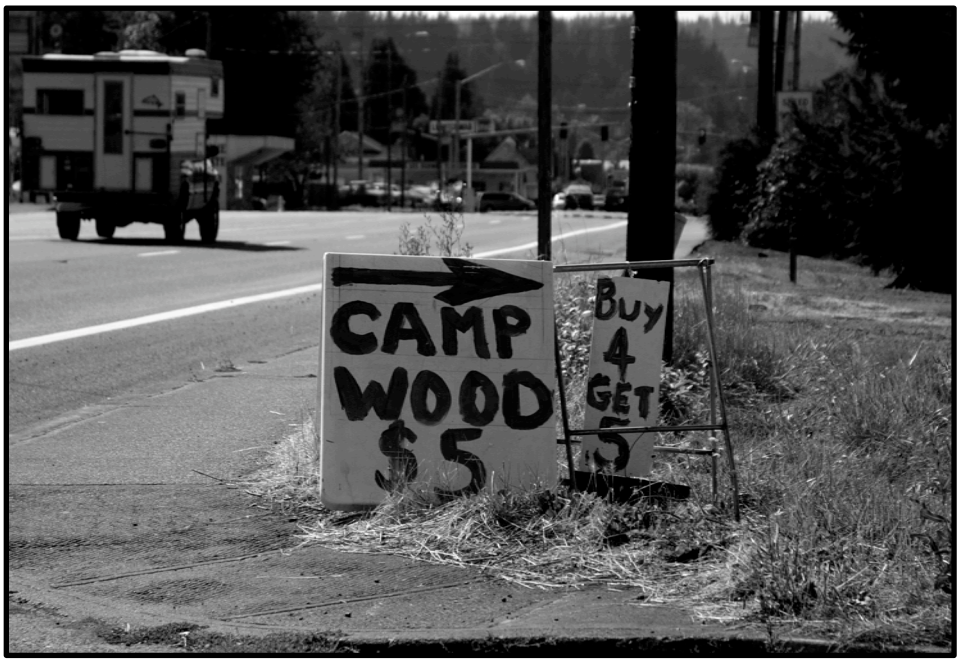
Educating Pacific Northwest Campers on the Risk of Spreading Invasive Forest Pests through Firewood: Developing a Mental Model



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ABSTRACT

Educating Pacific Northwest Campers on the Risk of Spreading Invasive Forest Pests through Firewood

The spread of invasive species into the Pacific Northwest (PNW) of the United States poses a serious threat to the valuable forest resources of the region. Many insects and diseases that are a threat to these forest resources can be transported inside firewood. When campers transport their firewood across borders and ecosystems they can simultaneously spread invasive species into campgrounds and parks. In response to this risk, a campaign was developed to inform campers in Oregon, Washington, and Idaho about the risk of invasive species being transported through firewood. There are two main objectives of this research study. The first objective is to measure the effectiveness of this campaign in informing campers about the risk of invasive species moving through firewood. The second objective is to conduct an audience analysis of Pacific Northwest campers to identify key characteristics of campers and develop a mental model of their views, knowledge, and beliefs regarding invasive species and firewood that may be used to guide future risk communication tailored to campers needs and perceptions. Two surveys were conducted with PNW campers, a pre and post-campaign survey, in order to measure the impact of the risk communication campaign. Twenty-seven PNW campers participated in in-depth interviews where they were asked to describe their basic camping practices, environmental values, and invasive species knowledge. Their responses were coded and analyzed for dominant beliefs and major decision-making influences. The results indicate that there was an increase in campers' exposure to information about invasive species in firewood after the completion of the campaign. However, several knowledge gaps and misconceptions by campers were identified that may be addressed in future risk messaging efforts to more effectively and efficiently communicate invasive species risks.

KEYWORDS: invasive species, mental models, campers, values, beliefs, knowledge, firewood, practices, audience analysis

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Introduction

The spread of invasive species in the Pacific Northwest is a threat to the economic, social, and ecological well being of local residents (Boersma, Reichard, and Van Buren, 2006). Humans often act as a vector for the spread of invasive species through the transportation of invasive plant, insect, and fungi species across borders and between ecosystems (Perrings et al., 2002). Invasive species are of particular concern in the Pacific Northwest where the natural resources, including forest and water resources, are important to both the culture and economy of the region.

Each year millions of Americans go camping at any of the thousands of campgrounds around the nation, which provide a cost-effective, family friendly, and relaxing escape from daily life. The U.S. Forest Service estimates that there are over 18 million annual visits to National Forests in the Pacific Northwest region (United States Forest Service, 2010). Many of these campers regularly make campfires for cooking, entertainment, or heating. It is not uncommon for campers to bring their own firewood when they go camping, as the wood that is sold near or at the campground is often perceived as expensive or low quality (United States Department of Agriculture, 2010). Many insects and diseases that are a threat to forest resources can be transported inside firewood. When recreationists and campers transport their firewood across borders and ecosystems they can simultaneously spread invasive species into campgrounds and parks (Robertson and Andow, 2010). When that firewood is transported long distances invasive

species can quickly become established within a previously unaffected ecosystem, which can result in the destruction of forest or other natural resources. The Oregon Invasive Species Council (OISC), with partners in Washington and Idaho, developed the 2010 Tri-State firewood campaign in order to inform campers about the risks associated with the transportation of firewood and alter campers' risky behavior.

Using a combination of qualitative and quantitative methods, an exploratory comprehensive audience analysis was conducted to identify Pacific Northwest (PNW) campers' values, knowledge, and practices regarding their camping experience, firewood, and invasive species. Results from this audience analysis were used to develop a list of key camper characteristics that could be used to tailor future risk messaging to the needs and perceptions of Pacific Northwest campers. In addition, results from this audience analysis were used to develop a mental model of PNW campers' knowledge and perceptions about the threat of invasive species moving through firewood. A mental models approach was adopted for this study to provide a "systematic way to identify…poorly structured or superfluous risk information" (Bostrom et al., 1994, p. 792) within the Tri-State firewood campaign, as well as, identify knowledge gaps or misconceptions campers possess about the risk. One objective of this exploratory audience analysis was to evaluate the effectiveness of the 2010 Tri-State Firewood campaign, however the main purpose of this study was to identify specific needs and perceptions of Pacific Northwest campers that could be used to construct more efficient and effective risk messaging in the future.

Background

The Problem

Invasive species pose a serious threat to both the economy and the environment of the Pacific Northwest. Invasions caused by humans have caused dramatic changes to the earth's landscape, which has resulted in changes to native species, evolutionary processes, and caused wholesale changes to ecosystems (Mack et al., 2000). Invasive species are pests that are "introduced, established, naturalize, and spread outside of their home range, and whose impacts involve significant harm" (Perrings et al., 2002, p. 1). In order to understand the political context and the rationale behind the Oregon Invasive Species Councils Tri-State firewood campaign it is important to recognize and understand the process of the spread of invasive species, the economic and ecological impacts of invasive forest pests, the role of firewood as a vector for the spread of invasive species, previous government responses to invasive species, and the importance of outreach and education in preventing the spread of invasive species.

Process for the Spread of Invasive Species

One of the major causes for the spread of invasive species has been the advent of the global economy that has resulted in the trade of economically valuable species. Often this trade has resulted in the exchange of either ecologically or economically beneficial species, but it has also resulted in the accidental spread of harmful species (McNeely, 2000). Through the global economy human-aided invasions occur when crops, animals, ballast water, soil, and food are transported, either intentionally or accidentally through ships, planes, vehicles, etc. that act as stepping stones for invasive species (Vermeij,

1996). The patterns of trade and travel are critical for understanding the spread of invasive species, as these patterns can often be used to identify both the pathways and frequency of invasions (Perrings et al., 2002).

The spread of invasive species can be broken up into specific steps or phases. Vermeij (1996) identified three stages for the spread of invasive species: arrival, establishment, and integration. Arrival is when individuals enter into the new host region or location outside the customary range. Once the species arrives, establishment is when the species can reproduce at the new location and sustain itself without further recruitment. Finally, an invasive species becomes integrated when this species interacts with the local ecosystem and "forges ecological links with other species in the recipient region, evolution occurs, reflecting the changed selective regime in the recipient community" (Vermeij, 1996, p. 4).

In the arrival stage, invasions often begin with introduction of a small number of individuals. The cost of measures aimed at excluding invaders at the arrival stage is usually minimal compared to the costs associated with eradication or management of the invader after establishment (Mack et al., 2000). As a result, proactive policies that restrict specific vectors known to transport pests are more cost-effective than reactive policies that are developed after a pest has become established. However, it can be difficult to gain political support for stopping a pest that has yet to cause any ecological or economic harm.

In the last century our increase in mobility and the popularity of the tourism industry have accelerated the human-aided invasion of pests as humans are traveling to

more remote and sensitive areas more easily than in the past. Human movement to remote areas of the world has also been accelerated by the recent trend towards outdoor activities and ecotourism (Wittenberg and Cock, 2001). The increase in mobility has been directly linked to the spread of specific invasive species. When mapping the spread of the European gypsy moth, Lippitt et al. (2008), found that anthropogenic variables such as population density and road access played a significant role in the distribution of the invasive moth. The spread of invasive species is not typically a natural process; instead it is most often a negative externality of economic activity.

Economics of Invasive Species

The spread of invasive species poses a serious threat to both biodiversity and ecosystem functions, which has direct economic consequences such as harm to fisheries, forestry, crops, and grazing. At the same time the direct economic impacts have been poorly explored, such that quantifying actual harm in an affected community is very difficult (Mack et al., 2000). When looking at the economics of forest invasive species it is difficult to identify the costs or benefits that are a result of these pests. For instance, there are both economic causes and consequences of invasive forest pests, these consequences may or may not be irreversible, and little is known about the extent of damage that will be caused by a particular invasive pest in specific ecosystems (Holmes et al., 2009). The damage caused by invasive species has resulted in exorbitant costs to numerous industries and nations throughout the world. The annual cost of the damage from invasive species in the United States was estimated to be nearly $137 billion in 2000 (Perrings et al., 2002).

Although there are economic consequences of the spread of invasive species, it is commonly overlooked that these invasions can be "ecological consequences of economic processes" (Holmes et al., 2009, p. 21). Invasive species are often a negative externality of economic activity and trade, such as the ballast water of commercial ships that is routinely discharged in foreign ports, which is a known vector for invasive pathogens (Ruiz et al., 200). However, like many other negative externalities, the costs of invasive species are often not factored into specific decisions about "exports, imports, and domestic transport of goods and people, all of which are pathways for the introduction and spread of invasive species" (Holmes et al., 2009, p. 21). Those that are intentionally and unintentionally responsible for the spread of invasive species almost always fail to pay for the costs of their actions. As a result these costs are externalized, which places the burden on either the general public or future generations (McNeely, 2000).

The large number of invasive species that threaten the United States, combined with the abundant vectors that can spread invasive species may cause policy makers to hesitate to invest in preventative measures if it seems these efforts will eventually fail. However, in a recent contingent valuation study, McIntosh, Shogren, and Finnhoff (2007), found that investment in measures to postpone both market and nonmarket impacts of invasive species for as short as a year were positively received by the respondents. As a result, for policy makers, it may be "reasonable to continue fighting today for what is ultimately a losing battle tomorrow" (McIntosh, Shogren, and Finnhoff, 2010, p. 93).

Ecological Impact of Invasive Species on Forest Ecosystems

Although it is apparent that invasive species have had a substantial impact on forests and will continue to have an impact on these ecosystems, it is unclear what the long-term ecological impact will be. It is particularly difficult to determine this long-term impact because forest ecosystems change and adapt to impacts caused by invasive species, and these same ecosystems are often subject to other human disturbances (Holmes et al., 2009). The difficulties in identifying the impacts of invasive species on forest ecosystems is compounded by the fact that it is difficult, if not impossible, to identify what these ecosystems would look like without the influence of invasive or other non-native species. Holmes et al. (2009), instead suggest that it would be beneficial to focus less on long-term impacts and more on the short-term impacts that occur while the ecosystem is adjusting to the biological invasion.

Firewood as an Invasive Species Vector

Firewood is an invasive species vector that can transport both invasive insects and fungi. Although insects and fungi being transported through firewood is not a new phenomenon, over the last twenty years there has been an acceleration of exotic bark and wood boring insects collected or reported for the first time in the United States. During the period between 1985 and 2005, at least 25 of these invasive wood-boring species that can be transported through firewood were first identified in the United States (Haack, 2006). A recent study conducted in Michigan found live borers in 23% of the firewood surveyed and an additional 41% of the firewood had evidence of previous borer infestation (Haack, Petrice, and Wiedenhoeft, 2010). The threat of transporting these

invasive forest pests through firewood is much higher with intermediate and long-distance movement of firewood. Long-distance transportation of firewood is usually done by non-commercial entities, such as campers or second homeowners who bring their own wood for convenience or cost savings (USDA, 2010). The potential that campers will introduce an invasive forest pest through firewood is only increasing as the use of firewood for pleasure or in recreational settings has been growing over the last decade. In one Minnesota firewood survey, there was a 15% growth in the use of firewood for pleasure between 2003 and 2008 (Minnesota Department of Agriculture, 2010).

Specific species that are transported through firewood, such as the Emerald Ash Borer (EAB), can have a substantial impact on forest ecosystems. This species, native to China, arrived in the United States around 2002 and has caused wide spread damage to ash trees throughout the Great Lakes region. In Michigan, it is estimated that EAB threatens nearly 850 million ash trees and the projected loss of these trees would exceed $1.7 billion (Poland and McCullough, 2006).

Adult woodborers and bark beetles are of particular concern, because they can be easily transported inside firewood where they are concealed and protected. Bark beetles are known as some of the worst forest pests due to their ability to spread fungal pathogens (Brockerhoff et al., 2006). Many of these woodborers can survive within firewood under varying conditions for long periods of time before emerging. For example, EAB adults have been known to emerge from firewood that had been harvested from an infected tree two years after being cut (Robertson and Andow, 2010). Woodborers can infest and kill healthy trees, however it is more common for borers to

attack weaker, recently cut, or dead trees (Haack, 2006). As a result, firewood is of particular concern as a vector for spreading invasive woodborers, because firewood tends to be cut from trees with similar characteristics.

The movement of firewood by campers has been identified by the U.S. Department of Agriculture (USDA) as a serious vector for the spread of forest pests (2010). When EAB first arrived in the Northeast of the United States, 75% of the new infestations were found at campgrounds or parks (USDA, 2010). Camping has been identified as one of the recreational activities that has contributed to the spread of invasive forest pests due to the popularity of campfires among campers. Campfire activities are a critical component of the camping experience to many Americans. Many campers are opposed to campfire or firewood restrictions and are willing to violate restrictions due to the importance of campfires to the overall camp experience (Robertson and Andow, 2010).

It has been difficult for regulatory agencies to control the movement of firewood in order to prevent the spread of invasive forest pests. The firewood industry is very diverse with varying and unpredictable producers, distributors, and consumers, which makes any control mechanisms difficult to implement. Regulating the movement of firewood is further complicated by the movement of firewood by independent citizens outside of the firewood industry who collect and transport their own firewood for home heating or camping (USDA, 2010). The firewood industry is complicated as there is both a formal and informal firewood economy (See Figure 1). The formal firewood economy has “identifiable companies that treat and transport firewood often among multiple

states" (Haack et al., 2010, p, 1683). In contrast, the informal economy is composed of private individuals who cut, transport, and sell their firewood locally. The informal firewood economy makes regulation difficult, because unlike wood pallets, nursery stock, and timber, which have both formal pathways and national organizations that regulate their movement, the informal firewood economy has "no representative or central clearinghouse for the industry to turn to for regulatory information" (Robertson and Andow, 2010, p. 9).

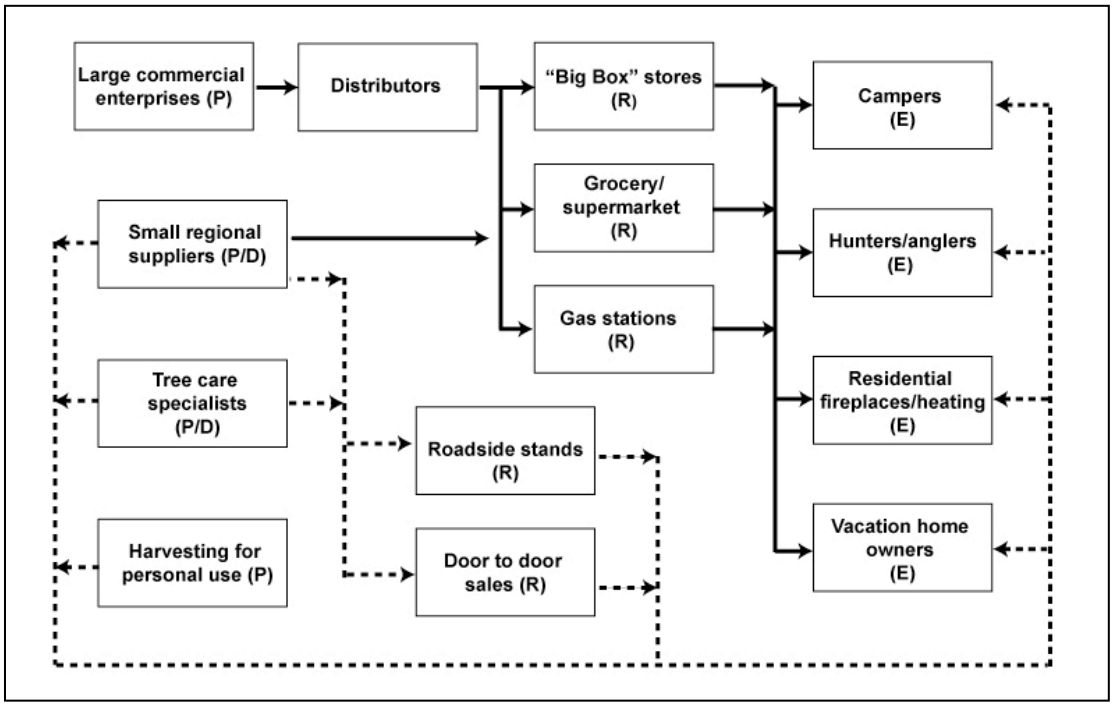


Figure 1: Firewood pathway (Formal pathway indicated by solid line; informal pathway indicated by dashed line. P=Producers of firewood (including harvesters); D=Distributors and brokers; R=firewood retailers; E=firewood end-users)
Source**:** Robertson and Andow (2010), p. 7

Although the movement of firewood is not well documented, it is nonetheless a common practice by many campers to transport their own firewood to their camping destination. In a recent survey, firewood was intercepted entering California from 48

different states (Bokach, 2010). This shows that firewood is not only being transported, but transported considerable distances from its point of origin, which increases the risk of invasive forest pests moving through firewood.

Governmental Responses to Invasive Species

There have been numerous actions taken by governments to prevent the spread of invasive species. One of the more common actions by governments is border measures that prevent particular products, goods, or services that are known vectors of invasive species from entering into the country or state (Sumner, 2003). Other regulatory policies aimed at excluding invasive pests and diseases, include "embargoes, certification, confiscation, destruction of pests or infected hosts, regulated lists, permits, surveillance, reports of detection, hold orders, and quarantines" (Sumner, 2003, p.23).

Federal, state, and provincial governments have already begun to implement measures to prevent and control the movement of Emerald Ash Borer (EAB). These governments have focused on preventing the human-mediated movement of EAB, detecting and eradicating populations, and controlling the major infestations that already exist. There are currently federal quarantines in both the United States and Canada that place restrictions on the transportation of ash trees, limbs, and cut firewood, as well as other vectors that are known to pose a risk (Poland and McCullough, 2006). In the United States, 16 states have developed regulations that prohibit the transportation of firewood due to the threat of spreading invasive forest pests. Many of these regulations have been ineffective because the general public is unaware of the regulations, the regulations are

inconsistent between states, and many of the restrictions are difficult for agencies to enforce with limited funding or staffing (USDA, 2010).

Benefits of Invasive Species Outreach and Education Programs

As a result of the severity of the risks associated with invasive species moving through firewood and the difficulty in regulating the movement of firewood due to its complex industry, there is a need for communication directly to those individuals responsible for transporting firewood. Communication about the threat of invasive species moving through firewood can encourage campers to change their risky camping practices. Communication can also increase public awareness, which can foster support for exclusion efforts and increase the likelihood that those efforts are successful. Gaining public approval of invasive species policies is essential as there have been numerous well designed and scientifically sound prevention measures that have failed because of a lack of public support (Wittenberg and Cock, 2001).

