

AN ABSTRACT OF THE THESIS OF

Angela Schaefer Wright for the degree of Master of Science in Forest Resources presented on February 11, 2000. Title: Citizen Knowledge and Opinions about Watershed Management in the South Santiam Basin in Oregon.

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Watershed management is widely recognized as an important component of healthy ecosystems and its success depends on cultivating the good will, stewardship values, and participation of citizens. Because much of the streamside land in Oregon is in private ownership activities on public lands will not be enough to protect salmon and restore water quality. Improvements will also depend upon conservation activities by private landowners and communities. Since citizens are an integral part of long-term solutions, understanding the level of knowledge people possess and their opinions about watershed management is essential.

This study examines citizen knowledge and opinions about stream management and ecology of the Lower South Santiam River, Crabtree Creek, and Thomas Creek watersheds in the South Santiam River basin. It focuses on the usefulness of various sources of information, public trust in specific information providers, citizens' understanding of watershed ecology, and the problems, preferences and concerns of private landowners. A mail questionnaire and interviews were used to elicit responses from community residents and members of the South Santiam Watershed Council.

Several conclusions emerge from the findings. First, most respondents claim to be interested in and concerned about watershed management issues, however, few are well informed about the technical or scientific aspects of watershed ecology and management. Second, respondents indicated they currently receive little useful information about watershed issues, but there are relatively high levels of trust in several information providers. This suggests that an increase or refocus of outreach efforts may be successful in raising citizen awareness and knowledge of watershed issues. Third, most respondents agree that good watershed management is beneficial to both humans and the environment, but are also strongly opposed to various forms of government intervention. Fourth, watershed council members are more knowledgeable about watershed issues and more supportive of conservation and environmental protection. They are also less likely to see government agencies and current policies as problems. These data can assist watershed management agencies and organizations better understand the knowledge, preferences, and concerns of the public. They can also provide a basis for developing ecologically sound and socially acceptable solutions to watershed problems.

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Citizen Knowledge and Opinions about Watershed Management in the South Santiam
Basin in Oregon

by

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CITIZEN KNOWLEDGE AND OPINIONS ABOUT WATERSHED MANAGEMENT IN THE SOUTH SANTIAM BASIN IN OREGON

INTRODUCTION

In recent years natural resource management has been fraught with conflict. Disputes are often settled through litigation and judicial appeals, however such contentious methods of problem solving usually lead to a stronger "us vs. them" division and further competition over resources (Daniels et al. 1993). Much of this conflict is because of a failure to recognize the socio-political aspects of resource management, such as the role and interests of affected parties (Shindler and Brunson 1999). One method to avoid past pitfalls is to develop a greater understanding of stakeholders' knowledge, attitudes, and values and then account for them in the planning and policy process (Brunson 1992).

While watershed management is widely recognized as an important component of healthy ecosystems, its success depends on cultivating the good will, stewardship values and participation of citizens (Priester and Kent 1997). The 1997 Oregon Plan for Salmon and Watersheds represents a new way of fostering good stewardship and restoring natural systems. It was developed as an effort to avoid federal intervention in salmon recovery planning and keep the management of Oregon's natural resources in the hands of the state. An alternative to most natural resource recovery plans, the Oregon Plan relies on coordination and cooperation rather than regulation (State of Oregon 1997). It stresses coordination among local, state, and federal agencies and emphasizes cooperation by incorporating citizen knowledge and values, integrating community and scientific concerns,

and encouraging favorable stewardship behavior. The Oregon Plan combines scientifically sound management activity with local watershed based public support (State of Oregon 1997). Designers of the plan recognized that government alone cannot restore salmon to the Pacific Northwest. Much of the streamside land in Oregon is in private ownership; consequently, activities on public lands will not be enough to protect salmon and restore water quality. Improvements will also depend upon conservation activities by communities and private landowners.

Since communities are an integral part of long-term solutions, understanding the level of knowledge people possess and their opinions about watershed management is essential. This study examined citizen knowledge and opinions about stream management and ecology of the Lower South Santiam River, Crabtree Creek, and Thomas Creek watersheds in the South Santiam River basin. It focused on the usefulness of various sources of information, public trust in specific information providers, citizens' understanding of watershed ecology, and the problems, preferences and concerns of landowners. Two survey techniques (interviews and mail questionnaires) were used to elicit responses from community residents as well as members of the South Santiam Watershed Council (SSWC), a citizen-based group active in education and conservation efforts.

Research Setting

The South Santiam River is a tributary to the Willamette River. It is located in the eastern central portion of the Willamette Valley with its headwaters extending into the

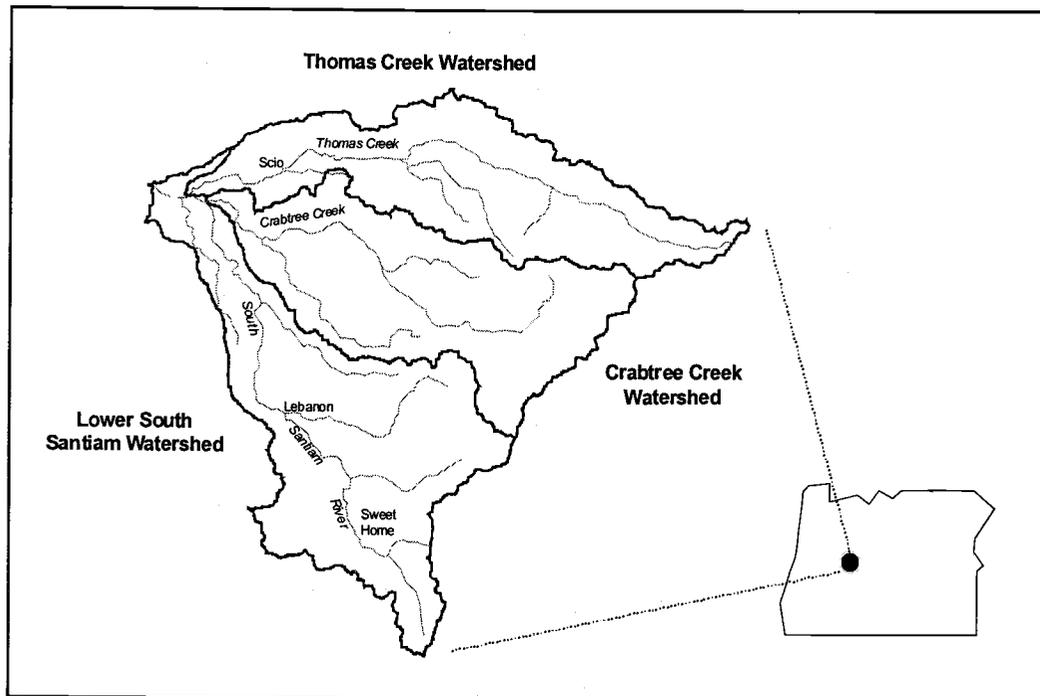


Figure 1. Map of study area.

Cascade Mountains (Figure 1). The region faces multiple watershed management challenges; for example, spring chinook salmon (*Oncorhynchus tshawytscha*) and winter steelhead trout (*Oncorhynchus mykiss*) were recently listed as threatened species under the Endangered Species Act (ESA). Several stream segments are listed on the Oregon Department of Environmental Quality's (ODEQ) 303(d) list for water quality violations related to stream temperature and fecal coliform bacteria. The Scio area has been plagued with persistent winter flooding for the past several years. In addition, the local economy was hit hard during the 1980s and 1990s by technological changes in the timber industry and decreased timber sales on public lands because of conflicts over logging old growth and the ESA listing of the northern spotted owl (*Strix occidentalis caurina*).

The South Santiam Watershed Council was formed in 1995 to bring together local people to raise awareness of watershed conditions and provide education for the protection and restoration of the watershed. The council includes landowners, representatives from state and federal management agencies and local government, resource users, and the timber industry and is generally representative of many watershed councils throughout the state. It has sponsored various watershed tours as well as coordinated several riparian restoration and tree planting projects. The council has an active water quality monitoring program and recently completed a watershed assessment.

Objectives

The purpose of this study was to examine citizen knowledge and opinions about watershed management in the Lower South Santiam River, Crabtree Creek and Thomas Creek watersheds in the South Santiam River basin in Oregon. This study took a descriptive approach with the goal of describing various aspects of citizen knowledge and opinions rather than predicting them. The project objectives were to:

- Examine the level of knowledge about watershed ecology and management held by private landowners;
- Identify where landowners get information on watershed management issues, including what sources of information they find useful and whom they trust to provide reliable and credible information;
- Assess landowner opinions about watershed management and potential problems in the South Santiam basin;
- Compare the level of knowledge and opinions of watershed council members with those of other landowners; and
- Measure the association of knowledge and opinions with specific respondent characteristics.

LITERATURE REVIEW

Citizen Participation/Public Involvement

Federal agencies have been required by law to formally involve the public in natural resource management issues since the early 1970s and, in recent years, many state governments have followed suit. Government and management agencies have come to realize that policies and plans that do not consider public preferences and values are often subject to intense opposition that can delay or even prevent implementation (Walesh 1999, Landre and Knuth 1993, Blahna and Yonts-Shepard 1989). Citizens become frustrated and conflict is inevitable when decisions appear to be made without consideration of local residents (Stein et al. 1999).

The purpose of citizen participation is to enhance the quality of decision making by providing an opportunity for the public to contribute to the decision making process (Duram and Brown 1999, Daniels et al. 1993, Lawrence and Daniels 1996). It also builds support and increases public ownership in the project, which help ensure that the final decision is deemed feasible and desirable by both the agency and society (Lawrence and Daniels 1996). By targeting management decisions to public sentiment, involvement can reduce resource management conflicts (Landre and Knuth 1993, Duram and Brown 1999). Whether or not they agree with the end decision, people are more likely to view management decisions as fair if the public is involved in the decision making process (Knopp and Caldbeck 1990, Lauber and Knuth 1999). Citizen participation strategies can also be effective in raising awareness and understanding of local conditions among both agency personnel and community members (Shindler et al. 1999).

Building relationships is another important part of citizen participation. It is well documented that meaningful public involvement can improve the relationship between citizens and management agencies (e.g., Shindler et al. 1999, Lauber and Knuth 1999, Duram and Brown 1999, Landre and Knuth 1993). Listening to and learning about each other's concerns helps people understand the "other side" and often leads to the realization that they have common goals and concerns (Shindler and Neburka 1997, Doppelt et al. 1993, Duram and Brown 1999). As relationships improve, trust and credibility also improve (Shindler et al. 1999, Moore 1996).

While public involvement has been mandatory for several decades, most natural resource agencies are still struggling with how to most effectively include the public in resource management decision making. In recent years there has been considerable research on characteristics that contribute to successful citizen participation (e.g., Shindler and Neburka 1997, Lauber and Knuth 1999, Blahna and Yonts-Shepard 1989, Landre and Knuth 1993). While the approach used for citizen participation may be affected by the local context there are several universal characteristics that contribute to a more successful process. The five most frequently mentioned principles for successful public involvement are: 1) early and continued interaction, 2) effective communication, 3) representation of all interested groups, 4) credible science, and 5) incorporation of citizen knowledge, ideas, concerns, and suggestions into the final decision.

The first principle of successful citizen participation is to involve the public early in the planning process and continue to interaction with them throughout the decision making process (Walesh 1999, Rhoads et al. 1999, Shindler et al. 1999, Blahna and Yonts-Shepard 1989, Lawrence and Daniels 1996). If the public is not consulted until late in the process or only consulted sporadically throughout the process, they may assume the decision has

already been made or that the agency is trying to hide something (Shindler et al. 1999). In addition, public involvement programs are more successful if the participants commit to active participation throughout the decision making process (Shindler and Neburka 1997).

Effective communication is another essential element of any public involvement program. The most important rule of effective communication is that it must be two-way communication. This means that people talk to each other, not at each other (Yankelovich 1991). Information flows freely, back and forth between stakeholders and management agencies. More personal forms of communication, such as group interaction and dialogue, are more effective than formal presentations and written comments (Shindler et al. 1999, Shindler and Neburka 1997, Lawrence and Daniels 1996). It is also important that everyone at the table speak the same language (Brunson 1992, Shindler et al. 1999). This means jargon and technical terms should be avoided whenever possible and those that cannot be avoided should be defined early in the process. Effective communication is based on mutual understanding, respect, and trust (Rhoades et al. 1999). It emphasizes the importance of listening and learning from each other and can lead to mutual learning (Stankey and Shindler 1997). Improving communication will help all involved to better understand both local and scientific concerns (Steins et al. 1999). Good communication increases trust and acceptability, while poor communication or lack of communication exacerbates feelings of mistrust and resentment (Rhoades et al. 1999).

Representation is another important issue in citizen participation. All interested and effected groups should be invited to participate in the decision making process; however, success is determined more by breath and quality of involvement than sheer number of participants (Walesh 1999, Shindler et al. 1999). The more "publics" that are identified and invited to participate, the higher the success rate (Walesh 1999). Using a variety of

communication methods helps increase the number of people and groups reached (Blahna and Yonts-Shepard 1989). The most successful public involvement programs are open and accessible to all members of the public (Shindler et al. 1999).

Not surprisingly, current and reliable scientific information is also important to successful public involvement (Shindler and Neburka 1997). Citizens want to know that management decisions are based on sound science, not politics (Tuler and Webler 1999). In addition, public involvement is more successful when participants have a basic understanding of the issues and access to the same information as agency staff (Shindler and Neburka 1997, Tuler and Webler 1999). Having citizens and managers work together analyzing information and forming alternatives also increases understanding and builds ownership in the project (Shindler and Neburka 1997).

