice if the city could provide some market development funds to home owners or contractors to aid in the construction of green practices.	10/8/2016 9:59 AM

Q9 Would you participate in the Ecoroof Symposium if we held it again next year?

So 11 - M3

Answered: 27 Skipped: 1



Answer Choices	Responses
Yes, definitely	66.67% 18
Possibly	29.63% 8
No thanks	3.70% 1
Total	27

#	If no, why?	Date
1	Depends on content offered	10/10/2016 8:57 AM
2	The program would have to clearly provide useful practice. Eneffts	10/9/2016 9:01 AM

2016 Ecoroof Symposium

SurveyMonkey

Q10 What would you add or change about the next Ecoroof Symposium to make it better?

So12 - Q2

Answered: 27 Skipped: 1

#	Responses	Date
1	A little cleaner registration for participants and vendors.	10/11/2016 3:56 PM
2	I thought it would be a great idea to meet in small groups and have a design/collaborative exercise. Fun way to meet people and learn things hands on. Thanks for the wonderful day!	10/11/2016 3:45 PM
3	Downtown tour	10/11/2016 8:47 AM
4	seek input from stormwater regulators around the country and internationally. maybe more papers/studies.	10/11/2016 7:48 AM
5	More focus on the best practices and feedback on what has worked and what doesn't. The best practices panel discussion could have been expanded to 2-3 hours. Lots of information and not enough time to hear it all!	10/10/2016 8:01 PM
6	Change from having it on a Monday.	10/10/2016 10:56 AM
7	Parking	10/10/2016 10:24 AM
8	Introductions for the vendors: who they are and what they do.	10/10/2016 9:46 AM
9	The speakers need a little bit of training on how to present the information better to the audience. Be careful in presenting the information so that it does not dwell on negatives and areas that are unknown.	10/10/2016 9:44 AM
10	See comments above	10/10/2016 8:57 AM
11	More vendors at the fair, if this is possible.	10/10/2016 8:56 AM
12	Nothing leaps to mind.	10/10/2016 8:40 AM
13	provide a basic overview of the status of ecoroofs in Portland (number, percent, percent new development per year, approx. cost of install, cost/ben over time) nothing in-depth, but just the rough numbers to orient people. Provide the schedule in hard copy. Provide the schedule earlier in advance. Overall, great job!! Really interesting mix of presenters and perspectives.	10/10/2016 8:31 AM
14	You all did an excellent job!	10/10/2016 8:27 AM
15	Appeal more to commercial owners.	10/10/2016 8:09 AM
16	Have the speaker schedule listed ahead of the event (maybe it was but I could not find it on facebook or PSU's site).	10/10/2016 8:04 AM
17	More specific break out sessions	10/10/2016 8:02 AM
18	Although this was specific to increasing greenroofs in Portland, it would be helpful to include any currently installed greenroofs in the Portland Metro area for discussion about success rates & management and how other cities outside of Portland incorporate greenroofs into their building codes.	10/10/2016 7:49 AM
19	Effective registration, and a tour of a variety of green roof examples that shows both good and bad details.	10/9/2016 4:36 PM
20	See above	10/9/2016 9:01 AM
21	Field trip in Portland	10/8/2016 7:31 PM
22	My only real criticism of this program was the registration/organization of it. I had no idea there were tours being held on Sunday despite searching out as much information as I could when purchasing my ticket. I would have like to attend a tour, but didn't know it had happened until I discovered the information buried in a blog somewhere during a break in the symposium. The registration/check-in process was also extremely clumsy. I have never attended an event at PSU, but I would have expected them to be more organized than they were. Providing a schedule of lectures prior to the day of the event would also be appreciated. I have never attended a symposium where something that basic is not provided.	10/8/2016 6:10 PM
23	shorter presentations, hard to listen to one person for a full hour.	10/8/2016 4:06 PM
24	No	10/8/2016 11:18 AM
25	The davis session after lunch was rough ... Should be a break out / optional session	10/8/2016 10:33 AM

2016 Ecoroof Symposium

SurveyMonkey

26	I would love to attend in a location other than downtown due to the parking.	10/8/2016 9:59 AM
27	Reach outside the choir and get some new adapters. Marketing and early planning required (likely starting now) Reports and follow-up on the next steps.	10/8/2016 9:42 AM

Question type: D - 2; R - 10; So - 12
Question format: M - 3; S - 19; O - 2



NWEC 2016 Evaluation

WELCOME. By taking a few moments to complete this short evaluation, you will help us improve our future conferences. Thank you!