The vast majority of citizens become aware of invasive species or the risks associated with these species through firsthand experience that tend to involve some economic costs to the individual or their community (Mack et al., 2000). This experience usually results in only local awareness of particular invasive species threats. As a result, there is a need for more public education and outreach that identify the risks and impacts of invasive species, the vectors that are known to spread invasive species, and the economic impacts of these species (Wittenberg and Cock, 2001). When public education or outreach programs are developed in conjunction with traditional invasive species measures, such as quarantines or border controls, these measures are likely to be more

"effective as well as socially and politically acceptable" (McNeely, 2000, p. 10). Education and outreach can also be used to show consumers that they are often the immediate pathway for the spread of invasive species. Consumers and travelers are frequently responsible for the spread of pests and simple education measures at the point of sale may help change consumers behavior (Lodge et al., 2006).

Successful public education campaigns can have a significant impact on the patterns of firewood transportation, which can alter the risks associated with long-range transportation of firewood (Muirhead et al., 2006). By informing the public about the risks, costs, vectors, species of concern, and ecological impacts of invasive species, average citizens can be used as an early detection system. There are far more citizens who explore the forests, rivers, lakes, and rangelands than professional scientists or agency officials who are looking for new infestations. The use of public education to help increase early detection of new infestations has been shown to be very cost effective (Lodge et al., 2006). The value of public outreach and education efforts in preventing the spread of invasive species cannot be stressed enough. The Oregon Invasive Species Council (OISC) in conjunction with partners in Washington and Idaho acknowledged the importance of communication regarding the risk of invasive species and developed the 2010 Tri-State firewood campaign in order to prevent the spread of invasive forest pests into the Pacific Northwest by campers.

Political Context

Invasive species prevention, early detection, rapid response, control, management, restoration, education and public awareness are all critical for protecting vulnerable

ecosystems and natural resources. These invasive species efforts are often thought of as a public good, where individual countries or states are given the responsibility to coordinate measures to protect the public interest of their citizens from the impact of invasive species (Perrings et al., 2002). At the federal level, the National Invasive Species Council (NISC) was formed in 1999 with the task of providing "high-level interdepartmental coordination of federal invasive species actions and works with other federal and non-federal groups to address invasive species issues at the national level" (E.O. 13112, 1999). Individual states have the responsibility to address invasive species within their own state. In response to the increased threat of bio-invasions, Oregon formed the Oregon Invasive Species Council to protect the state from external threats and bio-invasions.

The Oregon Invasive Species Council (OISC) was formed on January 1, 2002 and was created by the Oregon legislature through ORS 561 §685, 2002. The purpose of the OISC is to "conduct a coordinated and comprehensive effort to keep invasive species out of Oregon and to eliminate, reduce, or mitigate the impacts of invasive species already established in Oregon" (ORS 561 §685, 2009). The Oregon Invasive Species statue lists four main functions of the council. Nugent (2005, p.7) describes these functions; first is to "create and publicize a system for reporting sightings of invasive species." Second, the council has been directed to develop educational activities in order to increase public awareness about invasive species. Third, the council must develop a statewide plan for dealing with invasive species. Finally, the council is "authorized to administer a trust account for funding eradication and education projects."

Individual invasive species action plans by one nation or state that are independent of neighboring states are bound to fail as invasive species are unaware of artificial boundaries. Instead, these pests become established based on climate and ecosystem characteristics, which are often shared between nations or states (Wittenberg and Cock, 2001). For instance, the Pacific Northwest region of the United States is composed of fourteen distinct ecoregions, three states, and two countries. None of these fourteen ecoregions of the Pacific Northwest are entirely enclosed within one state or province. As a result, the effective management of invasive species requires an overarching national legal framework and a regional approach that takes into account these shared ecosystems and geographic characteristics. The OISC has been using a regional approach to invasive species education, outreach, and mitigation for several years. The council has worked with numerous federal, state, local, and industry partners to develop regional invasive species programs, such as *The Silent Invasion* campaign in 2008, which was an effort to inform Oregonians about the threats of all types of invasive species.

Tri-State Firewood Strategy

For the summer of 2010, the invasive species councils of Oregon, Washington, and Idaho developed a joint Tri-State firewood campaign. This campaign was designed to inform Pacific Northwest residents, particularly campers, about the threat of spreading invasive forest pests when transporting firewood. The project was developed to protect Pacific Northwest agriculture, forest resources, and environments that are at risk from invasive species that result from the importation of firewood from outside states or

ecoregions. The primary focus of this campaign was to develop education and outreach programs that would lead to "behavior change and promote self-efficacy to prevent and mitigate the problem" (L. DeBruyckere, Personal Communication, February 16, 2011).

The goal of the Tri-State firewood campaign was to design and implement education and outreach materials for 2010 that would communicate the risks of moving firewood and provide best practices regarding the movement of firewood so that the public can take individual actions to minimize the threat. The OISC hoped that an increase in camper awareness about firewood as an invasive species vector would foster support for legislation that would further protect the Pacific Northwest states from this threat.

In order to meet their objectives of increasing public awareness on the threat and pathways of moving firewood, the OISC developed several communication mediums that were used throughout Oregon, Washington, and Idaho. The strategy was composed of three direct communication mediums, which included campground materials (campground posters [see Figure 2], flyers, playing cards, and Frisbees®), roadside materials (billboards), and online/ electronic materials (www.dontmovefirewood.org, website warnings, and electronic campsite reservation notifications). In addition to these direct outreach mediums, there were several indirect communication mediums, such as newspaper articles and local news segments that were produced during the campaign.

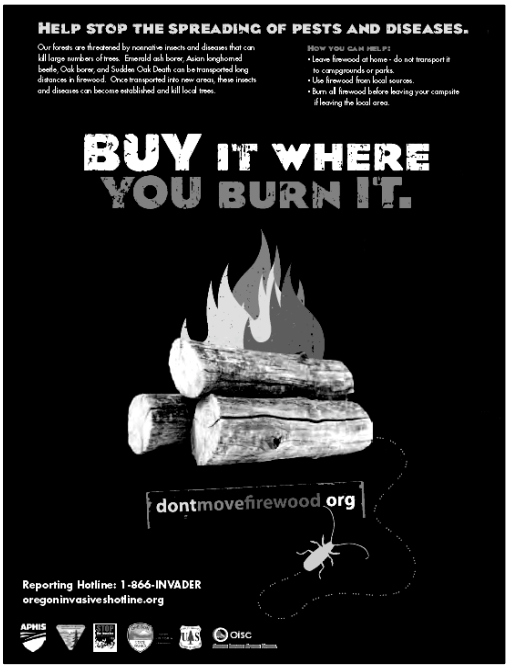


Figure 2: 2010 Tri-State firewood campaign campground poster
Source: Oregon Invasive Species Council (2010)

The Tri-State firewood campaign had numerous partners who agreed to participate and post outreach materials in their campgrounds or on their websites. These partners included the Bureau of Land Management, U.S. Forest Service, U.S. Army Corps of Engineers, National Park Service, Bureau of Reclamation, Oregon State Parks, Oregon Department of Fish and Wildlife, Oregon Department of Forestry, several private campgrounds, and other land management/ recreation agencies in Washington and Idaho. The communication plan began in the beginning of July 2010 and ran through the remainder of the camping season. Campground materials were sent to each participating agency and the agencies were responsible for distributing those materials to their respective campgrounds. No information is available on the total number of campgrounds that participated by posting outreach materials.

The Tri-State firewood campaign was based on an expert model of the processes and risks associated with the spread of invasive species through firewood. The communication strategy provided information about best practices, invasive species vectors, and details about the harm that can be caused by invasive species. Although scientifically credible, this expert model did not take into account Pacific Northwest campers' beliefs or knowledge about invasive species in firewood prior to designing communication materials. Audiences often have misconceptions, incorrect beliefs, or knowledge gaps about risks, which must be addressed in any effective communication strategy (Lundgren and McMakin, 2004). The following review looks at contemporary approaches to risk communication and more specifically the mental model approach, which confronts audience misconceptions and knowledge gaps about risks.

Literature Review

Environmental Risk Communication

As humans, we use language and symbols to "construct a framework (or discourse) for understanding and valuing and to bring the wider world to others' attention" (Cox, 2006, p. 15). Our private discourse extends into the public sphere as we begin to engage others in conversation. These private concerns are translated into "public matters and thus create spheres of influence, which affect how we and others view the environment and our relation to it" (Cox, 2006, p. 18). As a discourse gains a broader acceptance within a culture it becomes a dominant discourse. As dominant discourses are developed, they begin to "coalesce around specific policies and institutions," where "they

form symbolic boundaries that help to legitimize these policies" (Cox, 2006, p. 59). Communication within a group or culture takes place within the context of their dominant discourse. As Hillier (2006, p. 23) describes it, "a stranger in a strange land would hardly expect to communicate effectively with the natives without knowing something about their language and culture." Just as a stranger in a foreign land, risk communicators cannot expect to communicate effectively with their audience without understanding the cultural heritage or the dominant discourse of that audience.

The public becomes aware of new risks as a result of selective presentation of ideas, terms, symbols, and information that frames the risk at hand based on the boundaries of their dominant discourse (Cox, 2006). As a result, risk communicators need to frame communication efforts based on the dominant discourse of the audience in order to gain social acceptance. Identifying and employing the values within the dominant discourse is one of the most effective ways of communicating risk to the public. The traditional approach to risk communication has ignored these socio-cultural values and beliefs. The traditional model of risk communication has a basic form, which includes a source, which develops a message that is delivered through a channel to a receiver. Lundgren and McMakin (2004, p. 16) illustrated this model with the following example:

> A regulatory agency [the source], may decide that a chemical poses an unacceptable risk to the public [the message] and issues a press release [the channel] published by the news media [another channel] that is read by members of the local community [the receivers].

The type of communication in this model has generally been one-way, as the source group gives or forces information onto the receiver. The one-way nature of this model is further illustrated in its objectives, which are to inform, change risky behavior, and assure the concerned group (Cox, 2006). This model fails to understand or address the values or beliefs of the audience, which are crucial in communicating ways to mitigate a crisis (Lundgren and McMakin, 2004). In addition to values and beliefs of the audience, there is a "growing awareness that risk is a social and cultural concept and that risk perceptions depend less on the nature of the hazard than on the political, social, and cultural contexts in which they take place" (Hillier, 2006, p. 27).

Mental Models Approach to Risk Communication

An alternative to this traditional model of risk communication is the mental model approach. In this approach, communicators first develop an expert model of the decisions that the audience should make regarding a risk (Lundgren and McMakin, 2004). Then the communicators must identify the specific audience where communication efforts will be directed. Once the audience is identified, the communicators must detect "discrepancies between this (expert) model and recipients' existing mental models" about the risk (Atman et al., 1993, p. 780). An understanding of the audience's mental model is formulated through an empirical study of members of that audience in order to understand their dominant discourse and determine their views about the risk. Once the mental model of the audience is developed, researchers can look for discrepancies or gaps between the audiences' understanding of the risk and the experts' understanding of the risk. By identifying these knowledge gaps researchers can "pinpoint people's specific

information and decision-making needs, and contribute to the development of a framework for more efficient and effective risk communication" (Zaksek and Arvai, 2004, p. 1505). The message that is developed for the audience uses this mental model to address discrepancies with the expert model. The resulting communication strategy needs to improve the audiences' mental model by "adding missing knowledge, restructuring a person's knowledge when it is too general…and (dispel) misconceptions by deleting inaccurate pieces" (Bostrom et al., 1994, p. 789).

Atman et al. (1993, p. 779) identify three assumptions for the development of effective risk communication. First, the audience needs to have at least a basic understanding of the exposure, effects, and mitigation processes that are relevant in order to make decisions about the risk. Second, the audiences' existing "beliefs affect how they interpret and use any new information." Finally, information needs to be presented with "appropriate text structure" based on general research about the audience.

With an understanding of the mental model of the audience, communicators develop messages that add critical missing information and dispel misconceptions the audience may have that might affect decision-making (Atman et al., 1993). The intent of the messages developed from these mental models is not to "convince the public to think like scientists, but to identify the information the public would need to make an informed decision" (Lundgren and McMakin, 2004, p. 17). This mental model approach does not make any assumptions about the target audience; instead it seeks to understand the dominant discourse within that audience. The mental model approach acknowledges that

groups can be divided and segmented with varying characteristics and needs, which are identified in the development of the mental model (Lundgren and McMakin, 2004).

There are two general objectives of the mental model approach to risk communication, which are to provide important expert information about the risk and to address misconceptions held by the audience (Atman et al., 1993). By fulfilling these two objectives the mental model approach can be used to develop accurate and successful risk messages. Messages are not developed until after interviews are conducted with members of the audience, which provides an understanding of how members of the audience view that particular risk (Lundgren and McMakin, 2004). Messages are not developed to persuade people about a risk, instead messages are developed to supply the audience with reliable information to help them make "informed and independent judgments about risks…" (Lundgren and McMakin, 2004, p. 16).

A critical component of the mental model approach is an audience analysis, which is a tool for understanding the audience's beliefs, values, or knowledge about a particular risk. Many examples of failed communication have been the result of either an insufficient or flawed understanding of the audience's perceptions of the risk (Wittenberg and Cock, 2001). Without any evidence of how the audience perceives or understands the risk, there is no way to accurately develop an effective communication strategy (Morgan et al., 2002). To ensure that the audience will hear and react to a message it is first necessary to understand how the audience perceives the risk, which can be accomplished by an empirical audience analysis (Arkin in Covello, McCallum, and Pavlova, 1987).

Audience Analysis

There are several different levels of audience analysis, which include baseline, midline, and comprehensive. Depending on the type of risk that is being communicated and available time and resources, an organization should choose one of these forms of audience analysis. The least time consuming and most cost effective level of audience analysis is baseline, which focuses on the audience's ability to understand the communication and understand their level of opposition (Lundgren and McMakin, 2004). Midline audience analysis is one level higher and gathers baseline information as well as demographic, socioeconomic, and cultural information about the audience. Finally, the comprehensive audience analysis combines both baseline and midline level information but also looks into deeper psychological variables, which include audience motivations and their mental model of the risk (Lundgren and McMakin, 2004). The comprehensive audience analysis is an important tool for a communication strategy that intends to change the behavior of the audience as it provides the deepest understanding of the values, beliefs, and knowledge of that group.

Lundgren and McMakin (2004) developed a list of key audience characteristics to be addressed in a comprehensive audience analysis. For each characteristic identified, they developed questions to ask the audience, through surveys or interviews, to gain an understanding of the characteristics of that audience. Based on the answers to these questions, specific risk communication strategies are identified in order to reach the objectives of that message. Table 1 has a list of selected key characteristics, the questions to ask, and how answers affect risk communication efforts.

Table 1: Key audience characteristics for audience analysis

Characteristics	Questions to ask	How answers affect risk communication
Culture	How many cultures make up the audience? How does each view the world?	Address different views
Geographic areas	How near is the risk?	If close to risk, provide information to mitigate. In general, determine possible concerns.
Information sources	Where do they get information?	Use that source to disseminate risk messages
Preferred social institutions	Where do the go to relax? To recreate? Etc.	Determine possible concerns. Use preferred locations to communicate with audience
People they trust and believe	Whom do they trust and believe	Choose that person or organization as spokesperson
Their "hot buttons"	Are there words and concepts that infuriate them?	Avoid those words. Find other ways to discuss concepts.
Experience with other risks	Have they had good examples you can build on? Bad examples to overcome?	If good, build on. If bad, acknowledge and begin with basic risk information.
Background in risk subject matter	How much do they understand about the risk scientifically?	If little, provide explanation. If a great deal, build on concepts.
Experience with risk	Is the risk new to the audience or something they've been living with for a long time?	If new, build awareness first. If familiar, build on known concepts
Concerns and feelings about risk	What kinds of concerns do they have? How do they feel about the risk (angry, frustrated, apathetic, etc.)?	Address concerns and feelings in risk message
Effect of the risk on them	How do experts think that the risk can affect them? How does the audience think it can affect them?	If two views differ, address misconceptions to correct. If two views identical, build on concepts
Exposure to News Media or other coverage	Have they seen comprehensive coverage or tabloid-style journalism?	If comprehensive, build on. If tabloid, acknowledge and begin with basic risk information.
Experience with organization communicating risk	Are they familiar with the organization? Do they find it credible?	If unfamiliar, explain organization's role. If familiar and credible, build on good will. If familiar but not credible, use outside spokesperson.

Source: Lundgren and McMakin (2004, p. 131-132)

Using this comprehensive audience analysis, risk communicators can develop a mental model of the audience and develop personalized risk messages that meet the needs and situations of the audience. This information can guide risk communicators in determining "what media to use, how much audience interaction is needed, and what concerns must be addressed, among other factors" (Lundgren and McMakin, 2004, p. 138).

The audience characteristics in Table 1 were used as a guide for the comprehensive audience analysis of Pacific Northwest (PNW) campers. This audience analysis was selected in order to identify communication needs of PNW campers and develop a mental model of campers, which was then used to evaluate the effectiveness of the Tri-State firewood campaign by identifying changes in campers knowledge and firewood practices between pre and post-campaign campers. The mental model was also used to develop recommendations for future communication efforts by identifying misconceptions and knowledge gaps between campers mental model and the expert model of invasive species moving through firewood.

Methods

Mixed-Method Study Overview

The analysis of Pacific Northwest campers' practices, values, and knowledge regarding invasive species and firewood was conducted through a mixed-method study design. A mixed-method is when both qualitative and quantitative research techniques are used side-by-side in the same study (Robson, 2002). In this study, two quantitative surveys were conducted with Pacific Northwest campers. The first survey was conducted

at the beginning of the 2010 Tri-State firewood campaign and an identical survey was sent out after the completion of the 2010 camp season in order to detect any impact the risk communication strategy had on campers' practices, values, or knowledge. The qualitative approach adopted in this study was a series of campground interviews that took place with campers in Idaho, Washington, and Oregon during the camping season while the 2010 Tri-State firewood campaign was being conducted. These interviews were carried out to gain a deeper understanding of campers' motivations and knowledge regarding invasive species and firewood.

Qualitative and quantitative research methods each have their own strengths and weaknesses, however by combining these two approaches a mixed-method study can develop a more informative evaluation of the research questions (Bostrom et al., 1994). Although qualitative and quantitative approaches often answer different types of questions, when they are combined in the same study, they can be used to answer complementary questions (Robson, 2002). For instance, Robson (2002, p. 43) gives the example of mixed-methods being adopted in a complementary way to improve understanding, as the "interpretation of statistical analysis [from a primarily quantitative study] may be enhanced by a qualitative narrative account."

Combining both methods may reduce some of the weaknesses of qualitative and quantitative approaches. Quantitative approaches in particular are vulnerable to several flaws, which include "reactivity (changing people's beliefs through the cues offered by questions), illusory expertise (restricting the expression of nonexpert beliefs), and illusory discrimination (suppressing the expression of inconsistent beliefs)" (Bostrom et al., 1994,

p. 790). Many of these weaknesses can be addressed by the strengths of qualitative research approaches, which allow open-ended responses from individuals. However qualitative research approaches have flaws and weaknesses of their own including difficulty in generalizing findings, lower credibility, time consuming, and results are more easily influenced by researcher's personal bias (Johnson and Onwuegbuzie, 2004). Although there are benefits of using mixed-method approaches, it is important to note that in many circumstances this approach can result in conflicting results between the qualitative and quantitative methods, which can add confusion and uncertainty to a study (Robson, 2002).

Survey Methodology

The quantitative surveys were sent out to a sample of registered campers both before and after the Tri-State firewood campaign during the summer of 2010. These surveys were designed to identify basic camping practices of Pacific Northwest campers, their environmental values, their invasive species knowledge, and determine the effectiveness of the risk communication strategy in informing campers about the risk of spreading invasive species when moving firewood. The surveys were also designed to identify the most effective communication tools to inform future risk communication efforts directed towards campers in the Pacific Northwest.

The surveys were administered electronically through SurveyMonkey®, an online survey tool. The first survey was sent out to respondents in early July 2010 at the beginning of the Tri-State firewood campaign. This initial survey was used to develop a baseline understanding of Pacific Northwest campers' practices, values, and knowledge.

The second survey was administered at the end of the 2010 camping season in early December. The results from this second survey were used to identify any changes in Pacific Northwest campers' practices, values, or knowledge from the initial survey in July. The second survey was also used to identify the impact of the 2010 Tri-State firewood campaign in informing campers about invasive species in firewood and deterring risky behavior by campers.

Defining the Sample Population

Pacific Northwest (PNW) campers were the subject population for both surveys. A sample was drawn from the Oregon State Parks camper registration list. The sample of the first survey was drawn from the 2005 through 2008 Oregon State Parks lists. The sample for the second survey was drawn from the 2010 Oregon State Parks camper registration list. This study used stratified random sampling, which involves splitting up members of the population into different groups, where members of a group have particular characteristic(s) in common (Robson, 2002). This sample was stratified by state of origin in order to ensure responses from Oregon, Washington, Idaho, and PNW campers from outside the region. The total number of participants recruited for this study was approximately 4,000. For the first survey in July 2010, a consent form and a link to the online survey was sent to 2,000 randomly selected campers. The sample was stratified by state so that 500 campers from Oregon, Washington, Idaho, and non-PNW residents were surveyed. Participants were all 18 years of age or older, but there were no other restrictions on the sample, such as race, gender or ethnicity. For the second survey in December 2010, the consent form and a link to the online survey was sent to another

random sample of 2,000 campers from the 2010 camping season, which was stratified in an identical manner to the first survey.