The final and possibly most important principle of successful citizen involvement is that it must be meaningful. In order for public participation to be meaningful, people must feel that their input is truly valued and will make a difference (Yankelovich 1991). Providing a meaningful role for the public in decision making is key to the success or failure of the project (Walesh 1999, Friedmann 1987). Citizens want to see evidence that their comments, concerns, knowledge, and ideas are incorporated into the final decision (Shindler et al. 1999, Tuler and Webler 1999, Lauber and Knuth 1999).

In addition to the five main principles, researchers cited several other factors that contribute to successful citizen participation efforts. Shindler and Neburka (1997) found that active participation by the decision maker; common courtesies such as advance notice of meetings, definition of terms, and providing refreshments at meetings; and the ability to filter out agency politics and national debates and focus on the local issues were important in determining success. Good leadership (Shindler et al. 1999) and the creation of conditions

conducive to future public participation efforts (Tuler and Webler 1999) also play a role in the success of public involvement programs.

Despite the growing recognition of the principles and practices important to public involvement, achieving success is not easy. There are many barriers which are often difficult to overcome. These barriers can be divided into 1) structural problems related to the decision making process itself and the institutional arrangement of the agency and 2) impediments due to the attitudes of citizens and resource professionals.

The institutional structure of the agency can greatly influence the success of public involvement. A top-down management structure, in which the local resource manager has limited flexibility, makes meaningful public involvement difficult (Shindler et al. 1999, Daniels et al. 1993). To be successful, the local agency personnel must have the flexibility to try new tactics and use public input to direct management planning. Internal agency power struggles and political interference also hinder the citizen involvement process (Shindler et al. 1999, Blahna and Yonts-Shepard 1989). In addition, traditional public involvement has often been structured as an "us vs. them" debate, which fosters competition rather than collaboration and makes constructive dialogue extremely difficult (Daniels et al. 1993). Lastly, the complexity and technical nature of the planning and decision making process itself often makes involving the public difficult and time consuming (Blahna and Yonts-Shepard 1989).

Attitudes can also be an obstacle to successful public involvement. In many cases agency personnel have a "we know best" attitude (Shindler et al. 1999, Rhoades et al. 1999). They privilege scientific information and are not willing to trust the experiential knowledge of local citizens. This reduces the often already low levels of trust citizens have for land management agencies. Trust is often low due to past conflicts and poor public relations

(Shindler et al. 1999). In addition, past experience with litigation and appeals tends to put agency personnel on the defensive, which makes meaningful interaction difficult to accomplish (Daniels et al. 1993). In an effort to avoid additional controversy agencies attempt to construct bullet proof plans which only make the public more suspicious and distrustful (Blahna and Yonts-Shepard 1989, Daniels et al. 1993).

Community-Based Resource Management and Watershed Councils

Community-based resource management is rapidly gaining ground as a powerful management strategy both in Oregon and around the world. Frustration with current resource management decisions and lack of adequate public involvement has led to a shift from a top-down adversarial approach to a more collaborative, bottom-up approach in which citizens play an essential role (Griffin 1999, Walesh 1999, Kenney 1999). The traditional DAD model (decide, announce, defend) often employed by public agencies is no longer effective. In this era of social changes, citizens expect to have an active role in decision making along with federal, state, and local authorities (Griffin 1999, Walesh 1999).

Watershed councils are an example of this shift away from centralized, bureaucracy to more local, community-level control of resource management decisions (Griffin 1999). They have evolved in response to the public's dissatisfaction with public natural resource management (Griffin 1999, Kenney, 1999). Citizens want a decision making process that allows greater local control, uses flexible and creative problem-solving strategies, focuses on regional problems, is relatively quick and low cost, and leads to on-the-ground action (Kenney 1999).

Two of the most important characteristics of most watershed councils are their reliance on voluntary action and consensus-based decision making. These policies provide a

safe environment, encourage dialogue and discussion, and require consideration of all participants (Kenney 1999). Many scholars, interest groups, resource professionals, and elected officials see the grassroots watershed council movement as the solution to the citizen involvement dilemma (Getches 1996, Riebsame 1996). However, to date there has been little actual evaluation of the success of watershed councils.

One downfall of the watershed council movement is that their local orientation makes it difficult for national interest groups to "maintain a seat at the table" in natural resource decision making (Kenney 1999). This is particularly a concern for groups that traditionally used litigation and federal lobbying to obtain their goals. Many of these groups are afraid that the focus on local stakeholders will weaken or overturn hard-won environmental achievements and impede future progress towards environmental protection at a national level (Kenney 1999, McCloskey 1995).

The formation of watershed councils in Oregon is a relatively new attempt to bring varied interests together to form common goals for the ecological and economic sustainability of watersheds (State of Oregon 1997). Two main objectives of these local councils are the formation of partnerships among landowners, community groups and management agencies (State of Oregon 1997) and providing local citizens with a voice in managing resources that are important to them.

Public Knowledge

Recently, the role of knowledge in peoples' assessment of natural resource conditions and practices has received considerable attention among social scientists. There is general agreement that people possess two types of knowledge, scientific and experiential. Scientific knowledge, also called expert or technical knowledge has been described as empirical in

nature and based on formal scientific research (DeWalt 1994, Kloppenburg 1991). It is generally learned and passed on through scientific research, in formal educational settings and through scientific papers. Experiential knowledge, also known as local, tacit, folk, traditional, or indigenous knowledge is based on personal experience (Kloppenburger 1991, DeWalt 1994, Saint-Onge 1996). Experiential knowledge is derived from observation and direct, practical experience with the unique social and physical environment of a particular place or resource (Kloppenburger 1991). Once the foundation for most natural resource management decisions, experiential knowledge lost credibility as society became more scientifically and technically orientated (Kloppenburger 1991). Scientific knowledge became the best and only source of accurate information (Kloppenburger 1991, Hassanein 1997). Experiential data was disregarded because it did not conform to the standard format scientists were used to dealing with, it was difficult to access, it didn't fit neatly into a spreadsheet and it couldn't be analyzed with traditional statistical methods (Mackinson and Nøttesad 1998). Recently, however, experiential knowledge is again gaining acceptance as natural resource agencies work more closely with the public in the decision making process (Aldred-Cheek et al. 1997). Resource professionals have begun to recognize that both scientific and experiential knowledge have a place in watershed management. Scientists and managers can benefit from local experience and understanding, while citizens can learn how scientific theories and technical methods can be useful in managing their lands (Stankey and Shindler 1997).

One of the benefits of incorporating experiential knowledge into resource management decisions is enhanced social acceptability of the decisions (Shindler and Collson 1997, Mackinson and Nøttesad 1998, Shelby and Speaker 1990, Taylor and Mutch 1985, and McGee-Brown et al. 1995 in Aldred-Cheek et al. 1997). Shindler and Collson (1998) found

that while communities respect and accept scientific information they, feel that resource management decisions should also consider local experience and knowledge. For example, in the Southern Appalachian region, many residents believe their historic connection to the land gives them unique local knowledge that should be incorporated into Forest Service decisions (McGee-Brown et al. 1995 in Aldred-Cheek et al. 1997). As Stankey and Shindler (1997) note, experiential knowledge "can provide rich insight as an adjunct to the formal, scientific knowledge held by experts..." (p. 8).

Nevertheless, scientific literacy is also important. As natural resource issues have become more complex, the ability to understand technical and scientific information has become increasingly important in deciding among the various tradeoffs and alternatives (Steel et al. 1992-93, Pierce et al. 1989, Kuklinski et al. 1982). Increased opportunities for public involvement in resource policy decisions increase the need for an informed citizenry. Because people's knowledge influences their judgments, the public is more likely to support resource management decisions if they understand the rationale, research questions, and subsequent outcomes associated with proposed practices (Shindler and Collson 1998, Stankey 1996). For example, numerous studies on the use of fire as a management tool illustrate that the acceptance of managed fire increases as knowledge of the benefits of fire increases (e.g., Shelby and Speaker 1990, Taylor and Mutch 1985). Additionally, Bliss et al. (1993) found that the public's lack of knowledge about forests and forest practices contributed to opposition to certain practices.

Most studies that have looked at citizens' knowledge of the environment have used surveys that ask respondents to self-assess how much they know about environmental issues (e.g. Arcury et al. 1986, Arcury 1990, Steel et al. 1990). This type of survey measures the respondent's perception of their knowledge, rather than their actual knowledge. While

questions remain regarding the reliability of self-assessment measures; Pierce and Lovrich (1982) found that self-assessed and actual knowledge were closely related in a study that first asked respondents to assess their knowledge of technical terms, and later tested them on these same items plus a bogus term.

Research has found that while the public is concerned about the environment it lacks basic ecological knowledge and is often misinformed about the causes and consequences of many environmental issues (NEETF 1997, 1998, Jacobson and Marynowski 1997, Arcury et al. 1990, Reading et al. 1994, Read et al. 1994). For example, a 1997 national survey of American adults found that less than a third of Americans have a general understanding of the origins and outcomes of important environmental problems (NEETF 1997). Although many resource problems can in part be ameliorated by citizen action, if citizens are unaware of the situation they are unlikely to take action to improve conditions and if they are misinformed their actions may be misdirected (NEETF 1997). For example, while many people believe that factories are the main source of water pollution, non-point source pollution such as runoff from streets, parking lots, lawns and agricultural operations is to blame. If citizens fail to recognize the causal relationship, it is unlikely they will change their behavior.

While it is clear that additional public education is needed to improve ecological understanding and build on the public's positive attitudes toward the environment (Jacobsen and Marynowski 1997, NEETF 1997, 1998), it is important to realize that education is not a panacea. Many resource managers feel that the public simply needs to be "educated" about environmental problems when in fact the way citizens receive information, develop knowledge, and form judgments is much more complex (Kearney et al. 1998, Stankey and Shindler 1997). It is unlikely that people's judgments or behaviors will change based solely

on additional scientific information (Stankey 1996). While knowledge and information can improve the quality of decisions, they are still only two of the many factors that influence support of resource management decisions. However, public education is still useful and more innovative public outreach techniques could prove beneficial in improving citizen awareness and understanding of complex natural resource issues.

Trust and Credibility

The level of trust citizens have for various information sources is especially important given the complexity and technical nature of most natural resource problems. Because many citizens – including those that are relatively knowledgeable about watershed management issues – have difficulty judging the accuracy of information, they often base their judgments on the level of trust they hold for the information provider (Steel et al. 1992-93). If the source of the information is not trustworthy or credible, the public is unlikely to alter their behavior in response to the new information regardless of how accurate it is (Moore 1996, Brunson and Steel 1994). In addition, trust and credibility of natural resource management agencies is strongly linked to overall acceptance of management plans (Shindler and Brunson, forthcoming).

Considerable research suggests that the public's trust in resource agencies hinges on a suite of factors (e.g., Moore 1996, Shindler and Neburka 1997, Shindler and Brunson 1999). Although numerous influences exist depending on the situational context the three essential factors that contribute to citizen trust are agency personnel's ability to demonstrate genuine care and concern for the social and environmental setting, knowledge and technical expertise, and openness and honesty (Peters et al. 1997). Active disclosure greatly contributes to the perception of openness and honesty and care and concern (Peters et al. 1997).

Citizens judge these abilities best when they are able to have meaningful interaction with managers throughout the course of a plan or project.

Similarly, Moore (1996) found that trust is based on honesty, benevolence, and reciprocity, with honesty being the most important element. It is essential that all parties tell the truth and not hide any information from the other parties (Moore 1996). Explaining all the alternatives and their likely outcomes, admitting uncertainty, and discussing negative, as well as, positive aspects of management plans will help increase trust between citizens and management agencies. Trust is difficult if not impossible to achieve when the public believes that agencies are not sharing or using all available information (Shindler and Brunson, forthcoming). Perceptions of trust and credibility are strongly related to the amount of information received (Peters et al. 1997).

Listening to other parties is also an important element of trust building (Moore 1996). When citizens can see that management agencies are listening to and using their input they are more likely to trust the agency and support the management decision. By valuing citizen input, agencies defy the traditional negative stereotype often associated with citizen-agency interactions and greatly improve public perceptions of trust and credibility (Peters et al. 1997). Additionally, as people interact and get to know each other over time, real understanding occurs and trust increases (Moore 1996).

Truly involving local citizens in resource management decisions is extremely important to building trustworthy relationships (Shindler and Brunson, forthcoming). Failure to include the public in resource planning or including, but not implementing any of their suggestions is the primary reason for distrust of agencies (Shindler 1998, Brunson 1996). Shindler et al. (1999) found that trustworthy relationships were consistently characterized by inclusiveness, sincere leadership, innovative and flexible methods, early and continual

commitment, sound organizational and planning skills, and efforts that result in action. The trust that is built through these types of citizen-agency interactions helps maintain group cohesiveness, increases support for the government agencies involved, and increases the likelihood that decisions based on compromise can be reached and conflict avoided (Moore 1996).

Researchers have found a general decline in public trust and confidence in government and industry and a rise in trust in citizen and environmental groups (Peters et al. 1997). Steel et al. (1992-93) found that the public most trusted technical information about natural resources and the environment provided by environmental groups, government scientists, and college and university educators. The least trusted information providers were developers, timber companies, and labor unions. Similarly, Brunson and Steel (1994) found greater public trust in environmental groups, the U. S. Forest Service and the U. S. Fish and Wildlife Service than in commodity groups or Congress. In a survey of Oregon coastal residents, Smith et al. (1997) found word of mouth, television and radio and newspapers to be the most important sources of information about salmon-related issues. Pierce and Lovrich (1983) found that when evaluating instream flow policy the public was most trusting of technical information from state water resources agencies, local government and farmers and least trusting of developers and federal agencies.