1. Rate the overall conference.

		High-5	4	3	2	1-Low
Educational value?	Reaction (R1) - Scale (S1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Networking value?	R2 - S2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Value of the exhibits?	R3 - S3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Value of the conference overall?	R4 - S4	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Quality of the facility?	R5 - S5	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Quality of organization & logistics?	R6 - S6	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Likelihood that you will attend again?	R7 - S7	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

General conference comments: Solicit (So1) - Open-ended (O1)

2. Please rate the USEFULNESS or INTEREST VALUE of the sessions YOU attended. DAY ONE - TUESDAY RS - SS

	High-5	4	3	2	1-Low
1A - Environmental Forecasting: Clear or Clairvoyant?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1B - Determining Human Health Risks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1C - Carbon Pricing for the Northwest	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1D - Making the Business Case for Sustainability	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Keynote Panel: Regulatory Update	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2A - Stormwater Permitting Fundamentals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2B - Climate Change & Surface Water Resources	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2C - When Does Data Become Public Information?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2D - Joining the Circular Economy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tues. Lunch Keynote: Our Change The Course (CIC) Campaign	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3A - Air Quality Permitting Fundamentals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3B - Lessons from the New Industrial Stormwater Standards	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3C - Legislative Perspectives on the Environment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3D - Advancing Green Chemistry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4A - RCRA / Dangerous Waste Fundamentals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4B - Air Quality - Charting a New Regulatory Course	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4C - Community Perspectives on Acceptable Risk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4D - Understanding & Managing Business Water Risk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Specific session comments:

So2 - Q2

NOTE: Question 2 and 3 ask the same question and are therefore only counted once. Because the purpose of this analysis is to understand the evaluation methodology these two questions are considered to be and are thus considered as one question in their entirety.

3. Please rate the USEFULNESS or INTEREST VALUE of the sessions YOU attended. DAY TWO - WEDNESDAY *OMIT - See NOTE on page 2.*

	High-5	4	3	2	1-Low
5A - Managing for Environmental Excellence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5B - Latest Perspectives on TCE, Dioxins and 1,4-Dioxane	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5C - Environmental Data Management for Facilities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5D - Management Tools for Advancing Sustainability	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Keynote: Moving Toward a More Sustainable Freight Future	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6A - Spills & Emergency Response Preparedness	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6B - Emerging Contaminants Driving Assessments & Cleanup Technologies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6C - Succession Planning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6D - Moving Beyond Compliance to Sustainability	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wed. Lunch & Environmental Excellence Awards	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7A - Water Resources in the Northwest	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7B - Complex Issues in RCRA & Dangerous Waste	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7C - Communicating in a Crisis	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7D - Demonstrating Performance Through Corporate Disclosure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Specific session comments:

4. What would make the next conference more useful or valuable to you?

So3 - Q3

5. Suggestions for future topics and/or speakers:

So4 - Q4

6. What was your primary interest area at the conference? *Demographic (D1) - Multiple choice (M1)*

- ☐ Environmental protection, compliance, or cleanup
- ☐ Environmental health & safety
- ☐ Operations, process, or facility improvements
- ☐ Sustainable business practices
- ☐ Economic development / sector competitiveness
- ☐ Environmental policy
- ☐ Business services
- ☐ General interest

7. Where do you work? D2 - M2

- ☐ Industrial facility
- ☐ Commercial facility
- ☐ Government agency
- ☐ Service provider (engineer, consultant, attorney, etc.)
- ☐ Product or technology provider
- ☐ Education or non-profit
- ☐ Personal interest / student
- ☐ Other

8. Where are you from? D3 - M3

- ☐ Oregon
- ☐ Washington
- ☐ Other (please specify)

9. How many times have you attended NWECC? D4 - M4

- ☐ 1 - This was my first time
- ☐ 2 - Once before
- ☐ 3 - Twice before
- ☐ 4 - Three or more times before this

10. How did you learn about NWECC 2016? D5 - M5

- ☐ E-mail Notice
- ☐ Word of Mouth
- ☐ Print Ad
- ☐ NWECC Website
- ☐ Other Website
- ☐ Social Media
- ☐ Invited to Speak
- ☐ Internet Ad
- ☐ AOI
- ☐ Direct Mail Postcard

Done >>

Question type: D - 5; R - 8; S - 4
 Question format: M - 5; S - 8; O - 4