Recruiting Participants

Before participants were recruited, the Oregon State Parks list was separated by state of origin in order to stratify the sample. Oregon, Washington, and Idaho campers were placed on their own list, while the remaining individuals on the master list were placed into a non-Pacific Northwest (PNW) camper list. Once these stratified lists were generated, a random sample was created from each of these lists. Every individual from each list was given a randomly generated number between 1 and 100,000. After each individual was given a random number, the lists were sorted numerically from lowest to highest random number. The first 500 individuals on each of the four lists were selected for sampling for a total sample size of 2,000. The same process was repeated for the second survey.

Once the sample population was selected, participants were recruited through an email invitation, which provided a link to the survey on SurveyMonkey® (See Appendix A). If participants decided to take the survey they were directed to a consent page, which provided a detailed description of the study. Participants provided their consent by clicking the "continue to the survey" button at the end of the consent page. A reminder email was sent out to the entire sample one week after the initial email invitation was delivered. After this reminder was delivered, no further contact was made with participants.

During the recruitment process there were a substantial number of returned emails from addresses that were no longer active or had been incorrectly entered into the list. For each survey, the bad addresses were counted and a second round of sampling occurred to account for this loss. In the preliminary survey there were 86 returned emails with bad addresses and 51 for the second survey. The initial sampling protocol was mimicked for this second round of sampling with the new sample size being 86 for the first survey and 51 for the second survey. After this second round of sampling the total sample population was 2,086 for the first survey and 2,051 for the second.

Response Rate

Each survey was available online for two weeks. After closing the first survey there were 331 respondents for a response rate of 17%. When the second survey was closed there were 308 respondents for a response rate of 15%. This is a low response rate, which is a concern as answers from survey respondents can differ substantially from the answers of nonrespondents resulting in a nonresponse bias (Bean and Roszkowski, 1995). In addition, surveys that are sent via email are known to have lower response rates compared to mail surveys (Sheehan, 2001). Several techniques that are known for increasing response rates were attempted, including an introductory email and a follow-up email sent one week after the survey was distributed (Frankfort-Nachmias and Nachmias, 1996).

Although these techniques to improve response rates were implemented, the response rate was still relatively low. This low response rate can be attributed to the nature of emails in today's society. It is not uncommon for individuals to routinely

change their email address or have multiple email addresses that are used simultaneously. As the email addresses sampled were anywhere from a year to six years old, it can be assumed that many respondents never received their invitation to participate in the survey. However, this low response rate does not necessarily produce a high nonresponse bias. After an analysis of recent methodological studies, Grove found that empirically there is no support for the notion that low response rates produce estimates that have high nonresponse bias (2006). As a result the response rate of 17% for the first survey and 15% for the second survey should not be a concern. The stratified sampling resulted in almost equal responses from each stratum, as 28% of the respondents were from Oregon, 21.9% from Washington, 25.7% from Idaho, and the remaining 24.4% were from outside the PNW.

Survey Questions

The survey was divided into three sections (see Appendix B). The first section focused on general questions about camping and campers' awareness about invasive species. The camping questions were designed after the Saskatchewan Provincial Parks Camper Survey (2008), which was a survey developed and implemented by the Canadian Ministry of Tourism, Parks, Culture and Sport with campers in provincial parks. These camping questions focused on length of camping stay, distance traveled, camping hobbies and activities, regions visited, campfire practices, and firewood origins. Invasive species awareness questions were developed with the aid of several members of the Oregon Invasive Species Council who have a background in invasive species issues. These questions were designed to assess campers' ability to define an invasive species,

knowledge about specific invasive pests, and the impacts of these pests on the Pacific Northwest. Additional questions were developed to determine if campers had seen information about invasive species in firewood and identify the source of that information.

The second section of the survey focused on campers' concerns and values regarding the environment and firewood. Environmental values questions were developed from the New Ecological Paradigm created by Riley Dunlap. The questions adopted were used to measure campers "degrees of endorsement (from low to high) of an ecological worldview" (Dunlap, 2008, p. 7). Questions were worded in both pro and anti environmental language to ensure that questions were not worded in only one direction. Questions about campers' values and concerns regarding firewood were adopted from a University of Wyoming contingent valuation survey on lakes and rivers (1998). Finally, several questions were asked about the environmental impact of invasive species to determine what impacts campers were most concerned about.

The final section of the survey focused on demographic questions. These included questions about gender, age, residence, income, and level of education. The format for these questions was adopted from the Oregon Ocean and Coastal Policy Survey that was conducted in 2008 by Oregon State University.

Survey Analysis Methods

Results from the survey were placed into an electronic database to be analyzed using the statistical package SPSS. Frequencies, cross-tabs, and regressions were

developed to gauge campers' values, beliefs, and knowledge and to determine if there were differences between pre and post-survey respondents.

Semi-Structured Interview Methodology

The use of interviews with open-ended questions has the advantage of reducing the risk of "underestimating (or overestimating) people's understanding in cases where their frame of reference differs from that of the evaluator" (Bostrom et al., 1994, p. 790). For this reason the use of quantitative surveys was not exclusively relied on for determining campers' practices, values, and knowledge regarding invasive species and firewood. A series of qualitative semi-structured interviews were conducted with Pacific Northwest campers in campgrounds in Oregon, Washington, and Idaho to both explain and demonstrate the meaning of the survey findings (King, 1994). Semi-structured interviews have predetermined questions for respondents, however there is flexibility with these interviews as the interviewer has the ability to modify the order of questioning or ask clarifying questions of respondents depending on what the interviewer feels is appropriate (Robson, 2002). The use of the semi-structured interview format was selected over other interview formats, because of the informal nature of the campground setting and the ease of analysis with predetermined questions.

The selection of campgrounds for interviewing was determined on three criteria. The first being high pest risk areas, which was determined using the Oregon, Washington, and Idaho campground pest risk maps developed by the United States Department of Agriculture, Animal and Plant Health Inspection Service (See Figure 3).

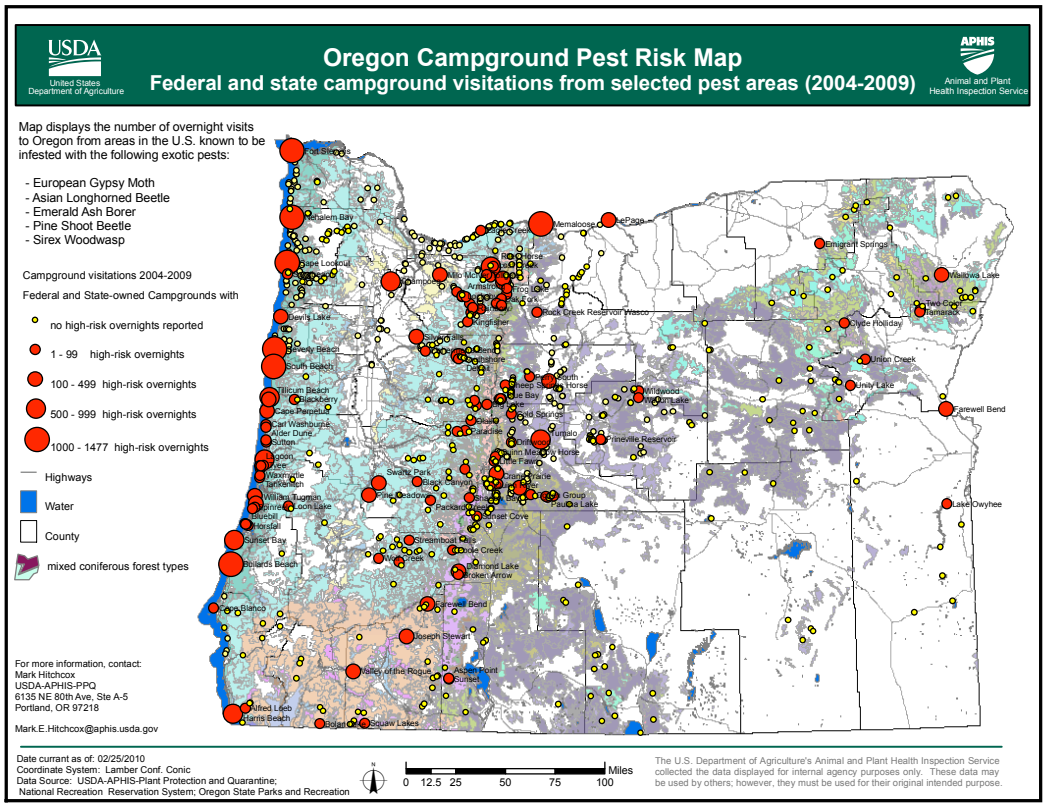


Figure 3: Oregon campground pest risk map
Source: Hitchcox (2010)

Second, campgrounds were determined according to ecoregion in order to ensure a spatial distribution of sites visited. Finally, campgrounds were selected on their overall popularity. Agency officials from Oregon, Washington, and Idaho advised the selection of campgrounds in their respective states. These officials recommended campgrounds that were extremely popular, with an emphasis on those campgrounds that had high visitation by out-of-state residents.

Defining Sample Populations

Interviews were conducted with Pacific Northwest campers at six Oregon, four Washington, and four Idaho campgrounds (See Appendix C). The intention of the

interviews was to gain a deeper understanding of campers who visit improved campgrounds (i.e., campgrounds with facilities, such as restrooms, showers, activities, etc.) who are less likely to be local and have campfires more often. Backcountry campers and campers who visit unimproved campgrounds were of less interest as it was assumed that they have campfires less frequently. This purposive selection of popular Pacific Northwest campgrounds resulted in a valid sampling of these improved campers as the vast majority of Pacific Northwest campers visit a small percentage of popular campgrounds and recreation areas (Stienstra, 2010). Two interviews were conducted in each campground selected (with the exception of Willow Flat Campground in southeastern Idaho where a second interviewee was unavailable) for a total of 27 interviews.

Recruiting Participants

Campers were directly recruited to participate by the interviewer. Participants were selected and recruited at campgrounds based on a random recruitment strategy. Prior to arrival at a campground, a random campsite was selected as a starting point. The interviewer recruited the camper(s) at every fifth campsite from the starting location. If no campers were willing to participate or the campsite was vacant the interviewer moved five campsites down until two interviews were completed at that campground.

When approaching campers the interviewer asked if they would be willing to participate in a 30-40 minute interview about their views on invasive species, the spread of invasive species through firewood, and the value of parks, campgrounds, and wilderness areas free of invasive species. If the camper agreed to participate they were

given a consent form to sign (See Appendix D). After signing the consent form, interviewees were provided a brief explanation of the purpose of the study.

Interview Questions

As described earlier, the interview process had a semi-structured format with pre-determined questions for campers (See Appendix E). Four general categories of questions were asked, which included camping practices, environmental values, invasive species knowledge, and policy feedback. Camping practice questions asked campers about their camping activities and hobbies, distance traveled, camp frequency, campground preferences, and firewood practices. Environmental questions asked campers about their general environmental concerns, their views about invasive species as a threat to the Pacific Northwest, and areas they perceived as being the most threatened by invasive species. Invasive species knowledge questions focused on campers' ability to identify vectors or pathways for the spread of invasive species or identify specific invasive species that threaten the Pacific Northwest. Finally, the policy feedback questions were designed to determine campers' views about further campground restrictions, willingness to pay for a bundle of firewood, and practicality of specific invasive species prevention measures.

Recording and Transcription Methods

All interviews were recorded using an Olympus DS-30 digital voice recorder. Following the completion of interviews all recordings were downloaded onto a personal computer. After the completion of the interviews a single researcher transcribed each

interview into the word processing program Microsoft Word®. Transcriptions were then used to analyze the interview data.

Analyzing and Coding Transcripts

Drawing conclusions from raw transcripts is difficult as a result of the large amount of text involved in interview transcriptions. Coding is one tool used with interview transcripts to discover patterns that cannot be seen by the naked eye within the large amount of text in the transcripts (Auerbach and Silverstein, 2003). Developing a coding scheme can be both difficult and time consuming; as a result there is an advantage in using existing coding schemes and strategies that have already been developed (Robson, 2002). The camper interviews were initially coded based on the key characteristics in the audience analysis developed by Lundgren and McMakin (2004) (See Table 1, p. 24). This initial coding mechanism divided the interview transcripts into different codes that could be used to better understand Pacific Northwest campers and develop a mental model of their views about invasive species in firewood.

Once the transcripts were coded into this first level of coding based on the key characteristics of the audience analysis, a second level of coding was developed based on the researcher's interpretation of the meaning or patterns that were within the text. This second level of coding was based on the editing approach of qualitative analysis, which is a flexible coding method that gives more freedom of interpretation based on experience with the audience and initial reading of the data (Robson, 2002). This second level of coding separated the data into more defined categories that were specific to campers, such as camping practices, firewood values, etc. Finally, a third level of coding was

conducted on many of the second level codes to develop a detailed understanding of PNW campers values, knowledge, and beliefs regarding invasive species in firewood (See Appendix F).

Once all the interviews were coded, the interview data were analyzed using the patterns and themes approach developed by Miles and Huberman (1994). The purpose of the interviews was to provide a deeper understanding of the quantitative data gathered through the series of surveys with Pacific Northwest campers. To provide this deeper understanding, several types of patterns were sought in the interview data, specifically variables that possessed similarities and/ or differences among categories, and different patterns within a given context (Miles and Huberman, 1994). This technique involved identifying patterns, but then finding evidence for these patterns throughout the data. Miles and Huberman (1994) emphasize the importance of being open to any evidence that disconfirms patterns or processes, as they can be used as counterexamples and prove that the patterns identified have been subjected to skepticism. The patterns and processes that were identified were presented alongside the survey data to bolster the validity and reliability of the survey findings and identify discrepancies that existed between the two types of data.

Results

The results from both the surveys and interviews are presented based on the characteristics defined by the comprehensive audience analysis described earlier. The survey and interview results are presented together in order to develop a deeper

understanding of Pacific Northwest campers and their mental model of invasive species and firewood.

Pacific Northwest Camper Culture

Camping Practices

The majority of campers who responded to the survey use one of three popular camp shelters, which include tents, travel trailers/ 5th wheels, and motor homes. Tents were the most popular camper shelter (46%), followed by travel trailer/ 5th wheels (22%), and motor homes (10%). Primary camp shelter seemed to be one of the most informative variables in the surveys as there were several differences between campers based on primary camp shelter, such as nights camping a year, campfire frequency, environmental policy stance, and origin of camp firewood, which will be discussed further below.

Pacific Northwest campers go camping often, as well over half (60%) of survey respondents stated that they go camping for at least seven days or more each year. The percentage of respondents' nights camping differed based on their primary camp shelter. Less than half of tent campers (40%) claimed that they went camping for seven or more days a year compared to most of the travel trailer/ 5th wheel campers (85%) and motor home campers (84%) (See Table 2).

Table 2: Number of nights camping a year based on camp shelter

		Tent		Travel Trailer/ 5th Wheel		Motor home	
		Pre	*Post*	*Pre*	*Post*	*Pre*	*Post*
Nights Camping	1 or fewer	3%	2%	0%	1%	0%	0%
	2 to 4	27%	17%	4%	6%	3%	7%
	5 to 7	29%	35%	11%	8%	13%	11%
	8 to 10	18%	19%	14%	9%	16%	19%
	11 to 15	10%	16%	22%	22%	16%	14%
	16 to 20	9%	7%	18%	21%	22%	8%
	21 or more	4%	4%	31%	33%	30%	41%
Pre-campaign χ^2 (36, N = 323) = 102, p < .001**							
Post-campaign χ^2 (30, N = 296) = 128, p < .001**							

There are a variety of camping hobbies and activities that campers regularly participate in. The most popular camping hobby/ activity was sight seeing. Other popular camping hobbies and activities include, hiking, campfires, swimming and beach activities, and picnicking (See Table 3).

Table 3: Popular camping activities and hobbies (1= never, 2= infrequently, 3= frequently, and 4= very frequently)

		Pre	Post
		Mean (Std. Dev.)	*Mean (Std. Dev.)*
Camping Activities/ Hobbies	Sightseeing	3.16 (.807)	3.23 (.752)
	Hiking	3.01 (.858)	3.09 (.839)
	Campfire Activities	2.87 (.889)	2.88 (.833)
	Swimming/ Beach Activities	2.74 (.866)	2.79 (.858)
	Picnicking	2.69 (.877)	2.82 (.849)
	Nature Photography	2.64 (1.05)	2.70 (.962)
	Nature Education	2.57 (.963)	2.60 (.882)
	Cultural/ Historic Visits	2.54 (.768)	2.66 (.800)
	Fishing	2.03 (1.02)	2.11 (1.05)
Pre-Campaign N=304			
Post-Campaign N=278			

The more technical hobbies and activities, such as mountain biking, kayaking/ canoeing, and fishing are less popular than some of the more general hobbies and activities that can be done without specialized gear or training. It was more common for PNW campers to

participate in a variety of camping hobbies or activities, instead of one or two specialized activities:

> We walk, bike, and hike. We also take our daughter to local cultural areas we want her to experience. We go swimming and rafting. Also we just relax and hang out. [Portland, Oregon family, Tent]

Families such as this one participated in more general camping activities and hobbies; however younger campers, retired campers, and those campers without a large family tend to have more specific activities and hobbies that they regularly participated in while camping:

> We basically are fly fisherman and hang out on rivers 99% of the time, at least for the summer time. [Hailey, Idaho retired couple, Travel Trailer]

Many of the campers who have specialized outdoor hobbies and activities, such as fisherman, rock climbers, and All-Terrain Vehicle (ATV) riders define their trips based on their hobby or activity. However, those campers who have more general hobbies and activities do not define their trip based on their hobbies or activities, instead camping is usually identified as the primary purpose of their trip.

Campers Value of Place

During the interviews, PNW campers described two different conceptions of place. Many campers define their experience as a specific place, either a specific campsite, campground, park, forest, mountain range, or ecosystem. For instance one camper from Beaverton, Oregon was very connected to a specific campsite as he, "always [went] to the same place every year and camp[ed] at the same spot." Another

camper and his family from Seattle, Washington were not connected to a specific campsite or campground, but they still had a more general connection to a place as they "love[d] the Olympic peninsula and the Cascades."

However, approximately one-third of the campers interviewed have little to no connection with a place when they go camping. Many campers purposely seek new places and camping locations to go visit in order to see more of the world:

> Normally, it's a different place every time. I have been here a couple times, but its not the only place I go. The whole world is an oyster; there are lots of places to go see, so I am not stuck with one place. [Central Point, Oregon man, Travel Trailer]

Many campers make a point of avoiding places they have visited before:

> We switch it up. We almost never go to the same place more than once. We have gone to Jasper multiple times, but every time we go, we stay at a different campground. [Vancouver, British Columbia couple, Tent]

Besides this sense of place, many PNW campers determine which campground to visit based on specific characteristics of that campground or region. Three preferred campground characteristics stood out from the interviews with PNW campers: campground cleanliness, campground amenities (such as showers, restrooms, fire pits, etc.), and the aesthetic beauty of the campground or surrounding area:

> We like the pristine beautiful nature of the campground and how clean it is…. [Portland, Oregon family, Tent Trailer]

> It is clean here and they are quiet families that are here. [Cornelius, Oregon woman, Travel Trailer]
>
> We value showers, although the showers are broken here. [Aumsville, Oregon group, Travel Trailer]
>
> I like the amenities. [Grass Valley, California man, Travel Trailer]
>
> The view right in front of us, and the lake. [Idaho Falls, Idaho couple, ATV Trailer]
>
> Its just beautiful and we love the outdoors and those places that have that beauty. [Spokane, Washington family, Slide-in Trailer]

There are other factors that seem to influence where campers go camping, such as proximity to home, however the most influential factors are a sense of place and these three preferred campground characteristics.

Camping Destinations

The most visited ecoregion by PNW campers is the coast range, which encompasses the western edge of Oregon and Washington. Approximately 40% of survey respondents claimed that they were most likely to travel to the coast range when camping. After the coast range, the Idaho Batholith of central Idaho, and the Oregon and Washington Cascades are the second and third most popular ecoregions. Other popular ecoregions include the Willamette Valley of northwest Oregon and the Northern Rockies of western Montana and the Idaho panhandle (See Table 4).