Associations Between Respondent Characteristics and Environmental Knowledge and Attitudes

The research literature suggests that socio-demographic variables such as gender, education, income, and age are often strongly associated with knowledge and attitudes about environmental issues (e.g., Arcury 1990, Van Liere and Dunlap 1980, Steger and Witt 1989).

Males are generally more knowledgeable about environmental issues than females; however, females are more likely to perceive environmental risk and are more supportive of environmental protection measures (Steger and Witt 1989, Sigelman and Yaranella 1986, Arcury et al. 1986). Higher levels of education and income are consistently related to greater knowledge about environmental issues (Arcury 1990, Reading et al. 1994). Education is also positively correlated with more favorable attitudes towards the environment (Steel et al. 1994, Van Liere and Dunlap 1980). However, the relationship between income and environmental attitudes is much less clear. Reading et al. (1994) and Jacobsen and Marynowski (1997) report a negative correlation between income and environmental attitudes while Sigelman and Yaranella (1986) report no significant relationship between the two. Younger individuals tend to be more concerned about the environment and more supportive of ecosystem management practices (Van Liere and Dunlap 1980, Steel et al. 1994, Reading et al. 1994). However, there is no conclusive relationship between age and environmental knowledge (Sigelman and Yaranella 1986, Arcury 1990).

METHODS

To obtain a more accurate picture of the level of scientific knowledge held by citizens and their opinions about watershed management, a multi-method approach was used. Semi-structured exploratory interviews and informal observation of watershed council meetings were combined with a mail survey. Given the complexity of watershed management problems, the use of multiple methods helps avoid bias and provides insights that would often be missed if only one method was used (Egan et al. 1995).

Exploratory Interviews

During the summer of 1998 exploratory interviews were conducted with the South Santiam Watershed Council coordinator and nine key community members who were familiar with the local watersheds. Five of the interviews were with active council members, three were with inactive members, and one was with a nonmember who had worked on a project with the council. The interviews were semi-structured and included questions on watershed management concerns, benefits associated with streams and the surrounding areas, and experiential and technical knowledge about local streams. The interviews were used to familiarize the researcher with the language used by landowners in the South Santiam basin, provide an initial understanding of the concerns and issues important to landowners, and serve as a base for developing the mail survey questionnaire. The three main themes that emerged from the interviews were the importance of maintaining private property rights, a general frustration with current management practices, and water quality concerns (See Appendix B for more detailed discussion of main themes from exploratory interviews).

Observation

The researcher attended the monthly watershed council and technical advisory committee meetings from June 1998 through December 1999. As with the interviews, observations provided an initial understanding of the language and level of technical knowledge held by council members and also revealed considerable experiential knowledge about the watershed.

Mail Survey

Development of the mail survey questionnaire was based on an assessment of the research literature, review of related mail surveys, observation of watershed council meetings, and exploratory interviews with landowners. Research colleagues in both the social and biophysical sciences at Oregon State University, the watershed council coordinator, and a small number of lay people reviewed draft questionnaires. The final survey included questions about watershed-related knowledge, basic environmental knowledge, usefulness of and trust in information providers and opinions on management and potential problems in the watershed.

The survey was administered to a stratified random sample of 450 landowners (150 from each watershed) drawn from the Linn County tax lot database. ArcView geographic information system (GIS) software was used to delineate the watershed boundaries and stratify the tax lot database. The United States Geological Survey (USGS) fifth field hydrologic unit code (HUC) boundaries were overlaid on the tax lot layer to select landowners within each watershed. A random sample of 150 landowners was then selected

from each watershed. Selection criteria required that survey participants be private landowners who resided in the watershed. Absentee, public, industrial, and corporate landowners were not included in the sample. Many of the primary landowners were male; therefore, in an effort to include more females the cover letters were addressed to both the primary and, where applicable, secondary owner listed in the database.

The survey was also sent to all 55 members of the South Santiam Watershed Council. While the majority of the council members are landowners in the watershed, approximately seven do not own property but are representatives of agencies or organizations that work in the watershed. Watershed council members were included as a separate sub-sample to determine if their knowledge, trust in and use of information sources and other opinions differ from landowners in the area. This data will provide insight as society and the resource management community considers the usefulness of watershed councils.

The survey was administered using a modified version of the "total design method" (Dillman 1978, Salant and Dillman 1994). An initial questionnaire packet including a personalized, hand-signed cover letter, questionnaire and postage-paid return envelope was mailed to each member of the sample in early March. Two follow-up packets were sent at four-week intervals to those who had not responded.

Data Analysis

Data were analyzed with SPSS 9.0 and 10.0 software. A variety of descriptive statistics was used to build a picture of citizen knowledge, use and trust of information sources and opinions. Independent sample t-tests, Pearson's chi-square, ANOVA, and

Tukey multiple comparison analysis were used for group comparisons. The strength of relationships between variables was assessed with bivariate correlation analysis (Pearson's Correlation Coefficient) and cluster analysis was used to sort the opinion and preference variables into relatively homogeneous groups. Data from the open-ended question were summarized using content analysis (Sanders and Pinhey 1983). Significance is reported at the $p \leq 0.05$ level unless otherwise noted.

Knowledge Measures

The survey included three measures of landowner knowledge: (1) a self-assessment of knowledge of technical terms, (2) a test of watershed knowledge, and (3) a test of basic environmental knowledge. The survey design and additive scales used for assessing landowner knowledge were based on those developed by Pierce et al. (1989) and Steger et al. (1988).

Knowledge of Technical Terms

Respondents were asked to indicate their level of knowledge of eleven technical terms often used in watershed management. Possible responses were:

- I know the meaning of the term;
- I've heard the term, but I don't know the meaning; and
- I've never heard the term.

Recorded data were examined first as individual frequencies of response and then combined into an additive scale. For the additive scale, responses for the eleven terms were scored (know meaning = 2; heard the term, but don't know meaning = 1; and never heard

the term = 0) and combined into a single measure of knowledge ranging from zero (had never heard any of the terms) to twenty-two (knew the meaning of all the terms).

Watershed Knowledge

While the previous section measured respondents' own assessment of their knowledge, this section provided a measure of the respondents' actual knowledge of watershed ecology and management. True-false and multiple-choice questions, each with identifiable correct and incorrect answers, were used. To help discourage respondents from simply making a random guess each question included a response option of "not sure." Item responses were examined both individually and combined into an additive scale. For the additive scale each correct answer scored one point and each incorrect answer zero points for a range of zero (no correct answers) to ten (all correct answers).

Basic Environmental Knowledge

To measure basic environmental knowledge, five multiple-choice questions were taken from the National Environmental Education and Training Foundation's (NEETF) 1997 report, "The National Report Card on Environmental Knowledge, Attitudes and Behaviors." Again responses were examined both as individual frequencies and combined into an additive scale. For the additive scale each correct answer scored one point and each incorrect answer zero points for a range of zero (no correct answers) to five (all correct answers).

Respondent Characteristics Coding

Individual respondent characteristics were coded as follows for all analyses:

Stream ownership:	0=Does not own stream, 1=Owns stream,
Years of residence:	Number respondent entered
Acres owned:	1=Less than 1 acre 2=1-2 acres 3=3-10 acres 4=10-50 acres 5= 50+ acres
Gender:	1=Male, 2=Female
Age:	1=18-24 2=25-35 3=36-48 4=49-65 5=65+
Education level:	1=Some high school 2=High school graduate 3=Some college 4=Associate's degree 5=Bachelor's degree 6=Some graduate course work 7=Graduate or professional degree
Income:	1=Under \$5,000, 2=\$5,000-\$9,999 3=\$10,000-\$14,999 4=\$15,000-\$24,999 5=\$25,000-\$34,999 6=\$35,000-\$49,999 7=\$50,000-\$74,999 8=\$75,000-\$99,999 9=\$100,000-\$149,000 10=\$150,000+
Retired:	0=Not retired, 1=Retired
Watershed council membership:	0=Not a watershed council member 1=Watershed council member

FINDINGS

Response Rate

The questionnaire was mailed to 505 households with 14 undeliverable or reaching people who were deceased or incapacitated. Of the 491 deliverable surveys, 298 completed surveys were returned for a response rate of 61% (Table 1).

Table 1. Response Rate by Sub-sample.

Sub-sample	Deliverable Questionnaires	Valid Responses	Response Rate
Thomas Creek	144	82	57%
Lower South Santiam River	145	83	57%
Crabtree Creek	148	90	61%
Watershed Council	54	43	80%
Total	491	298	61%

Group Comparisons

While the main focus of this study was to provide an overview of private landowners in the South Santiam basin, the four sub-samples were compared to determine if there were significant group differences. Watershed council members were significantly different ($p \leq 0.05$) from respondents in the other three sub-samples on two-thirds of the variables. Several of these differences will be highlighted in the text with additional comparisons presented in Appendix C. Across the survey, no significant differences were found between respondents in the Lower South Santiam River, Crabtree Creek and Thomas Creek watersheds; thus they

have been combined into a single group called landowners. Additionally, respondents with streams on their property were compared to those without streamside property. Few statistically significant differences were found and none were important to determining differences in knowledge and opinions; therefore, they will not be presented. Other significant comparisons are noted in the findings.

Respondent Profile

This section presents a profile of citizens surveyed in the South Santiam River basin. Basic socio-demographic characteristics are summarized to provide a frame of reference. This information will later be used to evaluate the differences between various respondent populations.

Table 2 provides a descriptive summary of the 298 survey respondents. Findings are presented for the sample as a whole, as well as separately for watershed council members and landowners. Forty-two percent of the respondents have a stream on their property, suggesting that many participants are familiar with stream environments. Watershed council members are even more likely to own stream property with 60% stating that they have streams running through their property. Average term of residence in Linn County is 30 years suggesting at least some familiarity with the rural environment and resource management issues of the watershed. Watershed council members have lived in the area for slightly less time, but still long enough to be familiar with the area.

The amount of land owned by participants varied with relatively equal distribution between all categories. Almost half of all respondents (47%) own over ten acres. Two-thirds of the respondents were male. The majority of the survey participants are age 49 or

Table 2. Characteristics of Survey Respondents.

	Overall	Landowners	Watershed Council
Sample size	298	255	43
% with stream on property*	42%	39%	60%
Mean years of residence in Linn County**	30	31	22
Acres owned			
Less than 1	18%	17%	26%
1-2	10%	9%	14%
3-10	24%	26%	14%
11-50	24%	26%	11%
More than 50	23%	22%	34%
Gender			
Female	32%	32%	29%
Male	68%	68%	71%
Age			
25-35	7%	8%	2%
36-48	28%	27%	34%
49-65	38%	37%	42%
Over 65	27%	29%	22%
Level of education**			
High school	29%	33%	5%
Some college	38%	42%	13%
Bachelor's degree	21%	14%	63%
Graduate or professional degree	12%	11%	20%
Occupation from which household derives its primary income			
Retired	38%	39%	35%
Agriculture	14%	14%	10%
Public administration, education and government	16%	13%	33%
Manufacturing and processing	28%	31%	10%
Forestry industry	18%	15%	23%
Business and professional services	25%	24%	28%
Tourism or recreation	1%	1%	0%
Other	12%	14%	5%
Pretax Household Income*			
Under \$9,999	5%	6%	3%
\$10,000 - \$24,999	11%	13%	3%
\$25,000 - \$49,999	43%	44%	34%
\$50,000 - \$99,999	32%	30%	40%
\$100,000 or more	10%	8%	20%

*Difference between council and landowners statistically significant at $p \leq 0.05$

** Difference between council and landowners statistically significant at $p \leq 0.01$

older (65%) with more than a quarter being over age 65 (27%). No respondents were under 25 years old, which is not unusual because the survey targeted property owners. Respondents in the South Santiam watershed appear well educated. Overall, one-third (33%) have a Bachelor's or advanced degree with watershed council members (83%) having significantly higher levels.

Over one-third (38%) of the survey participants are retired. In some communities, after retirement there may be a shift in the attitudes and values individuals hold toward natural resources. Many retirees are no longer dependent on the economic activity of the region or have moved in from other areas and often favor amenity values of natural resources over extractive uses (Shindler and Reed 1996). However, given the length of residence of most respondents, this latter point is unlikely to be an issue in this study.

Respondents derive their primary household income from a variety of occupations. Manufacturing and processing (28%), business and professional services (25%), and the forest industry (18%) have the highest concentrations. Slightly less than half of the survey participants (43%) have household incomes between \$25,000 and \$49,999 annually. Watershed council members tend to have slightly higher incomes than landowners.

Citizen Knowledge

Self-Assessment of Information Levels

Respondents were asked to indicate how well informed they were about watershed issues on a 5-point Likert scale ranging from not well informed to extremely well informed. Fifty-four percent of the respondents rated themselves at least moderately informed, while slightly over a quarter (27%) rated themselves as uninformed (Table 3). To further gauge their interest

Table 3. Level of Information about Watershed Issues.

Level of Information	Not Informed		Moderately Informed		Well Informed
		27%	20%	34%	16%

Table 4. Amount of Attention Given to Watershed Management.

Amount of Attention	Not Much		Moderate		Great Deal
		22%	13%	31%	18%

respondents were asked to rate the amount of attention they give to watershed management issues on a five point scale ranging from not much to a great deal. Two-thirds (65%) reported they give at least a moderate amount of attention to watershed management issues (Table 4).

Knowledge of Technical Terms

Respondents were asked to rate their knowledge of eleven technical terms often used in watershed management. Large woody debris and streamside buffers were the best known terms while a majority of respondents had never heard the terms anadromous, geomorphology, redd, refugia and 303(d) list (Table 5).