Table 4: Most visited ecoregions by Pacific Northwest campers

		Ecoregion Visited Most Often	
		Pre	*Post*
Pacific Northwest Ecoregions	Coast Range	40%	41%
	Idaho Batholith	11%	15%
	Cascades	11%	9%
	Willamette Valley	8%	5%
	Northern Rockies	6%	5%
	Puget Lowlands	5%	3%
	Blue Mountains	4%	4%
	North Cascades/ Olympics	3%	1%
	Eastern Cascades	3%	5%
χ^2 (13, N = 602) = 17, p =.181			

The majority of survey respondents (80%) camp most often in a different ecoregion than the one in which they live, however their travel is usually limited to nearby or adjacent ecoregions (See Table 5). The one exception where campers regularly travel to an ecoregion that is not nearby or adjacent to their home ecoregion is the coast range, which is often visited by campers from all of the highly populated ecoregions of the Pacific Northwest and non-Pacific Northwest residents.

The campground interviews supported these survey results, as very few campers interviewed reported that they camp more than 200 miles away from their home. The one exception is retired campers who use either a motor home or travel trailer/ 5th wheel and tend to travel for much of the summer:

> When we go in this RV we go for a longer period of time. In this particular trip we will be gone for more than 2 weeks. We will put on a lot of miles at one time. [Fox Island, Washington retired couple, Motor Home]

Table 5: Popular ecoregions visited by campers from the most populated ecoregions of the PNW
(A= Coast Range, B= Willamette Valley, C= Cascades, D= Eastern Cascades, F= Klamath Mtns, G= Puget Lowlands, H= Blue Mtns, I= N. Cascades/ Olympics Mtns, J= Columbia Plateau, K= Northern Rockies, L= Middle Rockies, M= Snake River Plain, N= Idaho Batholith, O= Northern Basin)

		Most Frequently Visited Area							
		1		**2**		**3**		**4**	
		Pre	*Post*	*Pre*	*Post*	*Pre*	*Post*	*Pre*	*Post*
Ecoregion of residence	*Willamette Valley*	A 52%	A 51%	C 21%	C 18%	B 15%	D* 12%	D* 6%	B 9%
	Snake River plain	N 49%	N 49%	M 16%	M 20%	A* 15%	A* 14%	L 8%	O 7%
	Puget Lowland	A 42%	A 51%	G 24%	G 16%	I 13%	C 10%	C 11%	I 7%
	Columbia Plateau	A* 40%	K 46%	K 25%	H 15%	J 20%	A* 8%	H 10%	C 8%
	Outside PNW	A* 50%	A* 58%	B* 17%	C* 9%	C* 13%	N* 7%	K/L* 5%	D/K* 4%

* Denotes an ecoregion visited that is not adjacent to ecoregion of residence
Pre-campaign N= 292/ Post-campaign N= 256

It is not uncommon for retired motor home campers to travel thousands of miles in a summer and be gone for months at a time. However, the majority of campers stay closer to home due to restrictions on their time or the higher cost of long distance travel:

> Its usually more local and we tend to go to the beach area. We also camp off the Deschutes. We don't usually go more than a couple hundred miles from Portland. [Portland, Oregon couple, Tent Trailer]

Firewood Values

Campfires are an extremely popular camping activity and they are an essential component of many PNW campers' experience. One camper from Spokane, Washington stated, "If we can't have a campfire it really sways our opinion whether we are going to go [camping] or not." Many PNW campers hold this sentiment, as more than half (58%) of survey respondents stated that they have a campfire very often when camping and an additional 25% stated that they have a campfire at least sometimes. As shown in Table 6, the percentage of respondents' campfire frequency differed by their primary camp shelter.

Table 6: Campfire frequency by camp shelter

		Tent		**Travel Trailer/ 5th Wheel**		**Motor Home**	
		Pre	*Post*	*Pre*	*Post*	*Pre*	*Post*
Campfire Frequency	Very Often	68%	73%	53%	60%	39%	33%
	Sometimes	25%	22%	30%	22%	26%	38%
	Rarely	6%	5%	14%	15%	23%	24%
	Never	>1%	>1%	4%	3%	13%	5%
Pre-campaign χ^2 (18, N = 322) = 54, p < .001**							
Post-campaign χ^2 (15, N = 293) = 35, p = .002**							

Tent campers tend to have campfires much more frequently than campers who use other popular camp shelters, as about two-thirds (68%) of tent campers responded that they had campfires very often compared to only about half (53%) of travel trailer/ 5th wheel campers and less than half (39%) of motor home campers. This trend is not surprising, as tent campers are more exposed to the elements and utilize their campfires for heating, light, and cooking.

Besides camp shelter, there are several other variables that significantly predict campfire frequency. Number of nights camping, age, and participation in swimming and beach activities were all significant predictors of campfire frequency (See Table 7).

Table 7: Predictors of campfire frequency (Pre- and Post-campaign Surveys)

	Models			
Independent Variables	**1**	**2**	**3**	**4**
Nights camping	-.119**	-.090**	-.117**	-.087**
	(.019)	(.021)	(.020)	(.021)
Age		-.019**		-.017**
		(.003)		(.003)
Household Income		.036*		.029
		(.018)		(.019)
Environmental Policy			-.072*	-.062
Stance			(.037)	(.039)
Hiking Frequency			-.031	-.054
			(.045)	(.046)
Sightseeing Frequency			-.080	-.040
			(.047)	(.048)
Swim/ Beach Frequency			.234**	.144**
			(.041)	(.043)
Picnicking Frequency			.036	.048
			(.043)	(.043)
Willingness to pay for a bundle of firewood				-.044
				(.042)
Adjusted R^2	.059	.142	.128	.177
N= 480				
*P ≤ .05, ** p ≤ .01				

Campers' average nights camping a year, their age, and how frequently they participated in swimming and beach activities remained significant predictors of campfire frequency even after controlling for various independent variables, such as popular activities and hobbies, environmental policy stance, willingness to pay for a bundle of firewood, and household income. Household income and environmental policy stance seemed to have a secondary impact on campfire frequency, although they were no longer significant after controlling for more variables in Model 4. As campers' average nights camping a year

increased and age increased than campfire frequency decreased. When campers' frequency of participating in swimming and beach activities increased so did their campfire frequency.

Most campers obtain their firewood from one of three sources. A third of pre-campaign respondents (33%) purchase their wood from the camp host or park ranger at their camping destination, another third (32%) bring their wood from home, and an additional 18% gather or scavenge for wood near or around their campsite. Very few campers responded that they obtain camp firewood from grocery stores/ supermarkets (6%), gas stations (4%), or roadside vendors (4%). In the post-campaign survey there was a significant increase in the number of campers who obtain their firewood from the camp host or park ranger and a decrease in those who bring their wood from home. This change in campers' firewood origin will be addressed in more detail later.

During the interviews, those campers who brought their wood from home obtained their wood from a variety of sources. Some of those campers had forested property and cut their own wood:

> We bring it from our own place…its stuff we cut down from our property. We live in the upper Elwha and have a stand of timber that we thin out. [Port Angeles, Washington camper, 5th Wheel Trailer]

Other campers who bring their camp firewood from home purchase that wood in bulk from local wood dealers near their residence and store it at their home:

> I buy it from a place in Logan (UT). It is a forest product store that sells firewood locally. He is kind of a wood, stone, and everything dealer. The

> wood comes from the Logan area or Idaho, so within 100 miles or so. [Logan, Utah campers, Travel Trailer]

Obtaining a firewood permit to cut personal firewood from a nearby National or State Forest was another source of firewood for those campers who bring their own firewood from home, such as one camper from Spokane, Washington who stated that "we bring our own chainsaw and cut [firewood] ourselves" from The Panhandle National Forest.

To determine the value of camp firewood to PNW campers, survey respondents were asked how much they were willing to pay for a bundle of firewood (defined as a grocery paper sack full of firewood). Nearly three-quarters of respondents (73%) stated that they would be willing to pay between $2 and $6. The average willingness to pay response for a bundle of firewood from the survey was $3.90 (SD= .932). Campers who were interviewed valued a bundle of firewood at a comparable level, with the average response being slightly more than $4 a bundle. However, the interviews were able to identify several variations among campers' valuation of firewood. Those campers who obtain their wood in bulk (either from a home stand, purchased firewood permits to cut in the National Forest, or purchased in bulk from a wood dealer) have a much lower valuation of firewood than those campers who purchase their firewood from the camp host or park ranger:

> If you consider that we get a cord (128 cubic feet of firewood) for 5-10 bucks, than what are you willing to pay for a small bag of wood? It is not comparable and does not make sense for you to pay for a bag full of sticks when you will need 50 bags. If you could come into a campground and the

> camp had a pile of wood and you could pay 10 bucks to use the wood all weekend that would be more reasonable. [Aumsville, Oregon campers, Travel Trailer]

Many of the campers who do not have firewood in bulk perceive campfires as a luxury and are willing to pay more for a bundle of firewood than those campers who bring their firewood from a home supply:

> Paying $4 for a bundle was reasonable for me, because campfires are a luxury for me. At that point we are willing to pay more for a fire. We could have a fire every night if we wanted to, but we don't. [Fox Island, Washington camper, Motor Home]

The cost of firewood is a major determinant of where campers obtain their firewood. Many individuals perceive the cost of firewood sold at the campgrounds as too high, and as a result many campers obtain their firewood from other sources. A camper from Salt Lake City, Utah found that the "price [of firewood] was a lot cheaper at the grocery store," which is "the deciding factor" in where he purchases his firewood.

Environmental Values

Pacific Northwest campers' general environmental values and concerns are fairly representative of the average Pacific Northwest resident. Campers tend to be slightly left of center regarding environmental policies. Forty percent of campers identify as either liberal or very liberal regarding environmental policy issues, compared to 23% who identify as either conservative or very conservative and 37% who identify as moderate. Respondents' environmental policy stance differs by primary camp shelter (See Table 8).

Tent campers tend to be more liberal than campers who use other popular camp shelters, as over half of tent campers identify as either liberal or very liberal compared to less than a quarter of travel trailer/ 5th wheel campers and motor home campers.

Table 8: Environmental policy stance of Pacific Northwest campers by camp shelter

		Tent		Travel Trailer/ 5th Wheel		Motor Home	
		Pre	*Post*	*Pre*	*Post*	*Pre*	*Post*
Environmental Policy Stance	Very Conservative	2%	1%	4%	4%	0%	0%
	Conservative	10%	10%	25%	35%	19%	43%
	Moderate	35%	32%	54%	34%	63%	34%
	Liberal	38%	37%	13%	20%	15%	20%
	Very Liberal	15%	20%	4%	7%	3%	3%
Pre-campaign χ^2 (24, N = 300) = 46, p = .004**							
Post-campaign χ^2 (20, N = 272) = 47, p = .001**							

During the interviews, campers were asked to identify specific environmental issues they perceived as a threat to the Pacific Northwest and several common themes emerged. The most common response was concern about trash and litter, as nearly half of all the campers interviewed mentioned trash or litter as a threat:

> Probably just people's lack of respect of nature, people throwing stuff on the ground and trash in the campgrounds. There are few people who come out and are actually serious about enjoying the wilderness and enjoying it for what its worth, instead the majority of people come out here and scatter their garbage and throw their cans in the woods. [Vancouver, Washington camper, Tent]

Most of the campers who are concerned about trash and litter are really concerned about the overall impact that trash and litter has on the aesthetics and beauty of nature. Campers do not seem to be concerned about the ecological impact of trash or litter:

> (We are most concerned about) the people that leave their garbage lying in a beautiful country such as this, from their beer cans to their potato chip bags. When we are four wheeling it just makes us sick. We pick it up when we see it. My biggest issue is people just throwing their garbage. [Idaho Falls, Idaho campers, ATV Trailer]

Another environmental issue that PNW campers are concerned about is the numerous threats to aquatic and riparian ecosystems and wildlife. Approximately one-third of the campers interviewed voiced a concern about water quality/ pollution, endangered salmon, barriers to fish migration, decreases in riparian areas, or invasive water species, such as the zebra and Quagga mussels:

> Water pollution, especially in the Sound. The Sound and the Ocean with the accumulation of plastics scares the hell out of me. [Seattle, Washington camper, Tent]

Many of the campers who are concerned about aquatic or riparian ecosystems participate in activities or hobbies that are somehow related to the water. Campers who go fishing or boating tend to be particularly concerned about water:

> Water quality for one… They are having a hard time with these ocean fish [salmon] making it back up here and that is an issue with me. I think they are going about it the wrong way myself, but they do seem to be having some success with the hatchery program that they got. [Hailey, Idaho fisherman, Travel Trailer]

Finally, a small number of campers are concerned about the impact of climate change on the Pacific Northwest. Around 10% of campers interviewed identified climate change or concerns about our dependency on fossil fuels as a serious environmental threat:

> Global warming is huge. I have seen things change around here, such as the size of glaciers. When I was out hiking around in July it was up in the eighties and ten years ago it would have never been that hot. [Tonasket, Washington camper, Tent]

However, several campers openly questioned the validity of climate change and were very skeptical of any negative impacts on the Pacific Northwest.

Campers' "Hot Buttons"

Words and concepts that infuriated or frustrated campers were determined using the campground interviews, as these interviews were able to go deeper than the surveys into the specific issues that campers were concerned or worried about. Three overarching concerns were identified based on these interviews: increases in costs, increases in regulations, and the quality of campground firewood.

Concerns about increased costs

The most common hot button that frustrates campers is the increasing cost of camping, which includes the high cost of campground firewood, reservation fees, and entrance/ parking fees. Campers have noticed an increase in the costs of camping over the last several decades:

> Fifteen or twenty year ago, I would go out all summer and not pay for more than two or three nights of camping. I am heading down to the Teton

> area in a couple weeks and they are charging over $23 a night. I am paying $12 here, so that's… kind of ridiculous. Cost is a factor, because it is just another person saying you need to buy this. [Tonasket, Washington camper, Tent]

Agencies with diminishing budgets are increasing costs and implementing new fees to cover for their shrinking budgets. Unfortunately, many campers seem to be unaware of these costs or fees until they show up at the campsite:

> I think the costs are the biggest thing that catches people. People come out camping to save money, because it's a cheap method of entertainment. They can't afford to stay at hotels and stuff so it makes more sense to come out and experience nature... You can do more than ten camping trips for the cost of one trip to Disneyland. I think that people get out here and at first they think its cheap then realize all the hidden costs with firewood being one of them. [Vancouver, Washington camper, Tent]

Many campers who were interviewed pointed out the high cost of campground firewood as a particular point of frustration. Of the campgrounds where interviews were conducted, $6.50 for a bundle of firewood was the highest price seen, while the lowest price was $3 a bundle. One Spokane, Washington camper refused to purchase campground firewood, because he felt that "If you come to camp and pay for [firewood], then its outrageous." The high costs of campground firewood have caused many campers to find alternative sources of firewood that are more reasonably priced:

> I have noticed that the (firewood) vendors provide about twice as much firewood for half the price as the campgrounds. So I no longer buy firewood from the campgrounds anymore. [Beaverton, Oregon camper, Tent]

Concerns about the increasing costs of the camping experience were identified by two-thirds of the camper interviewed. However, the majority of this frustration seems to be focused on the cost of campground firewood.

Concerns about increased regulation

Increases in campground regulations are the second most common hot button that frustrates campers. Many campers perceive camping as an opportunity to be independent and free. Increasing regulations on the camping experience are a very serious concern, as many campers already believe that there are already too many regulations:

> I think there are too many laws and regulations and rules. I think that organizations such as the one you work for have too much power and too much control. And it's an endless process of government control. Personally I don't like it. [Grass Valley, California camper, Travel Trailer]

Additionally, many campers are hostile to the notion of increasing regulations on the movement of firewood. The transportation of firewood is prevalent among campers and regulations on the movement of firewood is perceived as a direct threat to their camping experience:

> There are too many regulations in these parks and National Forests… now are they going to make another regulation on firewood? Are they going to

> have someone check my car to make sure I don't have firewood? [Tonasket, Washington camper, Tent]

Those campers who live near a state border or regularly camp in neighboring states are the most concerned about regulations on the transportation of firewood. Several states have already banned the inter-state transportation of firewood and other states are in the process of developing new laws to ban the movement of firewood. Many of these boundary campers are very concerned, because they identify local firewood as firewood from the same ecosystem, not the same state:

> I would think that not allowing firewood between state lines would be tough to swallow, because we live right on the border of Idaho and share an ecosystem with them. You need to look at the forest type in determining the definite boundary. We are right on the edge of tamarack and cedar here. So you have to look at the species of tree and draw the line that way. [Spokane, Washington camper, Tent]

Campers are generally skeptical of the ability of public agencies to implement any new regulations with the amount of firewood that is transported and limited budgets by federal and state agencies. As one camper from Central Point, Oregon pointed out, "I think that it would be pretty damn hard to get people to follow the law. It's hard enough to get people to stop talking on their cell phones when driving."

Concerns about quality of firewood

The last major concern that campers have is the low quality of firewood that is provided by campgrounds. A camper from Portland, Oregon pointed out that the problem

with firewood sold at campgrounds is that the "wood is super dry wood and burns up real fast." This concern was reiterated by several other campers who believed that the wood that they obtained from home or purchased from outside firewood vendors was not only cheaper, but of higher quality:

> The stuff you get here is junk, it's soft wood that burns quick and does not have a lot of BTUs (British Thermal Units). The stuff I bring in has high BTUs and burns for a long time. [Grass Valley, California camper, Travel Trailer]

Information Sources and Exposure to the Tri-State Firewood Campaign

Campers' Preferred Information Sources

Campers obtain information about environmental issues from a variety of sources. When asked how frequently they used fifteen different information sources, survey respondents listed campground materials as the most frequently used information source to obtain information about environmental issues (See Table 9). This was affirmed in the campground interviews, as many campers observe campground materials that are posted on bulletin boards and notice boards:

> Almost inevitably at every campground we stop and look at the [bulletin boards], because we want to know about all sorts of things going on in that campground. For instance, we were wondering about what the bear risk was here at this campground. {Vancouver, Washington camper, Tent]

Other information sources that are frequently used by campers include state agencies, Internet sources, federal agencies, and state/ regional newspapers (See Table 9). Internet

sources were a particularly popular information source used by campers interviewed. Many of the campers interviewed regularly observe the warnings and suggestions posted on reservation websites, such as one couple from Smithfield, Utah who said that if warnings or regulations were posted on "a website, we reserve through reserveamerica.com, than we would notice."

Table 9: Information sources most frequently used by Pacific Northwest campers to learn about environmental issues (1= never, 2= infrequently, 3= frequently, and 4= very frequently)

	Mean (*Standard Deviation*)	
Information Sources	*Pre*	*Post*
Campground Materials	3.01 (*.769*)	3.08 (.742)
State Agencies	2.63 (*.809*)	2.78 (.800)
Internet	2.59 (*.922*)	2.55 (.913)
Federal Agencies	2.58 (*.806*)	2.70 (.808)
State and Regional Newspapers	2.55 (*.875*)	2.52 (.861)
Public Radio	2.50 (*1.06*)	2.37 (1.07)
Television	2.48 (*.847*)	2.44 (.846)
Local Newspapers	2.47 (*.886*)	2.41 (.828)
Pubic Television	2.45 (*.937*)	2.55 (.935)
Environmental Groups	1.94 (*.885*)	1.89 (.839)
Radio	1.93 (*.816*)	2.00 (.777)
University Publications	1.78 (*.814*)	1.85 (.824)
Local Leaders	1.71 (*.723*)	1.69 (.710)
State Invasive Species Council	1.55 (*.778*)	1.63 (.774)
National Invasive Species Council	1.47 (*.695*)	1.51 (.715)
Pre-campaign N= 275/ Post-campaign N= 252		

Exposure to Tri-State Firewood Campaign

Only around a quarter (27%) of preliminary survey respondents had seen or heard communication about invasive species in firewood, compared to exactly half of post campaign survey respondents (See Table 10). The level of exposure to information about invasive species in firewood was much lower for campers interviewed during the

campaign, as only 35% of campers interviewed had ever seen or heard about invasive species moving through firewood.

Table 10: Exposure to information about invasive species in firewood

	Seen information about invasive species in firewood	
	Yes	No
Pre-Campaign Survey	27%	73%
Post Campaign Survey	50%	50%
χ^2 (1, N = 598) = 32, p < .001**		

Based on the results from the post-campaign survey, the percentage of respondents who were exposed to information about invasive species in firewood differed based on the number of nights campers went camping each year (See Table 11).

Table 11: Exposure to information about invasive species in firewood by campers average nights camping a year (Data from post-campaign survey)

		Average nights camping a year		
		1-4	5-15	Greater than 15
Seen Information about invasive species in firewood	Yes	37%	45%	62%
	No	63%	55%	38%
χ^2 (6, N = 287) = 16.4, p = .012*				

The more nights campers went camping a year, the more likely it was for them to have seen information about invasive species in firewood. However, the percentage of respondents who were exposed to information about invasive species in firewood did not differ based on primary camp shelter (χ^2 (5, N = 284) = 8.4, p = .135). Nearly half (49%) of tent campers had seen information about invasive species in firewood, which was only a slightly higher exposure than motor home campers with 41%.

In the post campaign survey, campers who were exposed to information about invasive species in firewood were asked to identify which communication materials they had seen. About 40% of respondents' reported seeing a campaign poster, with fewer respondents seeing other campaign materials (See Table 12). Although, not asked on the survey, a large number of campers interviewed had seen information about invasive species in firewood online at one of the numerous campground reservation websites. Surprisingly, the same number of campers who were interviewed (40%) had seen online information about invasive species in firewood as those who had seen campground materials.

Table 12: Outreach materials seen (Data from post-campaign survey)

		Percent of Outreach Materials Seen
Outreach Materials	Campground Poster	40%
	Brochure/ Flyer	24%
	Billboard	17%
	Personal Communication with Park Ranger or Camp Host	13%
N= 287		

Exposure to the 2010 Tri-State firewood campaign was significantly higher in Oregon. Fifty-nine percent of campers who had seen information about invasive species in firewood reported seeing the information in Oregon (See Table 13). These results were consistent with what was observed in the campgrounds where interviews were conducted, as Tri-State firewood campground materials were observed only in Oregon campgrounds.

Table 13: States where campers observed information about invasive species in firewood (Data from post-campaign survey)

State where information about invasive species in firewood was seen	Oregon	59%
	Other*	23%
	Washington	9%
	Idaho	9%

N=165
*Other states where campers had seen information include (listed in order of frequency): California, Montana, Wyoming, Colorado, Pennsylvania, Canada, Utah, South Dakota, Arizona, Wisconsin, Minnesota, Nevada, Iowa, Indiana, Ohio, Kentucky, New York

Campers' Experience with Invasive Species

General Perceptions about Invasive Species

The majority of survey respondents perceive invasive species as a serious threat to both ecosystem functions and more generally to the region as a whole. More than half (55%) of respondents from the preliminary baseline survey stated that invasive species were a very serious threat to ecosystem functions and an additional 41% of respondents stated invasive species are a somewhat serious threat. When asked to what degree they agree with the statement "the spread of invasive species is a threat to the Pacific Northwest," 54% of preliminary survey respondents strongly agreed and 35% mildly agreed with the statement. The percentage of respondents who believed that invasive species pose a threat to the PNW did not significantly differ between the pre and post campaign surveys (See Table 14).

Table 14: Perceptions about the threat of invasive species to the Pacific Northwest

Spread of Invasive Species are a Threat to the PNW	Strongly Agree	Mildly Agree	Neutral	Mildly Disagree	Strongly Disagree
Post Campaign Survey	63%	28%	6%	1%	2%
Pre Campaign Survey	54%	35%	9%	1%	1%
χ^2 (4, N = 579) = 6.95, p = .14					

Those campers who were interviewed also seemed to be concerned about invasive species, as many of the campers had heard about invasive species and perceived them as a threat:

> I don't know particular names, but I am aware of the threat that [invasive species] can overtake other plants and animals that are native to an area. As well as how rapidly many of them can colonize an area. [Cornelius, Oregon camper, Tent Trailer]

Campers who are personally impacted or threatened by invasive species are more aware of the risks that invasive species pose. For instance, the vast majority of campers who regularly went fishing were aware of the various aquatic invasive species, but in particular the threat of the Zebra and Quagga mussels:

> I know with the boat if we cross state lines there are issues. I know about the mussels and the milfoil. Although I have never been affected by it, I know it is a huge issue here. [Spokane, Washington camper, Slide-in Trailer]

There were only a few campers interviewed who did not perceive invasive species as a serious threat to the Pacific Northwest. However, those campers openly acknowledged that they did not perceive invasive species as a threat because they were not impacted by invasive species or they had a lack of knowledge about invasive species. For instance, one Grass Valley, California camper stated that he was not concerned about invasive species, because "I don't see any huge disaster coming from it and I have not heard anything about it."

Survey respondents were asked to rate the level of impact that invasive species had on several different areas, including aesthetics/ beauty of nature, the environment, human health, the economy, and recreation. Survey respondents rated the environment as being the most impacted by invasive species, as around three quarters of respondents identified invasive species as having a substantial impact on the environment (See Table 15). Campers' beliefs about the areas impacted by invasive species did not differ between the pre- and post-campaign surveys.

Table 15: Invasive species impacts that Campers are concerned about

		Substantial Impact		**Some Impact**		**No Impact**	
		Pre	*Post*	*Pre*	*Post*	*Pre*	*Post*
Areas Impacted by Invasive Species	Environment	76%	78%	22%	21%	1%	1%
	Aesthetics/ Beauty	65%	65%	34%	32%	2%	3%
	Economy	53%	57%	43%	40%	4%	3%
	Recreation	48%	47%	48%	50%	4%	2%
	Human Health	23%	16%	65%	73%	12%	11%

Pre-campaign N= 294/ Post-campaign N=260

Overall, campers are most concerned about the general impact of invasive species on the environment and aesthetics and beauty of nature. This concern about the impact of invasive species on the aesthetics and beauty of nature is consistent with campers general environmental concerns about trash and litter.

General Knowledge about Invasive Species

The majority of Pacific Northwest campers know what invasive species are, as many campers are able to correctly identify the definition of an invasive species. When presented with multiple definitions, two-thirds (66%) of preliminary survey respondents were able to correctly identify the definition of an invasive species. Many of the remaining respondents (27%) incorrectly identified invasive species as any non-native species, which failed to incorporate the harm component of an invasive species. The percentage of respondents who were able to correctly identify the definition of an invasive species did not differ between the pre- and post- campaign surveys (χ^2 (3, N = 596) = .925, p = .819). Campers from both the pre- and post-survey were generally knowledgeable about basic invasive species issues, as the majority of campers were able to correctly define invasive species.

Of those campers interviewed, general invasive species knowledge was greater in campers who had been personally impacted or threatened by invasive species. For instance, many of the campers interviewed from the Portland Metro Area were able to identify English Ivy (a prevalent invader in the region). Similarly, almost every camper interviewed who fished was able to identify the Zebra and Quagga Mussels and the threat that they posed to waterways:

> I know that there is the English ivy that is a problem coming up Canyon Road near the Portland Zoo. I have not participated in it but I know that people go out and remove invasive species. As a fisherman I know about the mussels and how they check our boats. [Beaverton, Oregon camper, Tent]

Most campers are able to identify invasive species that personally impact them or threaten their hobbies or activities, however very few campers are able to identify the specific pathway for the spread of those invaders. Many of the campers who were interviewed were able to identify humans and our transportation systems as possible vectors or pathways for the spread of invasive species, but very few individuals were able to identify specific vectors:

> I would imagine humans transport them. I know that when we go into agriculturally sensitive areas on some of our travels they are very conscientious of what we bring in. There is obviously a reason for that and I think that is important. I don't know that much about the spread of invasive species though. [Fox Island, Washington camper, Motor Home]

Even those campers who can identify specific vectors, such as boats or tires, are generally unaware of the process for the spread of invasive species.

Prior Experience or Knowledge about Invasive Species in Firewood

Pacific Northwest campers have very little prior experience with invasive species in firewood and very few campers have even heard of the issue prior to the Tri-State firewood campaign. The vast majority of campers confuse the threat of invasive species

in firewood with the mountain pine beetle that is devastating forested areas of western North America. For example, one camper from Fox Island, Washington thought he had heard about the threat of invasive species moving through firewood, but when asked if he could describe some of these invasive species he said, "Yeah, the pine beetle for one has devastated a lot of forests in central Oregon." As stated earlier, only about a quarter (27%) of respondents from the pre-campaign survey had seen or heard information about invasive species in firewood. Outside of the Tri-State firewood campaign, the only experience that campers interviewed had regarding invasive species in firewood was seeing warnings at border crossings:

> Recently when we went down to California we took some wood and at the border they asked us if we had any firewood. When they asked I said, "no," but then realized that I had a huge load on the top of my camper trailer. [Portland, Oregon camper, Tent Trailer]

Many of the campers who were interviewed were skeptical of firewood being a legitimate vector for the spread of invasive species. Campers questioned the prevalence of long-distance transportation of firewood and believed that most campers acquired their wood locally when they went on long-distance camping trips:

> I am not sure how much long-distance transportation of firewood occurs…I would just assume that most people already obtain their firewood locally. [Fox Island, Washington camper, Motor Home]

However, campers are not skeptical about the ability of insects to infest firewood. Many campers are aware of beetles or other insects that burrow into wood and have had personal experiences with insects in their own firewood:

> We know about bugs and see them when we cut our wood, we just never thought about how they could be transported through firewood. [Port Angeles, Washington camper, Travel Trailer]

Overall, there is a general lack of awareness about the threat of invasive species being transported through firewood. Many campers are receptive to this information, however, unlike boats or tires, many campers believe that firewood isn't transported far enough to be a legitimate threat of moving invasive forest pests.

Campers Concerns and Feelings about Invasive Species in Firewood

Invasive Species and Firewood Policy Solutions

In the campground interviews, campers were asked, "if you were a policy maker, how would you minimize the spread of invasive species through firewood?" Campers were asked to identify solutions that they believed would be socially acceptable to them and that they believed would be acceptable to other members of society. There was a wide range of responses from campers who were interviewed, with three general policy solutions emerging.

The most popular policy solution to minimize the spread of invasive species through firewood is to mandate the use of local firewood at campgrounds. This falls in line with the slogan from the Tri-State firewood campaign, "buy it where you burn it." Unfortunately, among campers interviewed there was a wide range of ideas and opinions

on what local firewood is. On one side there are campers who believe that campgrounds should mandate campers to purchase firewood from the campground in order to ensure that no firewood is being transported into the area:

> If [campgrounds] just made it mandatory for people [to buy their firewood at the campground] than over time people would just respect the rule and stop bringing it in their trucks. I think people are going to look at it as if this is going to be what it costs to go to Mt. Rainier than this is what its going to cost. [Vancouver, Washington camper, Tent]

However, other campers are opposed to mandating campground firewood, primarily, because of the current high cost of campground firewood. A handful of campers are supportive of mandating campground firewood if campgrounds lowered their prices to be competitive with outside sources:

> The cost of the firewood that they have available in the park must be comparable to the cost of the firewood outside the park. If the parks made it an economically viable solution to buy firewood from the (campground) than the park could control the wood being burned in their campgrounds. If they provided the local wood than people probably would not bring their own wood. [Beaverton, Oregon camper, Travel Trailer]

There is another group of campers who support mandating local firewood, but want a wider interpretation of local. Many campers are willing to obtain their wood locally as long as there are designated areas where campers can go to cut their own firewood or

registered firewood dealers nearby where campers can ensure that the wood that they are purchasing is local:

> I know that many places where we cut they require you to buy a firewood permit and make you cut in certain areas. So maybe that can be an [alternative] to buying firewood from the campground. [Idaho Falls, Idaho camper, ATV Trailer]

Many of the campers with large supplies of firewood at home do not like the idea of campgrounds mandating campers to purchase firewood from the campground. In general, a broader interpretation of "local" wood has support among campers, especially for those campers who cut their own wood or prefer to obtain their firewood from local vendors near their home.

The second most popular policy solution suggested is the development of further education and outreach efforts to inform campers about the risk of transporting invasive species through firewood and provide best practices regarding the movement of firewood. Many campers have never heard that invasive species can move through firewood; however after becoming informed about the risk of transporting pests through firewood, they are receptive to changing their firewood practices:

> The most effective way would be communication and outreach. I had no idea about this issue and I had never thought about it. I am very thoughtful and mindful of my impact and I never realized that firewood could be a source of the spread of invasive species. You have zero awareness of it, so

> the impact of simple communication would be the obvious place to start. [Beaverton, Oregon camper, Tent]

One camper from Portland, Oregon pointed out that there are a large number of invasive species messages being presented to campers, fisherman, boaters, etc. and that spreading the message about invasive species in firewood would be more effective if risk communicators "worked with other invasive species campaigns to help get the message out."

The final policy solution suggested is that campgrounds should simply include the cost of firewood in the camp fee. Although increases in costs are a hot button for campers, if campers know that firewood is included in their camp fee then they will not bring firewood from outside sources. In this situation, firewood is a sunk cost or a cost that has been paid by the camper and cannot be recovered:

> If you raised the price two dollars a night and that included a bundle of wood by your (campsite), I would go for that. Most people if it's incorporated into the cost of something than it's not a huge issue, but it's those add on costs where people go "eek." [Idaho Falls, Idaho camper, ATV Trailer]

Several campers who supported a mandatory firewood fee attached to the campsite fee were concerned about those campers who did not have campfires paying for firewood that they would not use. One camper thought of the idea of "firewood tokens," where each camper was given as many tokens as nights that they reserved at the campsite and

each token would be redeemable for a bundle of firewood. If a camper did not have a campfire than those tokens could be returned at checkout for a credit:

> The price of firewood should maybe be included in your camp fees and if you decided not to build a fire then you would get a credit back when you left. I don't think that firewood is a huge moneymaking scheme and if bugs in wood are becoming an issue than perhaps they should just make it a mandatory fee for camping. [Central Point, Oregon camper, Travel Trailer]

Campers are receptive to different policy solutions for preventing the spread of invasive species through firewood, however in almost every situation the policy solution that campers support is based on their personal firewood practices. For instance, the majority of those campers who bring their own wood are not supportive of any policy that regulates campers' movement of firewood; instead these campers are generally supportive of education and outreach measures.

Feasibility of Preventing the Spread of Invasive Species

Many campers believe that measures to prevent the spread of invasive species are necessary and support those efforts by federal and state agencies to reduce the risks associated with harmful pests. For instance, one of the campers interviewed was a schoolteacher from Beaverton, Oregon and he annually took his "classroom children out and clean[ed] invasive species out of parks" in order to educate children about the risks associated with invasive species. However, there is a sizeable group of campers who do not think that it is feasible to prevent the spread of invasive species:

> It's a concern definitely. I suppose they are trying, but that is a loser. They are going to lose that battle. It's inevitable, there is no way you can stop it. [Hailey, Idaho camper, Travel Trailer]

Campers who question whether it is possible to prevent the spread of invasive species are concerned about reducing the likelihood of an invasion to 0%. To these campers, efforts that only minimize the threat of invasive species are not worth the investment of public time or money:

> Isn't the only way to eradicate the spread of invasive species to reduce the risk to 0%? If 0% is completely unlikely, unreasonable, and not going to happen, than is it worth creating barriers, hassles, and costs to prevent the spread of invasive species? It really comes down to the question; if you have eradicated 99% of the risk, is that much different than eradicating 50% of the risk? It may lower the probability, but I am not sure whether it is worth it. [Portland, Oregon camper, Tent Trailer]

These campers want to see guarantees that invasive species can be prevented and if there is no way of ensuring that it is possible to exclude the introduction of invasive species than they are not supportive of more expensive measures to prevent the spread of pests. For instance, the above camper was supportive of education and outreach efforts to inform the public about the threat of invasive species, but was not supportive of more costly measures such as quarantines or border controls.

There are also a number of campers who believe that there is no need to create barriers or measures to prevent the spread of invasive species, because native species will

ultimately dominate any invading species. These campers believe that native species have a greater resilience and are better adapted to the local climate or ecosystem than invading species:

> It's been my observation that a lot of [invasive species] will take over for awhile, but Mother Nature has a way of balancing these things out. The native grass will be very prolific for a long time and even if cheat grass comes in, the native grasses will take them over again… With cheat grass in particular, if it were going to be the dominant grass than it would have been there to start with. The [grass] that lives here best, is the one that has developed over all these eons until the last hundred years where man has had such a huge impact. All of that stuff is going to get beaten out again. [Hailey, Idaho camper, Motor Home]

Campers have mixed opinions regarding the feasibility of preventing the spread of invasive species. Those campers who question whether it is possible to prevent the spread of invasive species fall into one of two camps. One group believes that it is impossible to reduce the likelihood of invasive species being introduced to 0%; as a result it is not worth creating barriers or investing in measures if it is inevitable. The other group believes that native plants and animals are resilient enough to combat and ultimately overtake invading species. Both of these groups were generally unwilling to change those camping practices that are considered high-risk behaviors, because they perceived the spread of invasive species as being an inevitable process.

Campers Response to Messaging about Invasive Species in Firewood

As pointed out earlier, exposure to information about invasive species in firewood appeared to have no effect on campers' ability to define what an invasive species is, their views about invasive species as a threat to the Pacific Northwest, their ability to identify specific invasive species, such as emerald ash borer, or their beliefs about the impact of invasive species on the environment, recreation, health, economy, or beauty. Although post-campaign survey respondents were not more concerned or knowledgeable about invasive species, those that had seen information about invasive species in firewood did show a willingness to change their camping practices to reduce the risk. Nearly two-thirds of post-campaign respondents (61%) who had seen information about invasive species in firewood stated that they would change their camping or firewood practices based on the information they had seen.

Of the campers who have changed their camping practices, the vast majority of them have adopted new practices that had been highlighted by the messaging from the Tri-State firewood campaign. For instance, 75% of those campers who stated they had changed their camping practices reported that they now buy their firewood where they are going to burn it, which was the slogan of the Tri-State firewood campaign (See Table 16).

Table 16: Specific camping practices changed by those who had seen information about invasive species in firewood and stated they had changed their camping practices (Data from post-campaign survey)

Stated Camping Practices Changed	Buy it where I burn it	75%
	I don't move firewood	45%
	I don't buy firewood from unknown sources	32%
	I tell others about invasive species in firewood	21%
	I buy bug free firewood	15%
	Other	6%
N= 99		

This willingness of PNW campers to change their camping practices and buy their firewood where they are going to burn it was supported by an increase in campers obtaining their firewood from the camp host/ park rangers (See Table 17). The increase in campers obtaining their firewood from the camp host/ park rangers was mirrored by a decrease in the number of campers who gather firewood near their campsite. This shift could be explained by efforts to limit campers gathering firewood in order to prevent the denudation of the understory in campgrounds.

Table 17: Change in campers' firewood origin between pre and post-survey respondents

	Origin of Campers camp firewood		
	Camp Host/ Park Ranger	Home	Gather
Pre-Survey	33%	32%	18%
Post-Survey	41%	30%	11%
χ^2 (8, N =617) = 15.8, p = .04*			

Generally, campers who were interviewed were also likely to change their camping practices after hearing about the threat of invasive species in firewood:

> Oh, I think if it was a big issue we would [change our camping practices]. We would research to see if the wood from our area is a problem or if there are invasive species in our wood. If there were, we would get the firewood that was from [the campground]. [Beaverton, Oregon camper, Tent]

Many of the newly adopted camping practices, however, are not considered best practices for preventing the spread of invasive species through firewood. Many of these campers either misunderstood the risk message of the Tri-State firewood campaign or developed their own solutions to the problem. For instance, the expert model encourages campers who have already transported their wood to burn it instead of leaving it behind or transporting it. Several campers said that they would still bring their own firewood to campgrounds, but when they went back home they would take their remaining firewood with them:

> Well, we only unloaded enough wood that we would burn. If we don't burn it all, than we will take it home. [Redmond, Washington camper, 5th Wheel Trailer]

Although campers are willing to change their practices, there is obvious confusion as campers have developed their own solutions to the spread of invasive species through firewood. Besides campers who have misunderstood the risk message, there are a number of campers who will not change their camping practices because they feel like the message does not apply to them. One group of campers from the Willamette Valley in northwest Oregon who obtain their wood from friends in eastern Oregon were

interviewed at a campground on the Oregon coast in the southwest part of the state. They stated they would not change their camping practices, because "all our wood is from Oregon." This was not an uncommon response, as another camper interviewed on the Oregon coast from the Portland Metro Area felt that we should be concerned about "people coming from Arizona" and that he was not "someone bringing in invasive species from Beaverton." Campers have varying definitions and perceptions of local firewood and many believe that only long-distance travelers can be responsible for transporting invasive species.

Discussion

The audience analysis of Pacific Northwest campers was able to identify campers' exposure to the 2010 Tri-State firewood campaign and assess the effectiveness of the campaign in changing campers' perceptions, knowledge, and practices regarding invasive species in firewood. In addition, the audience analysis identified several key characteristics of campers to be used in the development of future communication efforts tailored towards campers in the Pacific Northwest. Although these characteristics are essential for developing effective communication, a mental model of campers' views, beliefs, and knowledge about invasive species and firewood was developed in order to address misconceptions and incorrect information campers possess regarding the threat of invasive species moving through firewood. These key camper characteristics and campers' mental model about invasive species and firewood have been used to develop

recommendations for future efforts to communicate the risk of invasive species moving through firewood to campers in the Northwest.

Effect of the Tri-State Firewood Campaign

The survey results suggest that the Tri-State firewood campaign led to an increase in campers' exposure to information about invasive species in firewood (See Table 10). Along with this increase in exposure, a greater proportion of post-campaign campers obtained their firewood from local sources (See Table 17) and the majority of those campers who had been exposed to information about invasive species in firewood adopted new camping practices that were recommended by the Tri-State firewood campaign (See Table 16).