Table 5. Knowledge of Technical Terms Results.

Terms	Know Meaning	Heard, but Don't Know Meaning	Never Heard
Large woody debris	79%	12%	9%
Streamside buffers	77%	13%	10%
Biodiversity	58%	18%	23%
Riparian zone	55%	15%	30%
Habitat fragmentation	53%	24%	23%
Non-point source pollution	45%	27%	29%
Anadromous	32%	17%	50%
Geomorphology	25%	26%	50%
Redd	20%	13%	66%
Refugia	13%	18%	70%
303(d) list	12%	12%	77%

Table 6. Watershed Knowledge True-False Questions and Results.

Question (Correct Answer)	Correct	Incorrect	Not Sure
Vegetation along stream banks helps improve water quality. (True)	88%	3%	9%
Large woody material (logs, trees, etc.) in streams blocks fish passage and should be removed whenever possible. (False)	80%	9%	11%
Healthy rivers require inputs of sediment, gravel, and small rocks. (True)	58%	15%	27%
There are no biological differences between wild salmon and hatchery salmon. (False)	52%	18%	31%
Most water pollution today comes from factories. (False)	49%	24%	27%

Watershed Knowledge

Watershed knowledge was examined using a set of true-false (Table 6) and multiple choice (Table 7) questions specifically related to watershed ecology and management. Over three-quarters of the respondents knew that streamside vegetation helps improve water quality and that large woody material does not block fish passage and should not be removed from streams. A majority (or near majority) correctly answered that streams require inputs of sediment, gravel and small rocks; that there are differences between wild and hatchery fish; and that factories are not the main source of water pollution; however, many were also uncertain about these statements.

Many respondents (41%) incorrectly believe that clearcuts are the main cause of erosion on forested land, while 23% selected the correct answer – roads (Table 7). A similar number of respondents (30%) was able to correctly identify state standards for stream temperature, while about half were uncertain. Over half the respondents knew that streams and streamside areas are most altered in urban areas, yet, a quarter were not sure about answering. There is also a high level of uncertainty regarding which fish species are in danger of extinction in the South Santiam basin. The two species that were recently listed as threatened, chinook salmon and steelhead trout, received the most responses (40% and 38%, respectively), but both received fewer responses than the not sure category (43%).

Basic Environmental Knowledge

The basic environmental knowledge measure used a set of multiple-choice questions to assess respondents' understanding of some of society's common environmental concerns. In general, respondents did better on the basic environmental science questions than on the

Table 7. Watershed Knowledge Multiple Choice Questions and Results.

Question	Possible Answers and Percent Response				
The biggest source of erosion from forested land is...	Clearcuts	Roads	Unharvested forest	Natural geologic activity	Not sure
	41%	23%	1%	19%	16%
State standards say that stream temperature in salmon producing streams should not exceed _____ degrees Fahrenheit to ensure healthy habitat for fish	78°	64°	50°	Not sure	
	2%	30%	19%	49%	
Streams and streamside areas are most altered in...	Urban areas	Farm land	Forest land	Range/pasture land	Not sure
	55%	5%	6%	9%	25%
What fish species is/are proposed for listing as threatened species under the Endangered Species Act in the South Santiam watershed	Chinook	Coho	Bull trout	Steelhead	Not sure
	40%	30%	19%	38%	43%

Correct answers are in bold

more specific watershed knowledge questions with considerably fewer “not sure” responses (Table 8). Almost all the respondents were able to recognize a renewable resource and the majority could identify the definition of biodiversity, the most common cause of extinction, and the largest source of carbon monoxide. However, there was some confusion about the main source of power in the United States.

Table 8. Basic Environmental Knowledge Questions and Results.

Question	Possible Answers and Percent Response				
There are many different kinds of animals and plants, and they live in many different types of environments. What word is used to describe this idea?	Multiplicity 1%	Biodiversity 72%	Socio- economics 1%	Evolution 1%	Not sure 26%
Which of the following is a renewable resource?	Oil 1%	Iron ore 0%	Trees 97%	Coal 0%	Not sure 3%
Most electricity in the United States is generated from what source of power?	Nuclear 1%	Burning coal, oil and wood 29%	Solar 0%	Hydroelectric dams 57%	Not sure 13%
What is the most common reason that plant and animal species become extinct?	Predation 4%	Habitat loss 67%	Competition 8%	Natural disasters 5%	Not sure 16%
What is the largest source of carbon monoxide in the United States?	Factories 5%	Motor vehicles 78%	Home heating 0%	Forest fires 1%	Not sure 16%

Correct answers are in bold

Watershed Council Members Compared to Landowners

Watershed council members were significantly more knowledgeable than landowners on all of the knowledge measures (Table 9). Knowledge of technical terms ranged from an additive score of 22 (knowing the meaning of all the terms) to a score of zero (never having heard any of the terms). The average landowner has heard many of the terms and may know the meaning of two or three of them while the average watershed council member knows the meaning of most of the terms.

Watershed knowledge scores ranged from zero correct to all ten correct. On average landowners answered half of the questions correctly while council members averaged seven correct answers. Basic environmental knowledge followed a similar pattern with landowners averaging three correct answers and council members four correct answers.

In addition, almost all of the watershed council members (98%) consider themselves at least moderately well informed about watershed management issues compared to only 46% of landowners. For additional comparisons and an itemization of council member and landowner responses to each question in the knowledge section see Tables 2, 8, 9a, 9b and 10 in Appendix C.

Table 9. Summary of Knowledge Scores of Watershed Council Members and Landowners.

Knowledge Measures	Members	Landowners
Knowledge of Terms Mean Score (Range 0-22)	18.9	9.8
Watershed Knowledge Mean Score (Range 0-10)	7.4	4.8
Environmental Knowledge Mean Score (Range 0-5)	4.2	3.3
At Least Moderately Informed	98%	46%

Members and landowners are significantly different at $p < 0.001$ for all measures.

Associations between Respondent Characteristics and Knowledge

This section will examine the association between respondent characteristics and knowledge. The research literature suggests that socio-demographic characteristics such as gender, income, and education have a consistent and significant relationship with environmental knowledge (e.g., Van Liere and Dunlap 1980, Arcury 1990, Steger and Witt

1989). This analysis will tell us if these factors are associated with higher or lower levels of knowledge about watershed management for this sample.

Correlation analysis was used to assess the relationships between respondent characteristics and knowledge of previously described technical terms, watershed knowledge and environmental knowledge (Table 10). Findings show numerous correlations between categories. First, watershed council membership, education, and income are positively correlated with all three knowledge measures. Council members, respondents with higher levels of education, and those with higher income levels are likely to have higher knowledge levels than non-members and individuals with lower levels of education or income.

Table 10. Bivariate Correlations Between Respondent Characteristics and Knowledge Measures (Pearson's Correlation Coefficient).

Respondent Characteristics	Knowledge of Terms	Watershed Knowledge	Environmental Knowledge
Council Membership	0.530*	0.404*	0.276*
Education Level	0.422*	0.346*	0.389*
Income	0.230*	0.176*	0.209*
Gender	-0.169*	-0.173*	-0.126
Years of Residence	-0.127	-0.130	-0.213*
Age	NS	-0.157*	NS
Retired	NS	-0.129	NS
Acres Owned	NS	NS	NS
Stream Ownership	NS	NS	NS

All correlations shown are significant at $p \leq 0.05$ unless otherwise noted.

* Significant at $p \leq 0.01$

NS = Not significant

Second, gender and years of residence are negatively correlated with all three of the knowledge measures, indicating that females and long time residents generally have lower knowledge scores than males and respondents with shorter tenure in the area. Third, older respondents and those that are retired tended to have lower watershed knowledge scores than their younger and non-retired counterparts. Owning streamside property and the number of acres owned were not related to any of the knowledge measures.

Usefulness of and Trust in Information Sources

Usefulness of Information Sources

Respondents were asked to rate how useful eighteen different sources have been in providing good information on watershed management issues. The response categories were not useful, slightly useful, useful, very useful, or no basis for opinion. Ratings have been collapsed into three categories for presentation purposes. The sources of information ranged from government agencies to the mass media and personal experience (Table 11).

Only one information source, personal experience, was rated as useful or very useful by a majority. Other sources – the forest and agriculture industries, OSU Extension Service, Oregon Department of Forestry (ODF), Oregon Department of Fish and Wildlife (ODFW) and the United States Forest Service (USFS) – were also considered useful or very useful by one-third of the respondents. Interestingly, at least half of the respondents rated TV and radio (54%), newspapers (51%), and environmental groups (50%) as not useful or only slightly useful.

Table 11. Usefulness of Information Sources.

Information Source	Useful or Very Useful	Slightly Useful or Not Useful	No basis for Opinion
Personal Experience	60%	21%	19%
Forest Industry	36%	27%	37%
OSU Extension Service	35%	25%	41%
ODF	35%	27%	38%
ODFW	34%	28%	38%
USFS	34%	25%	42%
Agriculture Industry	34%	31%	36%
Newspapers	32%	51%	17%
Relative, Friends, Neighbors	31%	46%	23%
Community Organizations	28%	37%	36%
SSWC	26%	19%	55%
Fishing Industry	25%	46%	30%
BLM	24%	27%	49%
TV and Radio	24%	54%	22%
ODEQ	21%	38%	42%
University Scientists	21%	25%	54%
Environmental Groups	20%	50%	31%
NMFS	12%	28%	60%

Another noteworthy finding is the majority (or near majority) who indicated they had no basis for opinion about a number of information sources. These included university scientists, the South Santiam Watershed Council (SSWC), the National Marine Fisheries Service (NMFS) and the Bureau of Land Management (BLM).

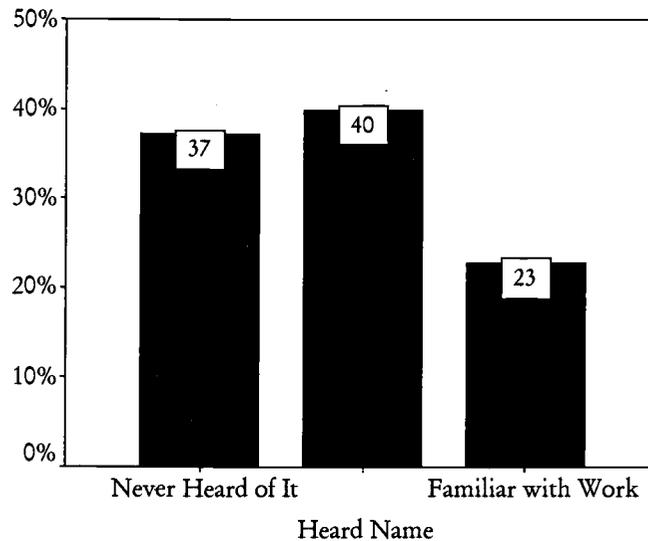


Figure 2. Percent and Level of Awareness of the South Santiam Watershed Council.

A particular aspect of this study was to determine landowner awareness of the South Santiam Watershed Council. The majority of the landowners knew little about the council, 37% had never heard of the watershed council, 40% remember hearing the name, but did not know what it does, and only 23% were familiar with the council's work (Figure 2).

Trust in Information Sources

To better understand whom landowners trust to provide them with credible information about watershed management respondents were asked to rate eighteen different information sources on a five point Likert scale ranging from distrust completely to trust completely (Table 12). Ratings were collapsed into three categories. The OSU Extension Service received the highest overall trust rating with 69% of respondents trusting them somewhat or completely. University researchers and scientists (60%), the Oregon

Table 12. Trust in Information Sources.

Information Source	Trust Somewhat or Completely	Neutral	Distrust Somewhat or Completely
OSU Extension Service	69%	24%	7%
University scientists	60%	23%	17%
ODF	59%	28%	13%
ODFW	58%	25%	17%
USFS	49%	32%	20%
SSWC	48%	47%	6%
USFW	48%	29%	22%
Forest industry	47%	29%	24%
Agriculture industry	43%	33%	23%
BLM	41%	37%	22%
Relatives and friends	37%	53%	9%
NMFS	37%	44%	19%
ODEQ	35%	30%	35%
Community leaders	30%	43%	27%
GWEB	28%	42%	30%
Newspapers	26%	38%	36%
Environmental groups	22%	23%	55%
Television and radio	21%	42%	37%

Department of Forestry (59%), and the Oregon Department of Fish and Wildlife (58%) were the only other groups trusted by a majority of the respondents.

Between one-quarter and a one-half of the respondents were neutral about each information source. Neutral opinions are often equated with a lack of opinion or lack of experience with the information source (Shindler et al. 1996). In this case, it may be reasonable to assume that people have had little or no exposure to some organizations (e.g.,

SSWC, NMFS) and that friends and relatives (usually a valued source of information) may simply not be dispensing much information about watershed management.

Interestingly, environmental groups were rated the lowest overall with 55% distrusting this source, followed by television and radio (37%), newspapers (36%), and the Oregon Department of Environmental Quality (35%). However, several groups (OSU Extension, SSWC, relatives and friend) appear relatively free from feelings of distrust.