Although there was an increase in campers' exposure to information about invasive species in firewood and a greater proportion of campers seem to have adopted best practices regarding firewood, the Tri-State firewood campaign did not seem to have an effect on campers' perceptions about the threat of invasive species (See Table 14), their general knowledge about invasive species (See P. 64), or their ability to identify invasive species that move through firewood (See Figure 4 below). This increase in exposure to information about the risk was an essential first step in informing campers about the general problems associated with invasive species moving through firewood, however the campaign failed to provide the in-depth information that campers who were interviewed sought, which might have resulted in higher levels of behavior change.

There were also concerns about the distribution of the Tri-State firewood campaign outreach materials. Almost all the campers who had reported seeing

information about invasive species in firewood saw that information in Oregon (59%) or non-PNW states (23%) (See Table 13). This was supported by general observations during the interview process, as Tri-State firewood campaign messaging was only observed in two of the 32 campgrounds visited and both campgrounds were Oregon State Parks. The Oregon Invasive Species Council and partners in Washington and Idaho delivered 3,000 Q and A fact sheets, 30,000 Frisbees®, 3,000 packs of playing cards, and nearly 5,000 posters to participating agencies to distribute throughout campgrounds. Although no formal analysis has been conducted to determine what happened to these materials, it is apparent that many of these materials either failed to be posted or were only posted for a short period, which may be attributed to inadequate communication between participating agencies or inadequate vertical communication within participating agencies. Regardless of where the communication breakdown occurred, it is important for future campaigns that work with numerous federal and state partners to verify both the receipt and posting of outreach materials. Had all of the outreach materials that were distributed been posted, it could be assumed that campers' exposure to information about invasive species in firewood would be higher.

Key Camper Characteristics

Several key characteristics of campers were identified through the audience analysis, which helped to provide a general understanding of important preferences and practices that should be addressed in any communication strategy that targets campers. The surveys and interviews found that campers are a diverse group, however a substantial amount of variation among campers was explained by primary camp shelter. Two

dominant camping groups, tent campers and travel trailer/ 5th wheel/ motor home campers (TT5WMH), emerged based on the survey and interview results. These two groups together represent the majority of campers, as Tent campers represent approximately half of all PNW campers and TT5WMH campers represent approximately one third. The most drastic variation in these two groups is in the number of nights they go camping a year, their firewood practices, and their stance on environmental policy issues (See Table 18).

Understanding the differences among campers by primary camp shelter is important for developing effective messaging that reaches a wide audience. For instance, tent campers may be more receptive to communication that emphasizes environmental protection, because they are much more liberal in their environmental policy stance than TT5WMH campers (See Table 8).

Table 18: Variation between campers based on camp shelter (Data from post-campaign survey)

	Tent Campers	Travel Trailer/ 5th Wheel/ Motor home Campers
% of campers that camp for more than a week each year (N=248)**	40%	84%
% of campers that make campfires "very often" (N=245)**	68%	48%
% of campers that bring their firewood from home (N=247)*	19%	37%
% of campers that are liberal or very liberal (N=229)**	53%	17%

* χ^2 Significant at the .05 level
** χ^2 Significant at the .01 level

Tent campers also have campfires much more frequently than any other camper group (See Table 6), but they are the least likely to bring their firewood from home (See Table

18). As a result, any risk communication directed towards Pacific Northwest campers should consider the needs and preferences of tent campers in the development of communication messages and communication placement. However, messaging about invasive species in firewood cannot ignore TT5WMH campers, as they travel much further than tent campers (See P. 44) and tend to bring their firewood from home the most frequently (See Table 18), which makes them more at risk of transporting invasive species into vulnerable ecosystems.

The patterns of camper movement and popular camping destinations are critical camper characteristics that are particularly important for invasive species messaging. By understanding these patterns of camper movement it is possible to identify the vulnerability of particular areas to invasive species infestations and allow communicators to focus risk messaging. The coast range of Oregon and Washington is a popular camping destination for residents of all of the highly populated regions of the PNW and it is also the most popular ecoregion for non-PNW residents (See Table 5). Other popular ecoregions visited by PNW campers include the Cascade Mountains, Idaho Batholith, and Northern Rockies. For the most part, campers tend to camp in regions that are near or adjacent to their homes, however those campers who travel further from home tend to camp at either the coast or one of these other popular camping regions.

One of the more surprising key camper characteristics identified through this study is that campers in the Pacific Northwest tend to be generalists. The top five most popular camping activities and hobbies are sightseeing, hiking, campfires, swimming/ beach activities, and picnicking (See Table 3). These popular activities and hobbies have

two commonalities, they are all relatively cheap (or free) activities and they do not require any prior experience or specialized equipment. Many of the campers who were interviewed emphasized leisure and relaxation as two of the primary motivations for camping, such as one family from Beaverton, Oregon who stated that "We do a lot of hanging out at the campsite, reading, snoozing, and playing games." This was a common response by many of the campers interviewed and very few campers mentioned more technical and physically demanding activities or hobbies as a motivation for camping.

The final key audience characteristic of campers is their preferred information sources to learn about environmental issues. The most popular information source that campers use to learn about environmental issues is campground materials followed by state agency publications, Internet sources, federal agency publications, and state/ regional newspapers. Campers read and learn from campground materials, such as posters, fliers, ranger talks, and bulletin board posts. For instance, a camper from Vancouver, Washington stated "almost inevitable at every campground we stop and look at the bulletin boards, because we want to know about all sort of things going on in that campground." Besides these campground materials, campers are also attentive to information posted on state and federal websites, particularly information provided by campsite reservation websites, such as www.reserveamerica.com and www.recreation.gov. When asked where the best place would be to post important environmental information about the area they were going to visit, a group from Aumsville, Oregon responded "if it was on a reservation website… than we would notice." Many of the campers interviewed who regularly utilize online campsite

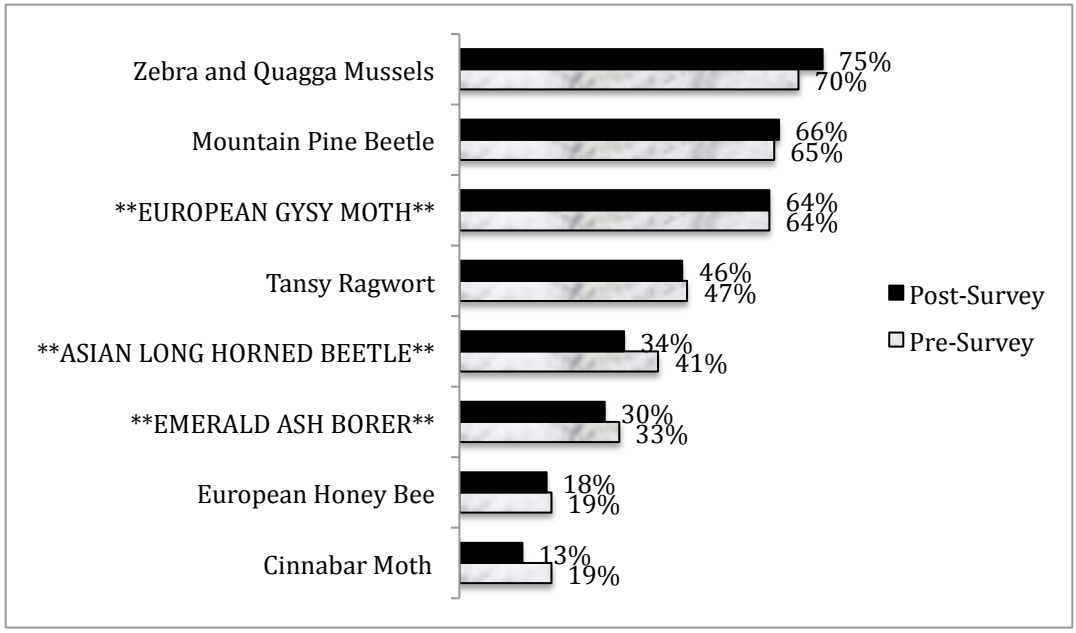
reservation services had read through the warnings and campground rules that were printed alongside their receipt. Overall, campers seem to utilize a large variety of information sources to learn about environmental issues, which means that future communication campaigns directed towards campers can communicate effectively with more than one medium.

Mental Model of Invasive Species and Firewood

Using a general understanding of the audiences' preferences and practices it is possible to identify the most effective communication materials and placement of those materials; however, this general understanding cannot be used to guide the content of the communication materials. When developing risk communication materials it is necessary to have a more detailed understanding of the audiences' mental model of the risk in order to address any missing information or misconceptions the audience may have regarding that risk (Zaksek and Arvai, 2004). The mental model developed from this study can be used to guide future risk messaging as it identifies the three areas where campers have missing information or misconceptions that affect their decision-making regarding invasive species and firewood. PNW campers have misconceptions and gaps in their knowledge about specific invasive pests that can be transported through firewood, the role of firewood as a vector for the spread of invasive species, and solutions to preventing the spread of invasive species through firewood.

Campers Knowledge Gaps About Invasive Pests Transported Through Firewood

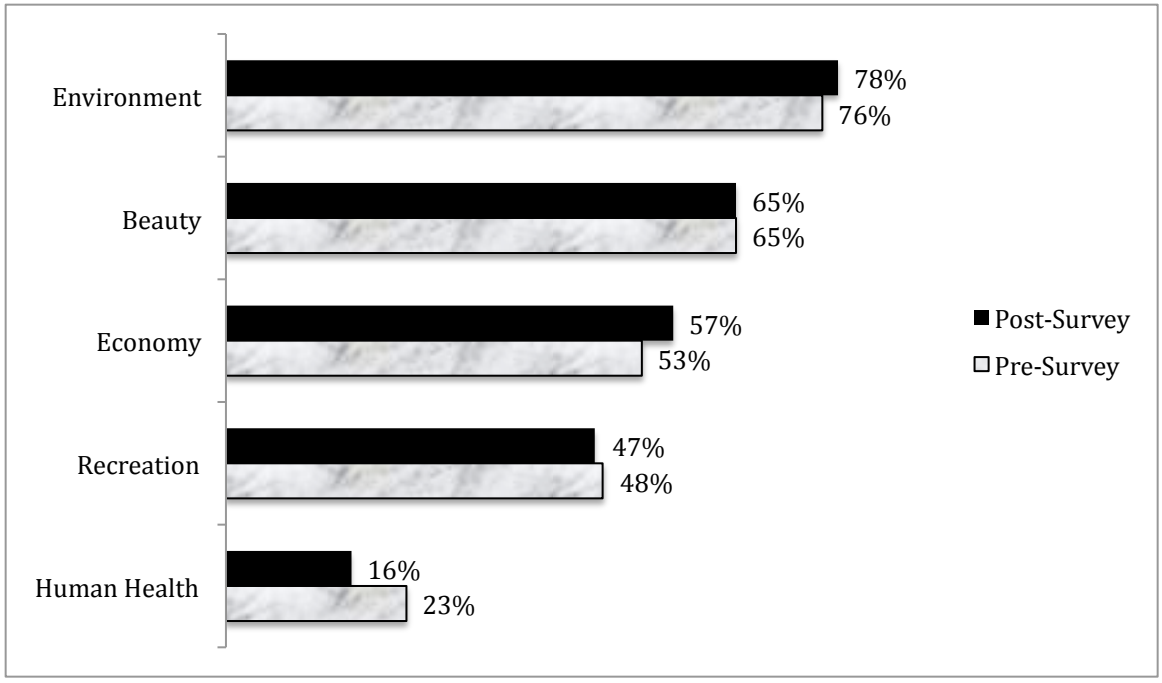
The vast majority of campers perceive invasive species as a threat to the Pacific Northwest (See Table 14) and many campers are able to identify specific invasive pests. Those campers aware of invasive species threats have a tendency to connect that threat to a specific pest, instead of the vector, pathway, or harm caused by that pest. During the interviews, when asked to identify invasive species threats, campers identified specific pests, such as Zebra and Quagga Mussels, English Ivy, Scotch Broom, Milfoil, European Beach Grass, Asian Carp, and several others pests. However, campers interviewed were generally unaware of specific pests that are transported through firewood. Only one camper who was interviewed was able to recall the name of an invasive pest that moves through firewood (European Gypsy Moth). When given a list of species in the post-campaign survey very few campers were able to identify invasive pests transported through firewood, in fact, there was no statistical difference between pre- and post-campaign campers in their ability to identify these invasive pests (See Figure 4). Three invasive species that are transported through firewood were included on the survey and the only one identified by more than half of respondents was the European Gypsy Moth.



CAPITALIZED= Invasive Species that can be transported through firewood (N=538)

Figure 4: Responses to the question "Which of the following are invasive species that are a threat to the Pacific Northwest?"

Besides the overall lack of awareness about specific pests that can be transported through firewood, campers also had limited knowledge about the impact or damage caused by these pests. None of the campers interviewed were able to identify the impact of invasive pests transported through firewood. However, campers seemed to have a general understanding of the impact of other invasive pests, such as one camper from Spokane, Washington who stated that he had "just [seen] Knap Weed alongside the road, which had [recently] been introduced by all the traffic." Although most campers were unaware of the impacts of specific pests transported through firewood, Figure 5 depicts campers' perceptions about the general impact of invasive species on several different areas.



(N=554)

Figure 5: Areas where there is a perceived "substantial impact" by invasive species

Campers' perceive invasive species as having the most substantial impact on the environment and aesthetics/ beauty of nature, although many also see potential impacts to the economy. These perceived impacts of invasive species are not surprising considering the impact of invasive species on the environment and beauty of nature would have the most dramatic impact on the camping experience.

The Role of Firewood as a Vector of Invasive Species

Besides being unaware of specific pests that can be transported through firewood and the harm those pests can inflict, campers are generally unaware of firewood as a vector for spreading invasive species. Two types of campers seemed to emerge from the interviews. First, are those campers who never thought that invasive species could be transported in firewood and never perceived moving firewood as a risky behavior:

> We know about bugs and see them when we cut our wood, we just never thought about how they could be transported through firewood. [Port Townsend, Washington camper, Travel Trailer]

Second, are campers who are skeptical about firewood being an invasive species vector because they do not believe that campers transport firewood long enough distances to represent a genuine threat:

> I am not sure how much long-distance transportation of firewood occurs…I would just assume that most people already obtain their firewood locally. [Fox Island, Washington camper, Motor Home]

This general skepticism regarding firewood as a vector for spreading invasive species was anchored in campers' personal firewood and camping practices. Those campers who were most skeptical about firewood being an invasive species vector were the campers who had a tendency to obtain their firewood locally or camp near their home. Many of these campers assumed that they were representative of the average camper and that it was rare for individuals to travel long distances to go camping and even more rare to transport firewood long distances.

Solutions to Reduce the Risk of Invasive Species Moving Through Firewood

The best practice to prevent the spread of invasive species in firewood is to limit long distance transport of firewood by using local firewood that is harvested near a camper's destination. The main slogan of the 2010 Tri-State firewood campaign was "buy it where you burn it," which was intended to encourage campers to obtain local firewood and burn that firewood in the same region or ecosystem in order to prevent

invasive pests from being transported into previously unaffected areas. Campers interviewed had missing information and misconceptions about these best practices regarding firewood. First, many campers are unaware of what "local" firewood is or where to obtain local firewood. Second, some campers perceive solutions to reduce the risk of invasive species moving through firewood as a threat to their camping experience.

There is confusion by many campers as to what local firewood is and at what point firewood is no longer considered local. Campers' perceptions of local firewood varied from within 50 miles, 100 miles, the same ecosystem, the same State, to the same region. As pointed out earlier, a group of campers who were interviewed on the southern Oregon coast believed that their wood was local when it was Ponderosa Pine that had been cut over 500 miles away in the Wallowa Mountains in northeastern Oregon. This variation in campers' definition of "local" firewood led to an inconsistent application of the 2010 Tri-State firewood campaign recommendations. Without a clearly stated range of local firewood, many campers seemed to adopt a range that was most convenient to their camping practices, such as the family who had transported their firewood 500 miles, but identified it as local, because it was still from within the same state.

Many campers are unaware of alternative local firewood sources. While most campers know that they can obtain local firewood from the camp host/ park rangers, the firewood provided at campgrounds is perceived as overpriced by those campers who obtain their wood from other sources. Not surprisingly, many of the campers interviewed who were unfamiliar with the area in which they were camping were unaware of alternative firewood sources such as a nearby National or State Forest where they can cut

their own wood, local vendors down the street, or cheaper bulk firewood that can be purchased nearby. Campers would be more receptive to obtaining local firewood if they were aware of cost effective local alternatives to the campground firewood:

> You need to publicize where to obtain local firewood. Any person that is from here knows where to go get firewood, but those that are coming from out of town don't have a saw with them or don't know that they can drive 5 minutes to go into the National Forest and gather their own firewood. [Spokane, Washington camper, Slide-in Trailer]

It would be advantageous to provide campers with a list of suitable alternative firewood sources or local firewood dealers in popular camping areas. One family from Vancouver, Washington who brought their own wood from home stated they would change their camping practices after hearing about the threat of invasive species moving through firewood, but they wanted to know where they could find "private vendors that provide cheaper wood than the expensive campgrounds." By providing campers with a list of local firewood sources more campers may be willing to obtain their firewood locally.

As pointed out earlier, two of campers' hot buttons include increasing camping regulations and costs. Many campers feel like there are already "too many laws and regulations and rules" in the campgrounds [Grass Valley, California camper]. Others believe that "you are already getting nickel and dimed at these campgrounds to death" [Hailey, Idaho camper]. Many campers associate the "buy it where you burn it" slogan with increased costs and/ or increased regulations on their camping experience. Campers do not want to be told they must obtain local firewood, particularly if they are forced to

buy firewood from the campgrounds. For those campers interviewed who bring firewood from home, the message in the slogan was perceived as an increase in the overall cost of their camping experience. In order to address campers' concerns, messaging should avoid discussing increased costs or regulations when informing campers about the threat of invasive species moving through firewood.

This mental model of campers' views, beliefs and knowledge about invasive species and firewood can be used to "contribute to the development of a framework for more efficient and effective risk communication" (Zaksek and Arvai, 2004, p. 1504) directed at Pacific Northwest campers. At this point, the risk of invasive species moving through firewood is both new and not very visible to campers in the Pacific Northwest, which means that it is necessary to first increase campers awareness about the pests, processes, vectors, and best practices. Once campers are more aware of the risk, than future efforts can communicate "more technical information, encourage behavior changes, or build consensus" (Lundgren and McMakin, 2004, p. 199). Campers need to be convinced that invasive pests can be transported by firewood, that these pests pose a threat to the PNW, and that by transporting firewood long-distances for camping purposes they are contributing to the problem.

Conclusion

The 2010 Tri-state firewood campaign was able to effectively increase Pacific Northwest campers' exposure to information about the threat of invasive species transported through firewood. In order to inform campers about this risk, a variety of

outreach materials were adopted including campground posters, billboards, online content, playing cards, fact sheets, and Frisbees®. The increase in campers' exposure is an excellent start; however, in order to change campers' practices and behaviors future messaging needs to be tailored to the values, practices, perceptions, and decision-making needs of Pacific Northwest campers (Atman et al., 1994). Based on the key characteristics and mental model of campers, several recommendations emerged for the development of more effective and efficient invasive species messaging directed towards Pacific Northwest campers.

Recommendations

Based on the key characteristics, several general recommendations emerged that should be considered in any communication directed towards Pacific Northwest campers. First, messaging needs to be tailored to the different types of campers. There are important differences between the most popular camping group, tent campers, and other popular camping groups, such as travel trailer, 5th wheel, and motor home campers. By tailoring messaging to the specific needs, perceptions, and practices of these different groups messaging may be better received.

Second, greater outreach and messaging efforts need to be focused on the most popular camping regions, as they are the most vulnerable to new invasive species infestations due to their high levels of out-of-region visitation. Messaging should be concentrated in these popular camping areas such as the coast range. Additional messaging should be placed in "gateway" areas, or major transportation routes that connect populated areas to popular camping ecoregions such as mountain passes or the

Columbia River Gorge (major transportation route between the west and east sides of the Cascade Mountains). Instead of posting additional billboards, which were seen by only 17% of post campaign respondents (Table 12), messaging in these gateways could be focused on rest areas, gas stations, scenic viewpoints, or other public areas. Risk communication needs to be placed where campers stop while traveling so that they receive the risk message prior to arrival in an ecoregion that is vulnerable to new infestations.

Third, messaging directed towards campers should be placed in areas where campers participate in general activities and hobbies, such as scenic viewpoints, trailheads, parking lots, and even day-use areas such as picnic sites. Fewer resources should be directed towards campers who participate in more technical activities and hobbies, because they represent a minority of campers in the Pacific Northwest.

Lastly, based on PNW campers' widespread use of campground materials to gather information about environmental issues it is critical to include these materials in any effort to communicate risk to campers. Communication efforts directed at PNW campers should also utilize reservation websites, as many campers are forced to visit these sites to make reservations and they read the rules and warnings posted there. Overall, campers are receptive to a variety of information sources, which means that numerous sources can be used to increase the likelihood that campers will see information about the risk of spreading invasive species through firewood.

Based on the mental model of Pacific Northwest campers' views about invasive species in firewood several more specific recommendations emerge to address campers'

misconceptions or missing information regarding the risk. First, campers need more details about specific pests that are transported through firewood. Because campers' knowledge of invasive species appears to be anchored in the threat of specific pests, future communication focused on detailed information about those invasive species transported through firewood and those pests that pose the most potential harm to the PNW may help reduce knowledge gaps. In addition, messaging may be more effective if it emphasizes the impact of specific pests on the environment and beauty of nature, which campers' perceive as the areas most impacted by invasive species.

Second, in order to address campers' misconceptions and missing information about the process of the spread of invasive species in firewood, future messaging should thoroughly describe this process and emphasize the prevalence of long-distance dispersal of firewood by campers. Campers need a clear statement of the problem and a clear definition of local firewood. "Buy it where you burn it" was probably too vague, as campers have varying interpretations of what is considered local firewood. In addition, by providing campers with a list of local firewood sources in addition to campground firewood, more campers may be willing to obtain their firewood locally

Limitations and Future Research

Methods

Very little previous research has been done on Pacific Northwest campers. Given the lack of existing information a mixed methodology that combined exploratory surveys and explanatory interviews was appropriate to obtain a general understanding of campers. The surveys were effective in developing pre- and post-campaign data about campers,

however there were several limitations in the lists used to survey campers. Campers were surveyed from the Oregon State Parks camper registration list. In order to ensure sampling of campers from all the Pacific Northwest states, the sample was stratified based on state of origin. Although the sample was stratified, those campers who have camped in Oregon State Parks may be different than campers who camp predominately in other campgrounds such as Forest Service, National Park Service, or Washington/ Idaho State Park campgrounds. For instance, a disproportionate number of campers may have selected Oregon ecoregions as their "most visited ecoregion" compared to the real population due to this Oregon State Park bias. In order to address this limitation, future researchers surveying campers should attempt to acquire similar registration lists from numerous campground owners throughout their target region.

Another limitation of the surveys was the timing of the pre-campaign survey. This survey was intended to be completed before the start of the 2010 Tri-State firewood campaign, however due to necessary revisions the survey was available to pre-campaign respondents only five days after the campaign had already begun. Fortunately this is not a significant concern, because less than ten percent of respondents submitted their survey responses in this five day period and of that ten percent only a handful of respondents had gone camping in that time period (i.e., very few pre-campaign campers would have been exposed to the Tri-State firewood campaign before taking the survey).

There were several limitations of the qualitative interviews. First, nearly a third of all interviews took place on a weekday. The vast majority of camping trips take place on the weekend and the high number of weekday campers who participated could have

introduced bias into the interview data. Although the sample was random, there was a high degree of self-selection among participants, which makes it impossible to generalize the results to the larger population of PNW campers. An additional random survey testing the findings of the interviews would be an opportunity for future researchers interested in campers' values, beliefs, and knowledge about invasive species and firewood.

Models

The mental model approach to risk communication was applied to the analysis of this research. This approach is usually adopted after a formal expert model of the risk has been constructed, which would then be used as a comparison to the audiences' mental model of the same risk. In the mental model approach both the expert model and mental model of the risk are usually mapped into a diagram. Because of time constraints a formal expert model of the risk was never diagrammed. Additionally, the mental model developed was never diagrammed into a formal map. Future research can focus on the development of a formal expert model and the mapping of campers' mental model, which may identify more specific knowledge gaps or misconceptions held by campers.

Current Research

For this study, only a portion of the qualitative and quantitative data collected was utilized. Future research can look into the connection between campers' environmental values (based on the New Ecological Paradigm questions) and their values, knowledge, and beliefs regarding invasive species and firewood. In addition, future research can look into specific differences (or similarities) that exist between campers based on their state

of residence. Very little analysis was done to determine if there were any differences between campers from different states and how significant any of these differences might be.

Bibliography

Arkin, E. B. (1987). Translation of Risk information for the Public: Message Development. In Covello, V., McCallum, D., and Pavlova, M. *Effective Risk Communication: The Role and Responsibility of Government and Nongovernment Organizations* (p. 127-137). New York: Plenum Press.

Atman, C., Bostrom, A., Fischhoff, B., and Morgan, M.G. (1994). Designing Risk Communications: Completing and Correcting Mental Models of Hazardous Processes, Part I. *Risk Analysis.* 14 (5), 779-789.

Auerbach, C. and Silverstein, L. (2003). Qualitative Data: An Introduction to Coding and Analysis. New York: New York University Press.

Barzen, M. (2008). State of Minnesota: Residential Fuel Wood Assessment. Minnesota Department of Natural Resources Technical Paper.

Bazely, P. (2004). Issues in Mixing Qualitative and Quantitative Approaches to Research. In Buber, R., Gadner, J., and Richards, L. *Applying Qualitative Methods to Marketing Management Research* (p. 141-156). UK: Palgrave Macmillian.

Bean, A. G.. and Roszkowski, M. J. (1995). The long and short of it. *Marketing Research, 7* (1), 20-26.

Boersma, P.D., Reichard, S.H., and Van Buren, A.N. (2006). Invasive Species in the Pacific Northwest. Seattle: University of Washington Press.

Bokach, M. (2010). Firewood Movement: A Threat to California's Forests. Retrieved from http://caforestpestcouncil.org/wp-content/uploads/2011/03/Matthew-Bokach.pdf

Bostrom, A., Atman, C.J, Fischhoff, B., and Morgan M. G. (1994). Evaluating Risk Communications: Completing and Correcting Mental Models of Hazardous Processes, Part II. *Risk Analysis*. 14 (5), 789- 798.

Brockerhoff, E., Bain, J., Kimberley, M., and Knizek, M. (2006). Interception Frequency of Exotic Bark and Ambrosia Beetles and Relationship with Establishment in New Zealand and Woldwide. *Canadian Journal of Forest Resources*. 36, 289-298.

Burns, R. and Graefe, A. (2006) Towards Understanding Recreation Fees: Impacts on People with Extremely Low Income Levels. *Journal of Park and Recreation Administration*. 24 (2), 1-20.

Cachelin, A., Paisley, K., and Blanchard, A. (2009). Using the Significant Life Experience Framework to Inform Program Evaluation: The Nature Conservancy's Wings and Water Wetlands Education Program. *The Journal of Environmental Education*. 40 (2) 2-14.

Chan, K. (1998). Mass Communication and Pro-environmental Behavior: Waste Recycling in Hong Kong. *Journal of Environmental Management*. 52, 317-325.

Cox, R. (2006). Environmental Communication and the Public Sphere. London: Sage Publications.

Dalton, R. S., Bastian, C. T., Jacobs, J. J. and Wesche, T. A. (1998). Estimating the Economic Value of Improved Trout Fishing on Wyoming Streams. *North American Journal of Fisheries Management*, *18*(4), 786-797.

Dettmann-Easler, D. and Pease, J. (1999). Evaluating the Effectiveness of Residential Environmental Education Programs in Fostering Positive Attitudes Toward Wildlife. *The Journal of Environmental Education*. 31 (1), 33-39.

Dunlap, R. (2008). The New Environmental Paradigm Scale: From Marginality to Worldwide Use. *The Journal of Environmental Education*. 40 (1), 3-18.

Frankfort-Nachmias, C., and Nachmias, D. (1996). Research Methods in the Social Sciences (5th Edition). New York: St. Martin's Press.

Groves, R. (2006). Nonresponse Rates and Nonresponse Bias in Household Surveys. *Public Opinion Quarterly.* 70 (5), 646-675.

Haack, R. Petrice, T., and Wiedenhoeft, A. (2010). Incidence of Bark- and Wood-Boring Insects in Firewood: A Survey at Michigan's Mackinac Bridge. *Journal of Economic Entomology*. 103 (5), 1682-1692.

Haack, R. (2006). Exotic Bark- and Wood-Boring Coleoptera in the United States: Recent Establishments and Interceptions. *Canadian Journal of Forest Resources*. 36, 269-288.

Holmes, T., Aukema, J.E., Von Holle, B., Liebhold, A., and Sills, E. (2009). Economic Impacts of Invasive Species in Forests: Past, Present, and Future. *The Year in Ecology and Conservation Biology*. 18-38.

Hillier, Dawn (2006). Communicating Health Risks to the Public: A Global Perspective. Burlington, Vermont: Gower Publishing Company.

Johnson, R.B., and Onwuegbuzie, A.J. (2004). Mixed Methods Research: A Research Paradigm Whose Time Has Come. *Educational Researcher*. 33 (7), 14-26.

King, N. (1994). The Qualitative Research Interview. In Cassel, C. and Symon, G., eds, *Qualitative Methods in Organizational Research*. London: sage.

Lippitt, C., Rogan, J., Toledano, J., Sangermano, F., Eastman, J.R., Mastro, V., and Sawyer, A. (2008). Incorporating Anthropogenic Variables into a Species Distribution Model to map Gypsy Moth Risk. *Ecological Modelling*. 210, 339-350.

Lodge, D., Williams, S., MacIsaac, H.J., Hayes, K.R., Leung, B., Reichard, S., Mack, R.N., Moyle, P.B., Smith, M., Andow, D.A., Carlton, J.T., and McMichael, A. (2006). Biological Invasions: Recommendations for U.S. Policy and Management. *Ecological Applications*. 16 (6), 2035-2054.

Lundgren, R., and McMakin, A. (2004). Risk Communication: A Handbook for Communicating Environmental, Safety, and Health Risks (3rd Edition). Columbus, Ohio: Battelle Press.

Mack, R., Simberloff, D., Lonsdale, W.M., Evans, H., Clout, M., and Bazzaz, F.A. (2000). Biotic Invasions: Causes, Epidemiology, Global Consequences, and Control. *Ecological Applications*. 10(3), 689-710.

McIntosh, C., Shogren, J., and Finnoff, D. (2007). Invasive Species and Delaying the Inevitable: Results from a Pilot Valuation Experiment. *Journal of Agricultural and Applied Economics*. 39, 83-95.

McIntosh, C., Shogren, J., and Finnoff, D. (2010). Invasive Species and Delaying the Inevitable: Valuation Evidence from a National Survey. *Ecological Economics*. 69, 632-640.

McNeely, J. (2000). Invasive Species: A Costly Catastrophe for Native Biodiversity. In: Preston, G., Brown, G., and Van Wyk, E. (eds) Best Management Practices for Preventing and Controlling Invasive Alien Species. Symposium Proceedings, pp 17-29. Working for Water Programme, Cape Town, South Africa.

Miles, B., and Huberman, A. (1994) Qualitative Data Analysis: An Expanded Sourcebook (2nd Edition). Thousand Oaks, California: Sage Publications.

Minnesota Department of Agriculture. (2010). Protecting Minnesota Trees from Invasive Pests than Can Move in Firewood: Prevention, Early Detection, Rapid Response. Retrieved from http://www.frc.state.mn.us/documents/presentations/Protecting_Minnesota_Trees_KathyKromroy.pdf

Morgan, M.G., Fischhoff, B., Bostrom, A., and Atman, C.J. (2002). Risk Communication: A Mental Models Approach. Cambridge, U.K: Cambridge University Press.

Muirhead, J., Leung, B., Overdijk, C.V., Kelly, D.W., Nandakumar, K., Marchant, K.R., and MacIsaac, H.J. (2006). Modelling Local and Long-Distance Dispersal of Invasive Emerald Ash Borer in North America. *Diversity and Distributions*. 12, 71-79.

Norton, B. (1998). Improving Ecological Communication: The Role of Ecologists in Environmental Policy Formation. *Ecological Applications*. 8(2), 350-364.

Nugent, M. (2005). Oregon Invasive Species Action Plan. Retrieved from http://oregon.gov/OISC/docs/pdf/oisc_plan6_05.pdf

Oregon Revised Statutes. Chapter 561, §685 (2009)

Perrings, C., Williamson, M., Barbier, E. B., Delfino, D., Dalmazzone, S., Shogren, J., Simmons, P., and Watkinson, A. (2002). Biological Invasion Risks and the Public Good: An Economic Perspective. *Conservation Ecology*. 6 (1), online.

Poland, T. M. and McCullough, D. G. (2006). Emerald Ash Borer: Invasion of the Urban Forest and the Threat to North America's Ash Resource. *Journal of Forestry*. 104 (3), 118-124.

Presidential Documents. (1999). Invasive Species (Executive Order 13112). Washington, D.C. Retrieved from http://ceq.hss.doe.gov/nepa/regs/eos/eo13112.html

Robertson, D. R. and Andow, D. A. (2010). Human-mediated Dispersal of Emerald Ash Borer: Significance of the Firewood Pathway (Working Paper). Retrieved from University of Minnesota website: http://www.entomology.umn.edu/prod/groups/cfans/@pub/@cfans/@ento/documents/asset/cfans_asset_139871.pdf

Robson, C. (2002). Real World Research (2nd Edition). Malden, MA: Blackwell Publishing.

Ruiz, G.M., Rawlings, T.K., Dobbs, F.C., Drake, L.A., Mullady, T., Huq, A., and Colwell, R.R. (2000). Global Spread of Microorganisms by Ships. *Nature*. 408 (2), 49-50.

Government of Saskatchewan, Ministry of Tourism, Parks, Culture, and Sport (2008). Provincial Parks Camper Survey. Retrieved from http://www.tpcs.gov.sk.ca/Camper-Survey-2008

Sheehan, K. (2001). E-mail Survey Response Rates: A Review. Retrieved from http://jcmc.indiana.edu/vol6/issue2/sheehan.html

Stienstra, T. (2010). Pacific Northwest Camping: The Complete Guide to Tent and RV Camping in Washington and Oregon. Jackson, TN: Publishers Group West/ Perseus Books Group.

Sumner, D. (ed.) (2003). Exotic Pests and Diseases: Biology and Economics for Biosecurity. Ames, Iowa: Iowa State Press.

U.S. Department of Agriculture, Animal and Plant Health Inspection Service. (2010). Risk Assessment of the Movement of Firewood within the United States. Raleigh, N.C.: Author. Retrieved from http://www.aphis.usda.gov/newsroom/hot_issues/invasive_species&firewood/downloads/firewood_pathway_assessment.pdf

U. S. Forest Service, Pacific Northwest Region. (2010). National Forest Visitation Report. Retrieved December 18, 2010, from apps.fs.usda.gov/nrm/nvum/results/Report.aspx

Vermeij, G. J. (1996). An Agenda for Invasion Biology. *Biological Conservation*. 78 (1), 3-9.

Wilson, S., Tucker, M. A., Hooker, N. H., LeJeune, J.T., and Doohan, D. (2008). Perceptions and Beliefs about Weed Management: Perspectives of Ohio Gran and Produce Farmers. *Weed Technology*. 22 (2), 339-350.

Wittenberg, R., and Cock, M. (eds.) (2001). Invasive Alien Species: A Toolkit of Best Prevention and Management Practices. Wallingford, Oxon, UK: CAB International Publishing.

Zaksek, M., and Arvai, J. (2004). Toward Improved Communication about Wildland Fire: Mental Models Research to Identify Information Needs for Natural Resource Management. *Risk Analysis*. 24 (6), 1503-1515.

Appendices

Appendix A: Survey Recruitment

Pacific Northwest Camper Invasive Species Questionnaire

Dear Camper,

Hello my name is Damon Runberg and I am a graduate student at Oregon State University in the Master of Public Policy program. I am currently working with Dr. Denise Lach on a study that deals with the spread of invasive species into campgrounds in the Pacific Northwest (PNW). You have been selected at random to take part in a study concerning camper attitudes and opinions toward invasive species in Pacific Northwest camps and parks. Responses to the survey will be used for research purposes, as well as to assist the Oregon, Washington, and Idaho Invasive Species Councils in their future strategy to reduce the impact of invasive species in the PNW. The Oregon, Washington, and Idaho Invasive Species Councils have all provided funding for this research.

We would appreciate it if you would take about 10 to 15 minutes to respond to an online questionnaire.

Click here to begin Camper Questionnaire:
http://www.surveymonkey.com/s/Camper_Survey

If you agree to participate your responses will help to develop new strategies for preventing the spread of invasive species into camps and parks throughout the Pacific Northwest. Thank you in advance for participating. The survey will only be available for two weeks so please complete the survey by August 6th, 2010.

Click here to begin Camper Questionnaire:
http://www.surveymonkey.com/s/Camper_Survey

Thank you for your help. We appreciate your cooperation and time.

Sincerely,

Damon M. Runberg
Master of Public Policy Candidate
runberda@onid.orst.edu

Dr. Denise Lach
Master of Public Policy Program

Appendix B: Survey Questions

SECTION 1
In this first section of the survey we would like to ask you some general questions about camping and your awareness of invasive species. Please select the response that most closely represents your view.

Q-1 Approximately how many nights do you go camping in a typical year?

1. 1 or fewer
2. 2-4
3. 5-7
4. 8-10
5. 10-15
6. 15-20
7. 20 or more

Q-2 What is the primary type of camp shelter that you use?

1. Tent
2. Tent Trailer
3. Travel Trailer/ 5th Wheel
4. Motor Home
5. Truck/ Van Camper
6. Other_____

Q-4 How often do you make a campfire when you go camping?

1. Very often
2. Sometimes
3. Rarely
4. Never

Q-5 Where do you acquire your firewood when you go camping?

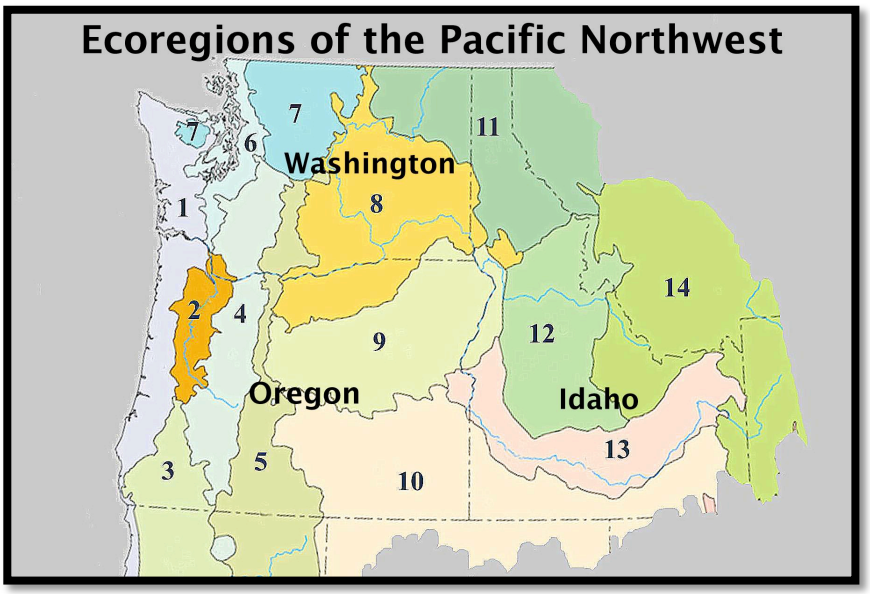
1. The ground near your campsite
2. Bring it from home
3. Purchase it from a "big box" store (e.g., Home Depot)
4. Purchase it from a grocery store/ supermarket
5. Purchase it from a gas station
6. Purchase it from an individual/ roadside vendor
7. Purchase it from the Camp Host/ Park Ranger

8. Don't ever make a fire while camping
9. Other_____

Q-6 We would like to know what outdoor recreation activities you participate in when you go camping and how frequently. Please select the frequency of your participation in the following activities.

		Never	Infrequently	Frequently	Very Frequently
a.	Fishing	1	2	3	4
b.	Swimming/ Beach Activities	1	2	3	4
c.	Driving to view scenery/ Sightseeing	1	2	3	4
d.	Day hiking	1	2	3	4
e.	Campfire activities	1	2	3	4
f.	Motorized boating	1	2	3	4
g.	Picnicking	1	2	3	4
h.	Golf	1	2	3	4
i.	Off-road motorized vehicles				
j.	Mountain Biking	1	2	3	4
k.	Nature Photography	1	2	3	4
l.	Learning about nature (e.g., bird watching/ wildlife viewing)	1	2	3	4
m.	Cultural/ historical visits	1	2	3	4
n.	Non-motorized	1	2	3	4

	boating				
o.	Horseback riding	1	2	3	4
p.	Spiritual/ restorative	1	2	3	4
q.	Guided tours	1	2	3	4



1 Coast Range
2 Willamette Valley
3 Klamath Mountains
4 Cascades
5 Eastern Cascades Slopes and Foothills
6 Puget Lowland
7 North Cascades/ Olympic Mountains
8 Columbia Plateau
9 Blue Mountains
10 Northern Basin and Range
11 Northern Rockies
12 Idaho Batholith
13 Snake River Plain
14 Middle Rockies

Q-7 For the following questions, use the map of the Pacific Northwest above to identify the appropriate region and circle the most accurate responses.

a.	Circle the PNW region where you go camping	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**

most often.

b. Circle all the PNW regions where you have gone camping. **1 2 3 4 5 6 7 8 9 10 11 12 13 14**

Q-8 Here are a few specific questions about invasive species. Please select the most appropriate answer.

a. An invasive species is:

1. Any non-native species (plant, animal, organisms)
2. Any wide-spread non-native species
3. Any non-native species whose introduction is likely to cause harm to the environment, economy, and/or public health
4. None of the above

b. In general, to what extent are non-native insects and diseases a threat to ecosystems?