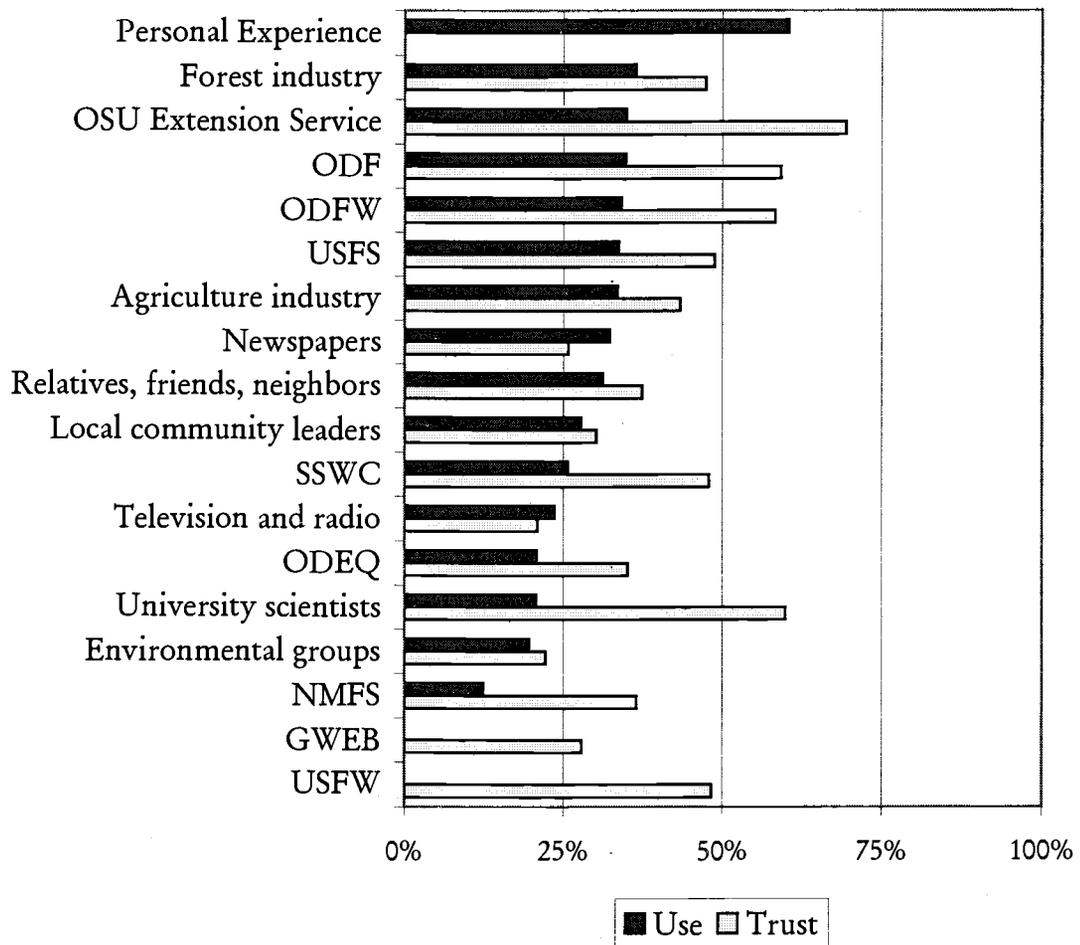


Figure 3. Usefulness of and Trust in Information Sources: Percent of Respondents Who Rate Each Information Source as Useful (Useful or Very Useful) and Trustworthy (Trust Somewhat or Completely).

Nearly all listed sources of information received higher ratings for trustworthiness than for usefulness (Figure 3). Newspapers and television and radio were the only information sources considered slightly more useful than trustworthy. The OSU Extension Service, Oregon Department of Forestry, and Oregon Department of Fisheries and Wildlife were the three most trusted and most useful sources of information. Newspapers, environmental groups, and television and radio were the three least useful and least trusted sources of information.

Relationship Between Number of Information Sources Used and Knowledge

A measure of the number of sources each respondent considered useful (those rated useful or very useful) was created to test whether level of knowledge is related to the number of sources of information used by the landowner (Steger et al. 1988, Reagan 1983). The

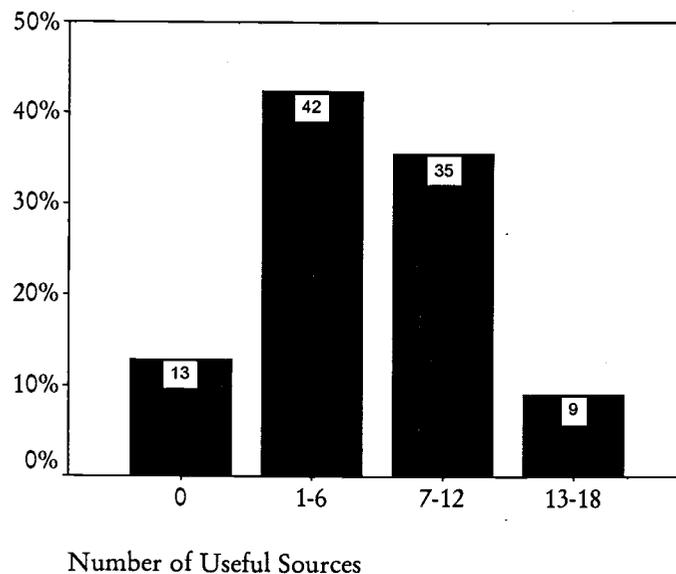


Figure 4. Number of Information Sources Respondents Rated as Useful.

number of information sources used ranged from 0 to 18 (Figure 4). The mean number of information sources considered useful by respondents was six. Thirteen percent of the respondents indicated they do not find any of the listed information sources useful and only 9% rated 13 or more of the information sources as useful.

Correlation analysis was used to assess the strength of the relationship between the number of information sources used and knowledge. Findings show that the number of information sources used is positively correlated with all four of the knowledge measures (Table 13). This means that as an individual's knowledge score increased the number of sources of information they rated as useful also increased.

Table 13. Correlation Between Number of Information Sources Used and Knowledge

Knowledge Measures	Correlation Coefficient
Self-Assessed Level of Information	0.557*
Self-Assessed Knowledge of Technical Terms	0.488*
Watershed Knowledge	0.341*
Environmental Knowledge	0.318*

*Statistically significant at $p < 0.001$

Perspectives On Watershed Management

Opinions About Watershed Management

To further assess views on watershed management issues, respondents were asked about their level of agreement with statements depicting benefits and problems associated with managing watersheds (Tables 14 and 15). The response categories were strongly

Table 14. Landowner Opinions About Watershed Management Issues.

Statement	Agree or Strongly Agree	Neutral	Disagree or Strongly Disagree
Stream and streamside conservation projects are important for fish and wildlife habitat.*	82%	14%	4%
Good watershed management increases property value.*	66%	25%	8%
Watersheds should be one of our highest local management priorities.*	54%	31%	15%
Vegetated buffers should be required along all streams, not just those on forest land.*	53%	24%	23%
The government doesn't care about the rights of rural landowners.**	52%	30%	18%
Natural resource policy focuses on punishing landowners rather than helping them.**	47%	32%	21%
Scientists are trying to fix problems they don't understand.**	46%	32%	22%
Statewide stream and streamside rules help people take better care of their land.*	45%	26%	29%
Endangered species laws should be changed to preserve jobs.**	37%	26%	38%
The government should protect public resources such as fisheries, water supply and wildlife on private lands as well as on public lands.*	36%	21%	43%
I would support community consensus even if it goes against my personal views.	30%	33%	37%

*Watershed council members are more likely to agree, $p \leq 0.05$.

** Watershed council members more likely to disagree, $p \leq 0.05$.

disagree, disagree, neutral, agree and strongly agree. Responses have been collapsed into three categories for presentation purposes.

Most landowners agreed that good stewardship activities such as stream conservation projects for fish and wildlife habitat and requiring vegetated buffers along all streams (not just forested ones) are important (Table 14). A majority also agreed that good watershed management increases property value and that watersheds should be one of our highest local management priorities. However, there was less agreement on other forms of government intervention such as whether statewide stream rules help people take better care of their land and if the government should protect public resources on private lands. Overall, more people disagreed with this last statement than agreed. Additionally, roughly half of the respondents feel that the government does not care about the rights of rural landowners; that policies focus on punishing landowners instead of helping them; and that scientists do not understand watershed problems. Respondents were about evenly divided on whether they would support community consensus if it went against their personal views and changing endangered species laws to preserve jobs.

As before, a high percentage of respondents was neutral about many statements. This data again bring into question whether watershed management is currently a salient issue for these individuals or whether they need additional information before they can form an opinion.

Table 15 depicts a set of potential problems and respondents' opinions about their presence in local watersheds. Of the five issues a majority of the people agreed were problems, two involved government intervention (i.e., too many agencies involved and loss of property rights). The others included concerns over stream bank erosion, water pollution, and herbicide, pesticide and fertilizer runoff.

Table 15. Landowner Perception of Watershed Problems.

Potential Problem	Agree or Strongly Agree	Neutral	Disagree or Strongly Disagree
Too many management agencies involved**	66%	28%	6%
Streambank erosion*	57%	28%	15%
Loss of private property rights**	55%	30%	15%
Water pollution*	54%	27%	20%
Herbicide, pesticide and fertilizer runoff into the streams*	52%	30%	19%
Low stream water levels during summer	43%	31%	26%
Wasteful irrigation practices*	41%	37%	22%
Poor fishing*	40%	38%	22%
Lack of streamside vegetation*	39%	26%	35%
Logging practices*	39%	33%	28%
High stream temperatures*	33%	43%	24%
Cattle in the streams*	33%	34%	34%
Run-off from residential lawn care*	29%	35%	36%

*Watershed council members are more likely to agree, $p \leq 0.05$.

** Watershed council members more likely to disagree, $p \leq 0.05$.

Over a third agreed that low water levels, irrigation practices, poor fishing, lack of streamside vegetation, logging, high stream temperatures and cattle in the streams are a problem. However, cattle and residential lawn run-off both received higher levels of disagreement than agreement. As before, many respondents (a third or more) were neutral about a number of problem areas. We also invited landowners to comment on problems

they see that we missed in our list. Additional problems cited were: flooding, the need to enforce existing regulations, uncertain knowledge/science, stream access for recreation, and too much development.

Tradeoffs Between the Economy and the Environment

In watershed management, as in most natural resource issues, citizens and managers are often presented with difficult choices between protecting the environment and protecting the economy. Respondents were asked to locate themselves on a seven-point scale regarding tradeoffs between the environment and the economy (Figure 5). Selecting a position left of the midpoint indicated priority should go to the environment, even if there

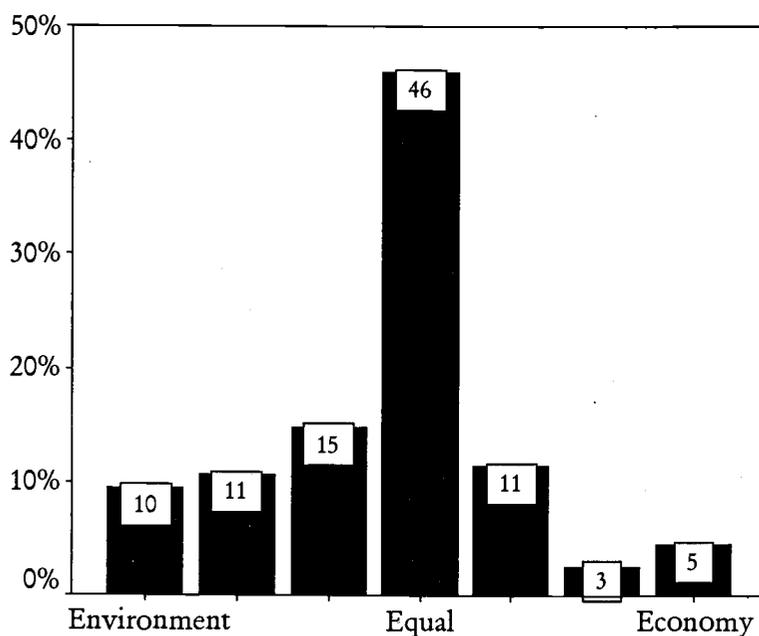


Figure 5. Environment/Economy Tradeoffs: Percent of Respondents that Prioritize the Environment and the Economy.

are negative economic consequences. Choosing a point to the right of the midpoint indicated priority should go to economic considerations even if there are negative environmental consequences. The greatest number (46%) selected the midpoint indicating the environment and the economy should be given equal priority. Overall, 36% believe that environmental protection is more important, while 19% favored economic considerations.

Associations Between Opinions and Respondent Characteristics

To further assess respondent preferences and opinions, cluster analysis was used to sort the responses to opinion statements and watershed problems into related groups. Two distinct clusters emerged for each set (Table 16). In both cases, respondents who agreed with the statements in cluster one tended to disagree with the statements in cluster two. The reverse was also true. In general, individuals who believe that managing watersheds and using conservation practices are important and that a substantial number of specific problems are present in streams do not necessarily think government intervention is bad. Alternatively, those who see relatively few environmental problems and little need for protection measures tend to be against government agency involvement.

Finally, correlation analysis was conducted to determine associations between respondent characteristics and environmental/economic tradeoffs as well as the opinion and problem clusters. Table 17 is arranged to show agreement tendencies. Watershed council members were more likely to favor protection and conservation practices, believe that there are many ecological problems in the watershed, and feel that the environment should be our highest priority and to disagree that government is a problem. In particular, they were more likely to agree that stream conservation projects are beneficial for fish and wildlife habitat,

Table 16. Results of Cluster analysis on Opinion Statements and Perception of Watershed Problems.

Opinions about watershed management	
Cluster 1	<ul style="list-style-type: none"> • Stream and streamside conservation projects are important for fish and wildlife habitat. • Good watershed management increases property value. • Watersheds should be one of our highest local management priorities. • Vegetated buffers should be required along all streams, not just those on forest land. • Statewide stream and streamside rules help people take better care of their land. • The government should protect public resources such as fisheries, water supply and wildlife on private lands as well as on public lands. • I would support community consensus even if it goes against my personal views.
Cluster 2	<ul style="list-style-type: none"> • Scientists are trying to fix problems they don't understand. • The government doesn't care about the rights of rural landowners. • Natural resource policy focuses on punishing landowners rather than helping them. • Endangered species laws should be changed to preserve jobs.
Perception of problems in the watershed	
Cluster 1	<ul style="list-style-type: none"> • Streambank erosion • Water pollution • Herbicide, pesticide and fertilizer runoff into the streams • Low stream water levels during summer • Wasteful irrigation practices • Poor fishing • Lack of streamside vegetation • High stream temperatures • Cattle in the streams • Run-off from residential lawn care
Cluster 2	<ul style="list-style-type: none"> • Too many management agencies involved • Loss of private property rights

Table 17. Bivariate Correlations Between Responses and Respondent Characteristics (Pearson's Correlation Coefficient).

Respondent Characteristics	Opinions Cluster 1	Opinions Cluster 2	Problems Cluster 1	Problems Cluster 2	Tradeoffs
Council membership	Agree*	Disagree*	Agree*	Disagree*	Environment*
Long-term residents	Disagree*	Agree*	Disagree*	Agree*	Economy*
Higher education level	Agree*	Disagree*	Agree*	Disagree	Environment*
Larger parcel size	Disagree*	Agree	Disagree	NS	NS
Females	NS	Disagree*	Agree	Disagree	NS
Higher income level	NS	Agree	Disagree	NS	NS
Older	NS	Agree	NS	NS	NS
Stream ownership	NS	NS	NS	NS	NS
Retired	NS	NS	NS	NS	NS

All correlations shown are significant at $p \leq 0.05$ unless otherwise noted.

*Significant at $p \leq 0.01$

NS = Not significant

that good watershed management increases property value, that watersheds should be a high local management priority, that vegetated buffers should be required along all streams, that statewide rules help landowners take better care of their land, that the government should protect public resources on private as well as public land, and that there are many ecological problems in the watershed (Tables 14 and 15). In contrast, they were more likely to disagree that the government doesn't care about the rights of landowners, that policies focus on punishing rather than helping landowners, that scientists do not understand watershed

problems, that the Endangered Species Act should be changed, and that loss of private property rights and too many management agencies are problems (Tables 14 and 15).

Respondents with higher levels of education also tend to agree with protection/conservation practices, that many problems exist, and that the environment should be our highest priority. They also believe government is not the problem. Another group with tendencies in this direction is women. However, longer term residents and individuals who own larger parcels tend to believe the opposite about practices and problem areas. Other respondent characteristics had little or no association with the variables.

Landowner Concerns

The survey included one open-ended question asking respondents' to state their biggest concerns regarding the management of streams and rivers. There were 194 responses to this question with many respondents mentioning multiple concerns. The top five concerns mentioned were: 1) water quality, 2) problems with the management process itself, 3) flooding, 4) loss of private property rights, and 5) erosion. Table 18 provides a summary of the concerns mentioned by respondents.

Table 18. Summary of Main Concerns Regarding Management of Streams and Rivers in the South Santiam Watershed.

Concerns	Number of Responses
Water Quality	60
Pollution	20
General water quality	16
Herbicide, pesticide and fertilizer runoff	10
Silt	6
Cattle in the stream	4
Temperature	4
Management	52
Need for balance	16
Lack of flexibility	11
Heavy-handed management	7
Lack of local involvement/control	10
Need to use good science	6
Need to use common sense	2
Flooding	44
Loss of Private Property Rights	33
Erosion	23
Fish and wildlife	20
Concern for fish/salmon	13
Degraded fish habitat	4
Wildlife	3
Government	18
Government intrusion	12
Distrust of government	4
Too many agencies	2
Irrigation	18
Low summer water levels	7
General irrigation	3
Lack of water availability	3
Water rights - enforcement and distribution	3
Wasteful irrigation	2
Logging	16
General logging practices	8
Clearcuts	6
Excessive harvest	2
Agriculture	15
Herbicide, pesticide and fertilizer use	8
Dairy waste	3
General agricultural practices	2
Livestock grazing	2

DISCUSSION

The purpose of this study was to examine citizen knowledge of and opinions about watershed management in the Lower South Santiam River, Crabtree Creek and Thomas Creek watersheds in the South Santiam River basin in Oregon. This study took a descriptive approach with the goal of describing various aspects of citizen knowledge and opinions rather than predicting them. The specific objectives were to: 1) Examine the level of knowledge about watershed ecology and management held by private landowners; 2) Identify where landowners get information on watershed management issues; 3) Assess landowner opinions about watershed management and potential problems in the South Santiam basin; 4) Compare the level of knowledge and opinions of watershed council members with those of other landowners; and 5) Measure the association of knowledge and opinions with specific respondent characteristics.

Citizen Knowledge

The findings show many respondents appear to be interested in watershed management issues and most consider themselves at least moderately well informed. Watershed protection and restoration organizers should be encouraged that respondents feel they are informed about watershed management issues. Feeling informed about an issue is often equally important to actually being informed and can significantly impact citizens' behavior and judgments (Pierce et al. 1989). It can also motivate individuals to become more directly involved in resource management regardless of the accuracy of the knowledge possessed (Pierce et al. 1989).

Familiarity and knowledge of technical terms used in watershed management was mixed. The majority of the respondents knew about half the terms, however these tended to be terms that are relatively self-explanatory (streamside buffer, large woody debris, and habitat fragmentation) or terms that have become rather common "buzz words" (biodiversity and riparian zone) in recent years. Not surprisingly the majority had never heard the terms geomorphology or 303(d) list. However, it was surprising that more people had not at least heard the terms anadromous, redd, and refugia with all the attention salmon have been getting over the past few years.

The knowledge scores for the technical terms suggest that improved communication about the terminology, language and core ideas used in watershed planning may help citizens be more effective partners in the decision making process. Language is one of the biggest barriers to effective communication. Watershed management is inundated with jargon and acronyms that can leave even the most informed members of the public reeling. Defining terms and establishing a common language for all parties early in decision processes is not only essential, but is the responsibility of resource professionals in leadership roles (Shindler et al. 1999). For citizens, part of the price for admission to the public debate is knowing something about the issues; but providing the people with the tools necessary to engage in the discussion is the job of public agencies and resource management organizations (Jamieson 1994). Failure to do so can be costly. "When jargon is used without interpretation the best that can happen is the audience will be confused; the worst is that they'll assume it was done deliberately" (Brunson 1992, p. 294). Alternatively, scientists and resource professionals can clearly define terms, explain the reasons and rationale behind their use, and foster both a learning atmosphere and relatively risk-free discussion.

Respondents were able to answer about half of the watershed and environmental knowledge questions correctly. In general, citizens are fairly knowledgeable about basic stream function, most knew that streamside vegetation helps improve water quality, that instream large woody material is beneficial to the stream, and that streams need inputs of sediments and gravels. While these questions only assessed general knowledge and were not designed to probe for in depth comprehension, it appears that most people probably have a fair understanding of the reasons and rationale behind streamside buffers and instream habitat restoration projects. The majority also knew that motor vehicles are the main source of carbon monoxide and could correctly identify the definition of biodiversity and a renewable resource. Collectively, these findings indicate that many respondents are at least aware of important watershed and environmental issues, providing a baseline point of entry should they decide to participate in the discussion.

Although respondents showed a fair understanding of some of the key ecological and technical concepts associated with watersheds and the environment, the number of incorrect answers and not sure responses indicates some clear areas for additional work. When landowners misunderstand or do not know how stream systems function they are unlikely to change their behavior or initiate the kind of voluntary conservation projects encouraged by the Oregon Plan. Areas of particular concern are stream temperature standards, salmon issues, and erosion.

The question about stream temperature standards produced the most not sure responses of any of the knowledge questions. The high degree of uncertainty may be because stream temperature concerns have not received much media attention, particularly west of the Cascades, because stream temperature is not something the public can see or easily verify (van Es et al. 1996) or because stream temperature problems do not directly

affect people. This is an area that watershed information providers may wish to work on, particularly since many of the streams in the South Santiam basin are listed on the 303(d) list for high summer temperatures.

There was also considerable uncertainty about salmon issues. Almost half the respondents were not sure which fish species are listed as threatened in the South Santiam basin and a third were unsure if there were differences between wild and hatchery salmon. Some of the confusion over fish species is understandable given that the Oregon Plan's original focus was on coastal coho and the relatively recent listing of chinook and steelhead. The uncertainty about the differences between wild and hatchery salmon is also understandable because the issue is controversial even in the scientific community. Nevertheless, it seems important for the public to be more involved in the discussion about hatchery fish and the possible consequences to wild salmon runs so they can make their own decisions regarding the value of hatcheries, particularly given the recent uproar over killing hatchery fish. In general, people are more willing to support what they understand (Shindler and Collson 1998). Therefore, increasing public understanding of listed species and hatchery concerns may help build support for the Oregon Plan and motivate citizens' to take part in salmon restoration efforts.

Many respondents were misinformed about the sources of erosion. Forty-one percent incorrectly identified clearcuts as the main cause of erosion while only 23% correctly selected roads. This misinformation may have a significant effect on peoples' views towards logging practices and the current debate over road building. Respondents were also confused about the major source of electricity in the United States. Most of the power in the Pacific Northwest does come from hydropower; therefore, it is understandable that Oregonians would think that hydropower is the main source of electricity in the United States. However,

given the concerns about global warming, the green house effect and air quality it is important that people understand that most of the country is dependent on burning wood and fossil fuels for power. Misinformation can make it difficult for managers and policy makers to address pressing issues and can lead to the misdirection of limited resources.

Not surprisingly, the data clearly indicate that watershed council members are more knowledgeable than landowners in the sample on all the knowledge measures. However, it would be a misrepresentation to conclude that council membership alone results in greater knowledge. The higher level of knowledge likely stems from a combination of several factors. First, watershed council members tend to have higher levels of formal education. Second, it is probable that people who are interested in and knowledgeable about watershed issues are simply drawn to involvement with the watershed council. Third, the hands-on experience and discussion inherent in watershed councils most likely helps increase awareness and knowledge of watershed issues. One would expect people who meet regularly to discuss the issues to be more knowledgeable about the terms and concepts related to watershed management. In the watershed council setting, various stakeholders (landowners, agency personnel, resource users, and local government and timber industry representatives) are able to share information and learn from each other as they discuss problems and possible solutions. In addition, education is one of the main goals of the South Santiam Watershed Council; therefore, they regularly invite scientists and agency personnel to speak at their meetings and include educational materials in their newsletter.

Socio-demographic characteristics also play a role in the level of knowledge held by citizens. Higher levels of watershed and environmental knowledge are strongly associated with five characteristics found in the sample population. The emergence of group membership, greater education, income and male gender all match with previous research on

knowledge of natural resource systems (e.g., Arcury et al. 1986, Sigelman and Yanarella 1986, Van Liere and Dunlap 1980). While longevity of residence seems to be a factor, it is unclear what higher knowledge scores among shorter-term residents imply. It may be that newer residents tend to be more educated and have higher incomes. It is interesting that streamside ownership is not related to knowledge. One might expect that proximity to a river or creek would spur an interest in knowing more about water resources. In any case, these data suggest areas where education and outreach may be effective.

Usefulness of and Trust in Information Sources

Overall, respondents appear to be receiving little information that they consider useful from the area's primary providers. Personal experience was the only source of information considered useful by a majority of the respondents. No other information provider was rated useful by more than 36% of the respondents. Additionally, a substantial number of respondents had no basis for opinion on many of the information sources. Trust in information sources followed a similar pattern. The level of trust in the information providers varied substantially. Several groups were rated higher than others (OSU Extension Service, university scientists, ODF, ODFW) and many respondents were neutral about each information source. There are a variety of possible explanations for this apparent indifference. One plausible one might be that watershed issues simply do not play a big role in peoples' lives; therefore, they have no basis for opinion or are neutral because they are not interested. Another is that the general public may have little if any contact with many of these agencies and organizations so they may not be able to judge whether or not the organizations provide useful or credible information. The finding that 19% of the respondents had no basis for opinion on the usefulness of their own personal experience

seems to imply that at least some of the respondents simply have no experience with watershed management and may not be interested in the issue.

The importance respondents placed on personal experience corresponds with numerous studies throughout the United States (e.g., Shindler et al. 1999, Peters et al. 1997). This reliance on personal experience is particularly important in the Pacific Northwest where citizens are being asked to support new (or at least newly named) strategies such as, ecosystem management, adaptive management, watershed management, and landscape level management. In a region where numerous initiatives have been promoted – and critically debated – citizens have become more cautious with their support, with many waiting to see how well these ideas are carried out (Shindler et al. 1996). A central factor of success for any of these approaches will be the public's observations of and direct personal experiences in their implementation (Stankey and Shindler 1997). This would appear to elevate the future role of watershed councils and other community-based management programs.

Information from the OSU Extension Service was both trusted and found useful by many respondents. These findings support those of other researchers; Kuhns et al. (1997) found that non-industrial private foresters in Indiana and Utah rank the Extension Service as one of the most important sources of information and Smith et al. (1997) found that Oregon coastal residents have a high level of confidence in the Extension Service. Based on these findings it appears the Extension Service may be ideally suited to provide additional public education about watershed issues. This may be particularly encouraging since the OSU Extension Service is currently increasing the number of staff members in its watershed education program.

Unexpectedly, over half the respondents find newspaper and television and radio not particularly useful. These sources of information are usually rated as some of the most

important (Steger et al. 1988, Shindler and Reed 1996, Smith et al. 1997). In particular, previous research by Shindler et al. (1996) in this region indicated much higher ratings for these information providers. The change may represent a shift in central Oregonian's views about the media over the last 4-5 years. This is somewhat discouraging since these are the most visible information sources. Public information providers may wish to further explore this issue.