1. Not a threat
2. Small threat
3. Somewhat serious threat
4. Very Serious

c. Which of the following are invasive species which are a threat to the Pacific Northwest (Choose all that apply):

1. Africanized honey bees
2. Spruce bark beetle
3. Asian long horned beetle
4. Brown spruce longhorn beetle
5. Emerald ash borer
6. European chafer
7. Granulate ambrosia beetle
8. European gypsy moth

Q-9 We would like to know which of the following information sources you use to learn about environmental issues. Please circle the number of the frequency of your use.

		Never	Infrequently	Frequently	Very Frequently
a.	Public broadcasting television	**1**	**2**	**3**	**4**
b.	Public Broadcasting radio programs	**1**	**2**	**3**	**4**
c.	Other television news or program	**1**	**2**	**3**	**4**
d.	Other radio programs	**1**	**2**	**3**	**4**
e.	State/ Regional newspapers	**1**	**2**	**3**	**4**
f.	Other local newspapers	**1**	**2**	**3**	**4**
g.	Local community leaders	**1**	**2**	**3**	**4**
h.	Federal agencies like US Forest Service or Park Service	**1**	**2**	**3**	**4**
i.	State agencies like Parks and Recreation, Fish and Wildlife	**1**	**2**	**3**	**4**
j.	State Invasive Species Council	**1**	**2**	**3**	**4**
k.	National Invasive Species Council	**1**	**2**	**3**	**4**
l.	Universities and colleges	**1**	**2**	**3**	**4**

m	Campground flyers, posters, or billboards	**1**	**2**	**3**	**4**
n.	Environmental groups	**1**	**2**	**3**	**4**
o.	Information available on the Internet	**1**	**2**	**3**	**4**
p.	Other?	**1**	**2**	**3**	**4**

_____
(Please list)

Q-10 Have you ever seen information at campgrounds about invasive species in firewood?

a. Yes
b. No (If no, skip to question 11)

if yes:

a. Where did you see it (what state): _____

b. What did you see (select all that apply):
   i. Poster
   ii. Brochure or flyer
   iii. Personal communication with camp host or park rangers
   iv. Other: _____

c. How effective were the following types of information in communicating details about:

i. Specific invasive species in firewood

	Highly effective	Effective	Ineffective	Highly ineffective	Not applicable
Poster	**1**	**2**	**3**	**4**	**5**
Brochure or flyer	**1**	**2**	**3**	**4**	**5**
Personal communication with camp host or ranger	**1**	**2**	**3**	**4**	**5**
Other:	**1**	**2**	**3**	**4**	**5**

_____
(please list)

ii. What you can do to reduce the spread of invasive species in firewood

	Highly effective	Effective	Ineffective	Highly ineffective	Not applicable
Poster	**1**	**2**	**3**	**4**	**5**
Brochure or flyer	**1**	**2**	**3**	**4**	**5**
Personal communication with camp host or ranger	**1**	**2**	**3**	**4**	**5**
Other:	**1**	**2**	**3**	**4**	**5**

_____
(please list)

iii. Impacts or harm cause by invasive species in firewood

	Highly effective	Effective	Ineffective	Highly ineffective	Not applicable
Poster	**1**	**2**	**3**	**4**	**5**
Brochure or flyer	**1**	**2**	**3**	**4**	**5**
Personal communication with camp host or ranger	**1**	**2**	**3**	**4**	**5**
Other:	**1**	**2**	**3**	**4**	**5**

_____
(please list)

Q-11 Have you ever seen billboards along a highway about invasive species in firewood?

a. Yes
b. No (If no, skip to question 12)

If yes:

a. How effective was the billboard in communicating details about:

i. Specific invasive species within firewood
ii. What you can do to stop the spread of invasive species in firewood
iii. Impacts/harm caused by invasive species in firewood

Q-12 If you have seen information about invasive species in firewood, did you change your camping practices?

a. Yes
b. No (If, no skip to question 13)
c. Not Applicable (Did not see information) (Skip to question 13)

If yes:

a. Which of the following practices did you change to reduce the spread of invasive species in firewood (check all that apply):

i. I don't move firewood I do not buy firewood from unknown sources
ii. I only buy firewood I know is free of invasive species
iii. I only buy local firewood
iv. I share information about invasive species in firewood with others
v. Other: _____
(Please list)

Section 2

This section of the survey concerns your attitudes toward the environment and your views on firewood. Please circle the number that most closely represents your view.

Q-13 Listed below are statement about the relationship between humans and the environment. For each please indicate your level of agreement.

	Strongly Agree	**Mildly Agree**	**Neutral**	**Mildly Agree**	**Strongly Agree**
a. The balance of nature is very delicate and easily upset by human activities.	**1**	**2**	**3**	**4**	**5**
b. Humans have the right to modify the natural environment to suit their needs	**1**	**2**	**3**	**4**	**5**
c. We are approaching the limit of people the earth can support	**1**	**2**	**3**	**4**	**5**
d. The so-called "ecological crisis" facing humankind has been greatly exaggerated	**1**	**2**	**3**	**4**	**5**
e. Plants and animals have as much right as humans to exist.	**1**	**2**	**3**	**4**	**5**
f. Humans were mean to rule	**1**	**2**	**3**	**4**	**5**

over the rest of nature. **g.** The spread of invasive species is a threat to parks and wilderness areas in the Pacific Northwest.	**1**	**2**	**3**	**4**	**5**

Q-14 On environmental policy issues, would you consider yourself to be?

1. Very Liberal	2. Liberal	3. Moderate	4. Conservative	5. Very Conservative

Q-15 If you were certain that the firewood you purchased was free of invasive species, how much would you be willing to pay for a bundle of "clean" firewood (the amount that will fit in a paper grocery bag)?

1. Less than $2
2. $2 - $4
3. $4 - $6
4. $6 - $8
5. Greater than $8

Q-16 Would you be willing to exchange the firewood that you bring into a campground with firewood free of invasive species provided by a Park Ranger/ camp host?

1. Yes
2. No
3. Maybe

Q-17 What area of a campground would be the most convenient if you were to exchange your firewood for treated firewood that is free of invasive species?

1. Main entrance of campground
2. Park ranger office
3. Camp host site
4. Restroom/ Shower facilities
5. Various location throughout the campground
6. Other: _____

Q-18 How much of an impact do you think that invasive species have to the following:

	No Impact	Some impact	Substantial impact	Don't know
Aesthetics or beauty of nature	**1**	**2**	**3**	**4**
Environment	**1**	**2**	**3**	**4**
Human health	**1**	**2**	**3**	**4**
Economy	**1**	**2**	**3**	**4**
Recreation	**1**	**2**	**3**	**4**

Q-19 Which do you think has the MOST potential for being harmed by invasive species in firewood (select one only)

1. Aesthetics/beauty of nature
2. Environment
3. Human Health
4. Economy
5. Recreation

SECTION 3

We now have a few concluding questions to check if our survey is representative of all types of people. Please remember that all answers are completely confidential to the extent permitted by law.

Q-20 What is your current age in years _____ ?

Q-21 Please indicate your gender? 1. Female 2. Male

Q-22 What is the highest level of education that you have completed?

1. Grade School
2. Middle or junior high school
3. High school
4. Vocational school
5. Some college
6. College graduate
7. Graduate school
8. Other

_____
_

Q-23 Where do currently you live:

a. City _____

b. State_____

Q-24 Which of the following best describes your current work situation?

1. Employed full time
2. Employed part time
3. Not employed outside the home
4. Unemployed
5. Retired
6. Other

_____
_ ?

Q-25 Which category best describes your household income in 2009?

1. Less than $10,000
2. $10,000 - $ 14,999
3. $15,000 - $24,999
4. $25,000 - $34,999
5. $35,000 - $49,999
6. $50,000 - $74,999
7. $75,000 – $99,999
8. $100,000 – $149,999
9. $150,000 – $199,999
10. $200,000 or more

Those are all the questions we have. Thank you for your precious time.

Appendix C: Interview Sites

Campground	State	Campground Owner	Ecoregion
Tumalo	Oregon	Oregon State Park	Eastern Cascade Slopes/ Foothills
Fort Stevens	Oregon	Oregon State Park	Coast Range
Valley of the Rogue	Oregon	Oregon State Park	Klamath Mountains
Wallowa Lake	Oregon	Oregon State Park	Blue Mountains
Diamond Lake	Oregon	USFS, Umpqua National Forest	Cascades
Horsfall OHV	Oregon	USFS, Siuslaw National Forest	Coast Range
Mary Hill	Washington	Washington State Park	Columbia Plateau
Cougar Rock	Washington	NPS, Mt. Rainier	Cascades
Colonial Creek	Washington	NPS, North Cascades	North Cascade/ Olympic Mountains
Klahowya	Washington	USFS, Olympic National Forest	North Cascade/ Olympic Mountains
Henry's Lake	Idaho	Idaho State Park	Middle Rockies
Priest Lake	Idaho	Idaho State Park	Northern Rockies
Willow Flat	Idaho	USFS, Caribou National Forest	Northern Basin and Range
Glacier View	Idaho	USFS, Sawtooth National Forest	Idaho Batholith

Appendix D: Interview consent form

Project Title: Risk of Invasive Species Spread through Campers' Firewood: Campground Interviews
Principal Investigator: Denise Lach
Student Researcher: Damon M. Runberg
Co-Investigator(s): Brent Steel and Sam Chan
Sponsor: Oregon Department of Agriculture
Version Date: June 21, 2010

1. What is the Purpose of this Form?

This form contains information you will need to help you decide whether to be in this study or not. Please read the form carefully and ask the study team member(s) questions about anything that is not clear.

2. Why is this Study Being Done?

The purpose of this study is to assess the values, beliefs, and knowledge of Pacific Northwest (PNW) Campers regarding the spread of invasive species through firewood into camps and parks. By developing a better understanding of PNW Campers we hope to assess the effectiveness of the Oregon Invasive Species Councils summer firewood awareness campaign and suggest recommendations for more effective outreach methods.

A Master of Public Policy student working on his final project is conducting this study.

Up to 42 Campers will be invited to take part in this study.

3. Why am I being Invited to Take Part in this Study?

You are being invited to take part in this study because you are camping in a Pacific Northwest campground.

4. What will happen if I take part in this research study?

Interviews conducted for this study are for research purposes and will be used to assess the values, knowledge, and beliefs of Campers in the Pacific Northwest regarding the spread of invasive species through firewood. If you feel uncomfortable or offended by any question you can choose not to respond to any of the questions asked.

The study activity includes an interview that will be conducted either at your campsite or a central location in the campground. Camp rangers/ hosts have selected participants in the study and selection of participants is based on no other attribute than being a Camper in a Pacific Northwest campground.

Study duration: These interviews will be approximately 30-40 minutes in length and will involve questions about camping practices, invasive species knowledge, and values towards the environment.

Recordings and photographs: Interviews will be audio recorded for research purposes and recording is required for the study. If you do not wish to be recorded than please do not enroll in the interview process. Only the researchers will use these recordings, and all personal information will be kept confidential to protect the identity of participants. No names or photographs will be obtained of participants to ensure that the recording cannot be traced back to the participant.

_____I agree to be audio recorded.
Initials

_____I do not agree to be audio recorded.
Initials

Significant new findings: The findings from this study will aid Pacific Northwest Invasive Species Councils in their effort to prevent the spread of invasive species into the parks and wilderness areas in the Pacific Northwest. Your participation is important for understanding Campers value, knowledge, and beliefs regarding the spread of invasive species into these parks and wilderness areas through firewood.

Storage and Future use of data or samples: Audio recordings will be transcribed and stored for analysis through qualitative measures. This data will be stored by the Principal Investigator on the OSU campus under lock and key for three years following the completion of the study. All electronic data will be stored by the PI on the OSU server for three years following the completion of the study. The study will be completed in June 2011. These interviews will be confidential and the only personally identifiable information collected will be your signature on this informed consent form. No personal information will be disclosed and your responses will be given a pseudonym in the reporting of the research to protect your confidentiality. Upon completion of the interview you will not be sought for further studies or interviews.

Study Results: The final study will be used for a master's thesis and will presented to the Oregon, Washington, and Idaho Invasive Species Councils. If you would like a copy of the final study please contact Damon Runberg by email at: runberda@onid.orst.edu.

5. What are the Risks and Possible Discomforts of this Study?

The possible risks and/or discomforts associated with the being in the study include:

Participants may feel uncomfortable answering questions about their personal values and camping practices. If at any point you feel uncomfortable with a question you can choose to skip to the next question or end the interview at any point. There is no long-term risk as there will be no personal information used in the interviews for researchers to identify participants within the study.

6. What are the Benefits of this Study?

You will not receive any direct benefit by participating in this study, however interview data from this study will be used to make recommendations for further invasive species policies that may have direct impacts on the economy, recreation, ecosystems, and aesthetics of camps, parks, and wilderness areas in the Pacific Northwest.

This study is not designed to benefit you directly.

7. Will I be Paid for Being in this Study?

You will not be paid for being in this research study.

8. Who is Paying for this Study?

The Oregon, Washington, and Idaho Invasive Species Councils are paying for this research to be done.

9. Who will see the Information I Give?

The information you provide during this research study will be kept confidential to the extent permitted by law. Research records will be stored securely and only researchers will have access to the records. Federal regulatory agencies and the Oregon State University Institutional Review Board (a committee that reviews and approves research studies) may inspect and copy records pertaining to this research. Some of these records could contain information that personally identifies you.

If the results of this project are published your identity will not be made public.

The Oregon, Washington, and Idaho Invasive Species Councils may have access to the information you provide in the interview. Upon completion of the study the audio recordings will be destroyed.

To help ensure confidentiality, there will be no personal information connected to the interviews. No names or identifiers will be asked during the recording to ensure that all responses are confidential. All interviews will be assigned a pseudonym and all interviews data will be identified by that pseudonym instead of your real name to protect confidentiality.

10. What other choices do I have if I do not take part in this study?

Participation in this study is voluntary. If you decide to participate, you are free to withdraw at any time without penalty. You will not be treated differently if you decide to stop taking part in the study. If you choose to withdraw from this project before it ends, the researchers may keep information collected about you and this information may be included in study reports.

Optional questions: All questions are optional and if you feel uncomfortable asking a question feel free to skip any question that you would prefer not to answer.

11. Who do I Contact if I have Questions?

If you have any questions about this research project, please contact: Dr. Denise Lach, at (541) 737-2641 or by email at denise.lach@oregonstate.edu

If you have questions about your rights or welfare as a participant, please contact the Oregon State University Institutional Review Board (IRB) Office, at (541) 737-8008 or by email at IRB@oregonstate.edu

Your signature indicates that this research study has been explained to you, that your questions have been answered, and that you agree to take part in this study.

12. What does my Signature on this Consent form mean?

Your signature indicates that this study has been explained to you, that your questions have been answered, and that you agree to take part in this study. You will receive a copy of this form.

Participant's Name (printed):

_____

_____

(Signature of Participant) (Date)

_____

(Signature of Person Obtaining Consent) (Date)

Appendix E: Interview Questions

Spread of Invasive Species through Firewood

Introduction: I am conducting a study on the spread of invasive species through firewood into camps and parks in the Pacific Northwest (PNW). For this study I am interviewing Campers throughout Oregon, Washington, and Idaho to better understand how invasive species are transported through firewood. This study has been funded jointly by the Oregon, Washington, and Idaho Invasive Species Councils. Your participation in this study will aid these councils in their efforts to prevent the spread of invasive species.

Signed Informed Consent: (*Provide consent form and if the participant signs the form continue to explanation of study*)

Brief explanation of study: The purpose of this study is to assess the values, beliefs, and knowledge of Pacific Northwest (PNW) Campers regarding the spread of invasive species through firewood into camps and parks. By developing a better understanding of PNW Campers we hope to assess the effectiveness of the Oregon Invasive Species Councils summer firewood awareness campaign and suggest recommendations for more effective outreach methods in order to prevent the spread of invasive species.

I will ask a series of questions about your camping practices and your values and knowledge pertaining to invasive species. None of the questions are meant to make you feel uncomfortable, however you may choose to skip any of the questions asked. You may also choose to end the interview at any time, however your responses are important for this study.

We will now begin the interview. I have several predetermined questions that I will ask, however I will also ask clarifying questions and/or follow-up questions for certain responses you may have.

Do you have any question before we begin?

Questions:

1. We will start with, how often do you go camping?
2. Can you walk me through a typical camp experience for you (i.e., what you do, hobbies, adventures, experiences, etc)?
3. On average, how far would you say that you travel when you go camping (in miles)?
4. Where do you usually go camping? Are there any regions or campgrounds that you visit repeatedly?
    a. If so, why do you visit this place? And is it special to you compared to other locations?
5. When you go camping how often do you tend to make a campfire?
6. Where do you usually obtain your firewood when you go camping?

7. What environmental issues do you think are the greatest threat in the Pacific Northwest?
8. Do you perceive invasive species as a serious environmental threat here in the Pacific Northwest? Why or why not?
    a. *If yes*, what in the Pacific Northwest is most threatened by the spread of invasive species (i.e., recreation, economy, natural beauty, etc.)?
9. How do you think that most invasive species spread across regions?
10. Firewood is one vector for the spread of invasive specie here in the Pacific Northwest. If you were a policy maker, how would you minimize the spread of invasive species through firewood?
11. Would you change your camping practices knowing that firewood can transport invasive species across regions? Why or why not?
    a. In what ways would you change these practices?
12. Buying firewood where you are going to burn it is often thought of as the best management practice for preventing the spread of invasive species through firewood. Can you think of any barriers that would make buying firewood locally difficult?
13. If firewood that was free of invasive species were sold at campgrounds, would you purchase your firewood at campgrounds? Why or why not?
    a. *If so*, how much would be a fair price for a bundle of firewood that would fit into a paper grocery sack?
14. One solution to the spread of invasive species into camps and parks is to develop a firewood exchange program that would exchange the firewood you bring for firewood that has been treated and is free of invasive species. Can you think of any reasons of why you would either participate or not participate in such an exchange?
15. Finally, have you seen any signs, billboards, or other information sources about the spread of invasive species through firewood?
    a. How effective have these information sources been?
    b. Can you think of any alternative methods for informing campers about invasive species that you think would be more effective than those you have seen?

Those are all the questions that I have. Do you have any questions or comments for me?

If you would like a copy of the final study you can give me your email and I will send you an electronic copy when it is completed next spring. Otherwise, thank you for your precious time and enjoy the rest of your vacation.

Appendix F: Campground Interview Codebook

I. **Culture/ Geographic Areas (level 1 coding)**
   a. Camping practices (level 2 coding)
      i. Length of stay/ Camping Frequency (level 3 coding)
      ii. Camp activities and Hobbies
      iii. Distance traveled
   b. Camping values
      i. Value of camping experience
      ii. Campground preferences
   c. Camping destinations
      i. Favorite campgrounds
      ii. Preferred regions or ecosystems to camp
   d. Firewood values
      i. Campfire frequency
      ii. Origins of camp firewood
      iii. Value of campfire to camping experience
      iv. Willingness to pay per bundle

II. **Information Sources/ People they trust and believe/ Exposure to News Media or other coverage**
   a. Preferred Information sources
      i. Campground information sources observed
      ii. Non-campground information sources observed
   b. Exposure to OISC tri-state firewood campaign

III. **Campers "hot buttons"**
   a. Issues that anger or frustrate campers
      i. Concerns about increased regulation
      ii. Concerns about increased costs
      iii. Concerns about quality of firewood
      iv. Concerns about trash or impact on beauty

IV. **Experience with other risks**
   a. Experiences with invasive species issues (excluding firewood)
   b. Observance of invasive species risk communication strategies (excluding firewood)
   c. General Knowledge about invasive species (excluding firewood)
      i. Knowledge about vectors or methods of spread
      ii. Knowledge about specific invasive species

V. **Background in risk subject matter**
   a. Prior experience with invasive species in firewood
   b. Knowledge about invasive species in firewood

VI. **Experience with risk/ Concerns and feelings about risk/ Effect of the risk on them**
   a. Environmental Concerns
      i. General environmental concerns
      ii. Preferred Environmental Characteristics
      iii. Invasive species threat
   b. Invasive Species/ Firewood policy solutions
      i. Feasibility of preventing invasive species from entering campgrounds through firewood
      ii. Policy solutions
   c. Response to risk