Environmental groups were ranked near the bottom for both usefulness and credibility as information providers. This is not particularly unexpected; other studies in Oregon related to forest management and salmon restoration have found similarly low levels of interest in information from environmental groups (Shindler and Reed 1996, Smith et al. 1997). In addition, the South Santiam watershed experienced intense conflict between environmental groups and the timber industry over the spotted owl listing in the early 1990s. The environmental movements cries of "Save an Owl, ban logging" were met by the timber industry's pleas to "Save a logger, eat an owl" (Schaleger, nd). It is likely this controversy left many residents with bitter feelings towards environmental groups. However, studies in other regions of the country have found relatively high levels of trust in environmental groups (Steel et al. 1993-93, Brunson and Steel 1994, Peters et al. 1997).

It is interesting that almost half the respondents rated relatives, friends, and neighbors as not useful to only slightly useful sources of information and most were neutral on whether or not they trusted them. This may indicate that watershed issues simply are not talked about in everyday conversation. Habron (1999) found that rural Oregonians do not talk about land management issues with their friends and neighbors. For many landowners land management decisions are closely related to private property rights issues and talking

about management practices could be construed as attempting to tell others what to do and infringing on their rights.

Not surprisingly, over half the respondents had no basis for opinion about the usefulness of information from the South Santiam Watershed Council (SSWC). In a separate question looking at awareness of the council, only 23% of the respondents were familiar with the work of the council. This may be partly because it is a relatively new organization and encompasses a large geographic area. In addition, the rural nature of the region makes outreach particularly difficult. However, in the past year the council has begun more concentrated community outreach that may increase their visibility in the watershed.

For several of the information sources there were relatively large gaps between the percent of respondents that find them trustworthy and those that find them useful. For example, university scientists are one of the most trusted sources of information, but few respondents considered them useful sources. It is noteworthy that the majority of respondents had no basis for opinion on information provided by university scientists. It may be that many citizens do not have either an interest in or ready access to information produced by university scientists. This information is most often published in scientific journals and when, or if, it trickles down to the public it usually does so through other providers, i.e. the media, management agencies, or the Extension Service. In addition, scientific language can be very technical and complex which can create an insurmountable barrier for many citizens (Brunson 1992). As for the high level of trust citizens have for scientists one possible explanation may be that society has traditionally thought of scientists as "experts." Another explanation could be that the public has had limited contact with scientists and citizens may be willing to trust them until given a reason otherwise. Some of the other management agencies and organizations (e.g., ODFW, ODF, SSWC) may also be

experiencing high credibility and low usefulness due to lack of contact with the public. In local settings, contact with these organizations may not be particularly relevant. However, as decision making models seek greater citizen involvement, improved methods for communicating messages from specific sources will be necessary.

Other researchers have found specific types of communication to be more successful than others for reaching the public and increasing the usefulness and credibility of outreach and education efforts. One method is to use more personal forms of communication, such as group interaction and dialogue, in which information flows back and forth between all participants (Yankelovich 1991). Education is more likely to occur in small group settings such as watershed council, professional organization, user group, and civic group meetings that stress group interaction rather than simple information provision. These types of interactive exchange are more effective than formal presentations and written comments (Jamieson 1994, Shindler et al. 1999, Shindler and Neburka 1997). It is also important to remember that personal experience and evaluation greatly influence public judgments. For most citizens, "seeing is believing" (Shindler and Collson 1998). Demonstration sites, field tours and interactive GIS displays provide an opportunity for citizens to see management practices with their own eyes. The Deschutes National Forest has used demonstration plots near residential areas to introduce the use of fire as a management tool to residents (Shindler and Collson 1998). The media may also be useful; despite its low ratings for usefulness and credibility it is still the most available and visible source of information for most people. Having information inserts, sidebars or stories by trusted information providers – such as the OSU Extension Services' insert, "A Snapshot of Oregon Salmon," that was distributed in newspapers statewide in the fall of 1998 – may help increase public awareness and knowledge.

Overall, some of these findings may be encouraging, particularly for the more highly rated public organizations (i.e., OSU Extension, university scientists, ODF, ODFW) whose basic role includes information provision. Although most people currently do not use these sources, the credibility of these agencies suggests that an increase in or refocus of their outreach efforts may be successful. The South Santiam Watershed Council also appears to hold promise locally. While the council is currently relatively unknown in the watershed, almost half the respondents indicated that they trust the council and only a small fraction voiced distrust. This suggests there may be potential for the council to become a leader in raising awareness and providing information about watershed management issues; however, many citizens are likely to reserve judgment until they see action. One advantage is that most watershed council members are fellow landowners and citizens may be more inclined to trust and work with their peers than agency staff or scientists.

Opinions About Watershed Management

Findings indicate that most respondents agree that good watershed management is beneficial to both humans and the environment, but there is much less agreement on how decisions are made and peoples' relationships with the government agencies that implement management decisions. There is substantial opposition to any form of government intervention or loss of private property rights. Many respondents seem to feel there is a lack of concern for landowners, particularly those in rural areas. These feelings of neglect and the strong support for private property rights probably contribute to the lack of support for a community consensus process. While landowners are clearly concerned about watershed issues, feelings of resentment and distrust of government can make it difficult for many agencies to connect with landowners. This provides an opportunity for citizen-led, non-

governmental organizations, such as watershed councils, to provide guidance, education, and assistance to landowners interested in watershed management issues.

Respondents also exhibited some degree of uncertainty about whether or not scientists understand the problems they are trying to fix. This uncertainty is likely fueled in part by disagreements within the scientific community. For many environmental issues citizens are hearing one thing from one group of scientists and the opposite from another group. While disagreement is not uncommon in the scientific community and often leads to better data in the long run, it only increases the public's doubt in the usefulness of scientific information. Changes in the scientific understanding of an issue also contribute to public skepticism. Landowners, particularly those involved in the timber industry, remember being told to clean all debris from streams in the 1960s; and now they are being told to leave it in, or even to add more. It is likely the public will remain skeptical of scientific information that they do not understand or that goes against their common sense.

Moreover, if neutral responses are a sign of uncertainty, there is considerable indecision, or perhaps skepticism, about watershed management. Where strong conflicting opinions about watershed management programs exist, reaching agreement is difficult. However, in this case the high percentage of neutral responses may indicate that opinions are still malleable and may be influenced with additional information (Brunson and Steel 1994). In such cases, raising awareness and increasing knowledge about management issues frequently leads to more positive attitudes and encourages voluntary conservation efforts (Shelby and Speaker 1990, Bright and Manfreda 1997). People need information they perceive as reliable in order to form judgments about watershed management. However, they also need to be able to determine the relevance of the information, work through the alternatives and tradeoffs, and decide where they stand on the issue (Yankelovich 1991,

Brunson and Steel 1994). Community-based management organizations and agency public involvement programs can help provide these opportunities.

As expected, people want a balance between the economy and the environment. They want clean water and healthy streams along with a strong, diverse economy. Several other studies support these findings (e.g., Smith et al. 1997, Shindler and Reed 1996). One potential problem with this question is that respondents were not actually forced to make a choice between alternatives. It is easy to say you want balance when you do not have to choose. However, in the real world achieving balance often means that both sides must sacrifice. Without sufficient information and an understanding of the consequences, the public may not be willing to sacrifice either environmental quality or a healthy economy when the time comes for tradeoffs.

Respondents' perception of problems in the watershed and their concerns were very closely related. Water quality, erosion, private property rights, and frustration with the management process were the most frequently cited issues in both questions. Flooding was the one issue that was not included on the survey that was of great concern to respondents.

Two problem areas that many respondents did not recognize merit further discussion. First, while several streams in the South Santiam basin are listed on the 303(d) list for high summer stream temperatures, only 39% of the respondents recognized high stream temperatures as a problem. This may be because of the public's lack of familiarity with the stream temperature standard, only 30% of the respondents were able to correctly answer the watershed knowledge question about the temperature standard. However, even the majority of the council members only slightly agreed that stream temperature is a problem in the watershed even though the 303(d) temperature listing is a major topic of discussion at watershed council meetings. This may be due to skepticism regarding the validity of the

stream temperature standard. Many watershed council members believe that summer stream temperatures in the South Santiam basin were historically high because of the basic geography and geomorphology of the area.

Second, according to a watershed assessment of the South Santiam basin by Bischoff and others (2000), much of the lower basin is lacking riparian buffers or only has narrow, sparsely vegetated buffers; however, only 39% of the respondents thought that lack of streamside vegetation was a problem. Findings from the knowledge and opinion questions indicate that respondents seem to recognize the importance of streamside buffers. For example, the majority thought that buffers should be required along all streams and most knew that buffers help improve water quality. This discrepancy suggests that respondents may not know what a streamside buffer should look like or that they are unfamiliar with conditions in the watershed.

These findings indicate there is some confusion and a lack of awareness about some watershed problems. Before any management action can be taken to improve these problems the public must be made aware the problems exist along with their causes and consequences (Rhoades et al. 1999, Yankelovich 1991, Kuhns et al. 1998). Watershed information providers can use these findings to target education and outreach programs to areas where knowledge and problem recognition are low.

Watershed council members generally have more positive opinions towards watershed management. They are more likely to agree that watershed management is important and less likely to feel that government and natural resource policy are problems. In addition, they are more likely to see ecological problems in the region and less likely to see agencies and loss of property rights as big issues. They also prioritize the environment over the economy. While this study did not attempt to evaluate watershed councils, from the

findings it appears that these organizations may hold promise given today's climate of mandatory public participation and the Oregon Plan's emphasis on voluntary action. Watershed councils are logical places to bring various stakeholders together to share ideas, generate discussion, and exchange information; thus they can provide forums for working through problems and fostering feelings of local control in resource management decisions. However, given the strong sentiment that there are already too many management agencies involved it seems essential that watershed councils not be seen as simply another agency.

Watershed council membership, education, and length of residence were strongly associated with opinions about watershed management and environment/economy tradeoffs. Similar to the findings of other researchers (e.g., Arcury et al. 1986, Van Liere and Dunlap 1980), council membership and higher levels of education were associated with more positive attitudes towards conservation and environmental protection. While few studies have examined the effect of length of residency on attitudes, our findings support those of Reading et al. (1994) who found that longer term residents were more likely to support commodity uses of resources and protection of individual rights and were less supportive of environmental protection measures.

CONCLUSION

The current shift towards more community-based resource management and greater public involvement means managers and scientists will likely be working more closely with the public. The findings from this study provide valuable insights into landowners' knowledge about watershed management issues, the agencies, and organizations they feel provide useful and credible information, and their opinions about watershed management.

Although respondents are concerned about watershed issues and understand that there are some ecological problems in the watershed, their willingness to buy-in to organized conservation programs may be compromised by the perception that involvement may end up being costly or punitive. Across the country, citizens are tired of bureaucratic systems and feeling the effects of restrictive policies (Griffin 1999, Kenney 1999). This situation does not bode well for government agencies attempting to gain support for landscape level policies. Citizen-based organizations, such as watershed councils, may hold greater appeal for a majority of private landowners. The short history of these organizations indicates they may be valuable players in solving the gridlock between citizens and government agencies. They appear to provide a useful forum for discussion, learning and working through complex natural resource issues.

The success of voluntary and community-based programs largely depends on landowners' willingness to participate. In turn, willingness is heavily influenced by people's overall opinions about watershed management and trust in the organizations providing leadership. Achieving the balance and trustworthy relationships people prefer will require the provision of information that is credible and relevant to private landowners' concerns, plus a demonstrated set of interaction skills that legitimately encourage landowner participation.

These findings will help watershed management agencies and organizations better understand the knowledge, preferences, and concerns of the private landowners. They can also provide a basis for developing ecologically sound and socially acceptable solutions to watershed problems.

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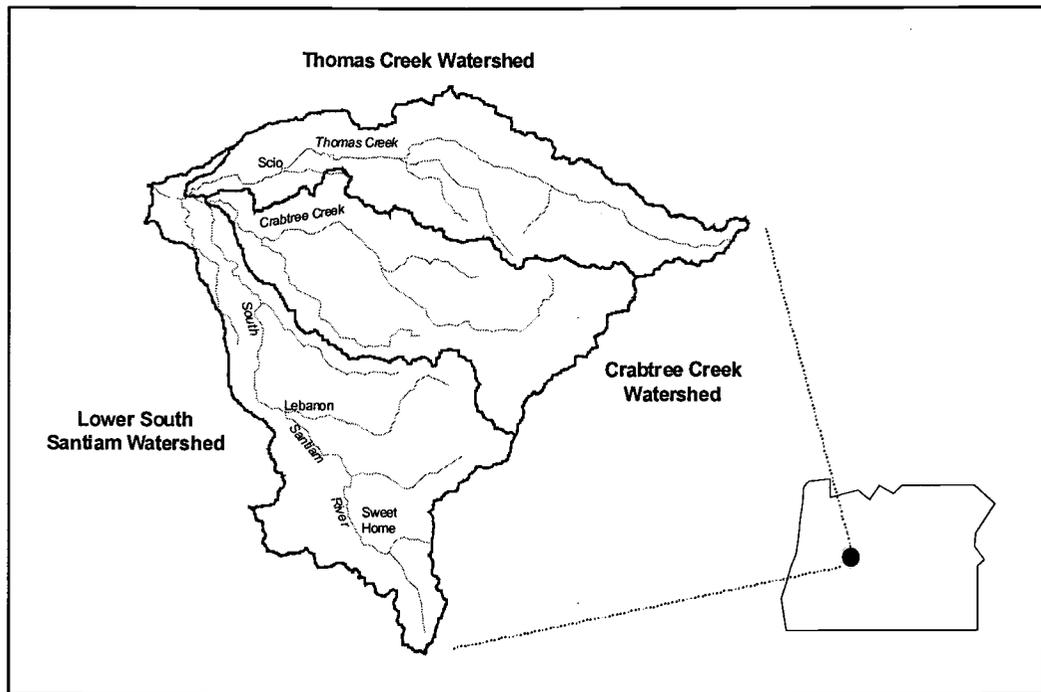
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APPENDICES

Appendix A: Summary Of Survey Responses

Landowner Perspectives on Watershed Management: Views from the Lower South Santiam, Crabtree Creek, and Thomas Creek Watersheds



What is a watershed? A watershed is an area of land that collects rain and snow and drains much of it into a stream or river. It includes everything from the stream to the ridge tops.

What is watershed management? Watershed management considers how decisions for one resource affect other resources and the ecological functions of the watershed. Logging, ranching, farming, recreation, water quality, urban growth, fish and wildlife habitat, dams, and mining are just a few of the resource issues involved in managing watersheds.

We are interested in landowners' perspectives on watershed management issues. Please respond to all the questions, even if you are not familiar with watershed management. For some questions you may have no experience or no basis for opinion. It is important that you let us know this as well.

Please use the back of the survey form or additional paper to comment on any questions in the survey that you feel deserve more attention. Your answers and comments are strictly confidential.

First we would like to know about your interest in watershed management issues.

1. How much attention do you give to watershed management issues? Please check the box most closely matching your answer.

Not much attention		A moderate amount of attention		A great deal of attention
21%	<input type="checkbox"/>	14%	<input type="checkbox"/>	31%
1		2		3
				18%
				<input type="checkbox"/>
				4
				17%
				<input type="checkbox"/>
				5

2. We would like to know how long people have been paying attention to watersheds. How many years have you given attention specifically to watershed management issues?

25%	<input type="checkbox"/>	Not applicable (do not give them much attention)
13%	<input type="checkbox"/>	1-3 years
20%	<input type="checkbox"/>	4-7 years
10%	<input type="checkbox"/>	8-12 years
32%	<input type="checkbox"/>	More than 12 years

3. How well informed would you say you are about watershed issues? Please check the box most closely matching your answer.

Not very well informed		Moderately well informed		Extremely well informed
27%	<input type="checkbox"/>	20%	<input type="checkbox"/>	34%
1		2		3
				16%
				<input type="checkbox"/>
				4
				4%
				<input type="checkbox"/>
				5

4. How useful have these sources of information been to you? By useful we mean sources that you pay attention to and that provide good information about watershed management. If you have not had experience with a particular source, please indicate "no basis for opinion".

	No basis for opinion	Not useful	Slightly useful	Useful	Very useful
Information from federal agencies:					
a. Bureau of Land Management	49%	7%	20%	21%	3%
b. Forest Service	42%	7%	18%	29%	5%
c. National Marine Fisheries Board.....	60%	13%	15%	11%	2%
Information from state agencies:					
d. Department of Forestry.....	38%	6%	21%	30%	5%
e. Department of Fish and Wildlife.....	38%	8%	20%	28%	6%
f. Department of Environmental Quality.....	42%	16%	21%	19%	2%
Information from industry groups					
g. Forest.....	37%	8%	19%	29%	8%
h. Agriculture	36%	6%	25%	27%	6%
i. Fishing.....	46%	8%	21%	22%	3%
j. Courses in school (college or K-12).....	60%	6%	12%	17%	4%
k. Personal experience (farming, logging, recreation, etc.).....	19%	3%	17%	35%	26%
l. Information from environmental groups.....	31%	24%	26%	15%	5%
m. Information from local community organizations	36%	10%	26%	21%	6%
n. Information from the South Santiam Watershed Council	55%	9%	11%	14%	11%
o. Newspaper reports.....	17%	13%	38%	29%	3%
p. TV and radio reports.....	22%	15%	39%	21%	3%
q. OSU Extension service	41%	8%	17%	26%	9%
r. Relatives, friends, neighbors.....	23%	12%	34%	28%	4%
s. Information from university scientists.....	54%	10%	15%	16%	5%
t. Other _____	N/A	0%	5%	32%	63%

In this section we want to know your opinions on specific watershed management issues. For each question please check the box that most closely matches your view.

5. Listed below are different opinions people may hold about watershed management. Given your own experience do you agree or disagree with these statements?

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a. Stream and streamside conservation projects are important for fish and wildlife habitat.....	1%	3%	14%	47%	35%
b. Scientists are trying to fix problems they don't understand.	6%	16%	32%	31%	15%
c. Good watershed management increases property value	1%	7%	25%	50%	17%
d. Endangered species laws should be changed to preserve jobs.....	15%	22%	26%	25%	12%
e. The government should protect public resources such as fisheries, water supply and wildlife on private lands as well as on public lands	18%	25%	21%	27%	9%
f. The government doesn't care about the rights of rural landowners	5%	14%	30%	32%	21%
g. Natural resource policy focuses on punishing landowners rather than helping them.....	6%	15%	32%	32%	15%
h. Vegetated buffers should be required along all streams, not just those on forest land.....	6%	17%	24%	33%	20%
i. Watersheds should be one of our highest local management priorities.....	2%	13%	31%	39%	15%
j. Statewide stream and streamside rules help people take better care of their land.....	6%	23%	26%	39%	7%
k. I would support community consensus even if it goes against my personal views.....	8%	29%	33%	27%	3%

6. Listed below are items mentioned as potential problems when people talk about watershed management. Do you agree or disagree that each of the following items is a problem in the WATERSHED where you live? This question refers to the entire watershed, not just your property.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a. Lack of streamside vegetation.....	4%	31%	26%	31%	8%
b. Poor fishing.....	4%	19%	38%	34%	6%
c. Low stream water levels during summer	2%	24%	31%	35%	9%
d. Run-off from residential lawn care	7%	28%	35%	21%	8%
e. Streambank erosion.....	2%	13%	28%	43%	14%
f. High stream temperatures.....	3%	21%	43%	25%	8%
g. Water pollution	2%	18%	27%	36%	18%
h. Cattle in the streams.....	7%	27%	34%	22%	11%
i. Logging practices.....	7%	21%	33%	26%	13%
j. Wasteful irrigation practices.....	4%	18%	37%	29%	12%
k. Herbicide, pesticide and fertilizer runoff into the streams	2%	16%	30%	34%	18%
l. Loss of private property rights.....	3%	12%	30%	31%	23%
m. Too many management agencies involved.....	1%	5%	28%	32%	34%

If we have missed any, please tell us here: _____

7. Watershed management involves difficult trade-offs between environmental and economic considerations. **Where would you locate yourself on the following scale concerning these issues?** Please check the box most closely matching your answer.

The highest priority should be given to protecting environmental conditions even if there are negative economic consequences.			Environmental and economic factors should be given equal priority.	The highest priority should be given to economic considerations even if there are negative environmental consequences.		
↓			↓	↓		
10%	11%	15%	46%	12%	3%	5%
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7

There has been a lot of discussion lately about watershed management. However, many people are unfamiliar with the terms managers and scientists use. Please help us understand how familiar private landowners are with these watershed management concepts and terms by giving your single best response to each question below.

8. **How familiar are you with the following watershed management terms?**

	I know the meaning of the term	I've heard the term, but I don't know the meaning	I've never heard the term
a. 303(d) list	12%	11%	77%
b. Riparian zone	55%	15%	30%
c. Anadromous	32%	17%	51%
d. Biodiversity.....	58%	19%	23%
e. Geomorphology.....	25%	26%	50%
f. Non-point source pollution.....	45%	26%	29%
g. Large woody debris.....	79%	12%	9%
h. Habitat fragmentation	53%	24%	23%
i. Streamside buffers	77%	13%	10%
j. Refugia.....	13%	17%	70%
k. Redd	20%	13%	66%

9. Are you aware of the South Santiam Watershed Council?

- 32% No, I've never heard of it
 34% I vaguely remember hearing the name, but I don't know what they do
 20% I'm familiar with their work, but I'm not a member
 14% Yes, I'm a member

10. Please answer the following questions to the best of your ability by indicating whether the statements are generally true, generally false, or you're not sure.

	Generally True	Generally False	Not Sure
a. Most water pollution today comes from factories.....	24%	<u>49%</u>	27%
b. Vegetation along stream banks helps improve water quality.	<u>89%</u>	3%	9%
c. Large woody material (logs, trees, etc.) in streams blocks fish passage and should be removed whenever possible.	9%	<u>81%</u>	10%
d. There are no biological differences between wild salmon and hatchery salmon.	18%	<u>52%</u>	31%
e. Healthy rivers require inputs of sediment, gravel, and small rocks.	<u>58%</u>	15%	27%

11. The biggest source of erosion from forested land is... (circle the best answer).

a. Clearcuts	b. Roads	c. Unharvested forest	d. Natural geologic activity	e. Not sure
41%	<u>23%</u>	1%	19%	16%

12. State standards say that stream temperature in salmon producing streams should not exceed

___ degrees Fahrenheit to ensure healthy habitat for fish (circle one).

a. 78	b. 64	c. 50	d. Not sure
2%	<u>30%</u>	19%	49%

13. Streams and streamside areas are most altered in... (circle the best answer).

a. Urban areas	b. Farm land	c. Forest land	d. Range/Pasture lands	e. Not sure
<u>55%</u>	5%	6%	9%	25%

14. What fish species is/are proposed for listing as threatened species under the Endangered Species Act in the South Santiam watershed (please circle ALL that apply)?

- a. Chinook salmon b. Coho salmon c. Bull Trout d. Steelhead trout e. Not sure
- 40% 30% 19% 38% 43%

This next section looks at familiarity with general, ecological terms and concepts. Many people do not know the answers to these questions, so if you don't know the answer please mark Not Sure.

15. There are many different kinds of animals and plants, and they live in many different types of environments. What word is used to describe this idea?

- a. Multiplicity b. Biodiversity c. Socio-economics d. Evolution e. Not sure
- 1% 72% 1% 1% 26%

16. Which of the following is a renewable resource?

- a. Oil b. Iron ore c. Trees d. Coal e. Not sure
- 0% 0% 97% 0% 3%

17. Most electricity in the United States is generated from what source of power?

- a. Nuclear b. Burning coal, oil and wood c. Solar d. Hydroelectric dams e. Not sure
- 1% 29% 0% 57% 13%

18. What is the most common reason that plant and animal species become extinct?

- a. Predation b. Habitat loss c. Competition d. Natural disasters e. Not sure
- 4% 67% 8% 5% 16%

19. What is the largest source of carbon monoxide in the United States?

- a. Factories b. Motor vehicles c. Home heating d. Forest fires e. Not sure
- 5% 78% 0% 1% 16%

Earlier we asked which organizations provided useful information about watershed management. Now we would like to know who you trust to give you credible information about watershed management issues. This means information that you feel is reliable.

20. Who do you trust to give you credible information about watershed management issues? Please check the box that most closely matches your response.

	Distrust Completely	Distrust Somewhat	Neutral	Trust Somewhat	Trust Completely
a. University researchers and scientists ...	5%	13%	23%	51%	9%
b. Forest industry groups	6%	18%	29%	44%	3%
c. Agriculture industry groups	5%	18%	33%	40%	4%
d. Environmental groups.....	26%	29%	23%	19%	3%
e. Local community leaders	5%	22%	43%	30%	1%
f. OSU Extension Service	2%	5%	24%	54%	15%
g. South Santiam Watershed Council	3%	3%	47%	38%	10%
h. Relatives, friends, neighbors.....	3%	7%	53%	33%	5%
i. Television and radio	10%	27%	42%	20%	1%
j. Newspapers.....	9%	27%	38%	25%	0%
k. Oregon Department of Fish and Wildlife.....	7%	11%	25%	52%	6%
l. Oregon Department of Forestry.....	4%	9%	28%	52%	7%
m. Oregon Dept. of Environmental Quality	14%	21%	30%	33%	2%
n. Governor's Watershed Enhancement Board	14%	16%	42%	24%	4%
o. U. S. Bureau of Land Management	7%	15%	37%	38%	3%
p. U. S. Fish and Wildlife	7%	15%	29%	44%	4%
q. U. S. Forest Service	5%	15%	32%	45%	4%
r. National Marine Fisheries Service	8%	11%	44%	34%	2%

The survey is almost complete! In order to check how well this survey represents all landowners we need to ask you some questions about yourself. All responses will remain strictly confidential.

21. a. Do any streams run through your property? Yes - 42%
 No - 58%

b. If yes, please list their names if they are named? _____

22. How long have you lived in Linn County? 30 years.

23. What is your ZIP code? _____

24. How many acres do you own in these watersheds (please refer to the map on the front of the survey form)?

- | | | | | |
|---|------------------------------------|-------------------------------------|--------------------------------------|---|
| <input type="checkbox"/> Less than 1 acre | <input type="checkbox"/> 1-2 acres | <input type="checkbox"/> 3-10 acres | <input type="checkbox"/> 10-50 acres | <input type="checkbox"/> More than 50 acres |
| 18% | 10% | 24% | 24% | 23% |

25. How many acres of your property do you use for each of the following land uses?

Mean Acreage

56 Agriculture (not livestock)

2 Residential

32 Pasture/rangeland

753 Forestry/small woodlot

10 Other _____

(please specify)

26. Are you Male - 68% or Female - 32%

27. How old are you? 18-24 25-35 36-48 48-65 65+
- | | | | | |
|----|----|-----|-----|-----|
| 0% | 7% | 28% | 38% | 27% |
|----|----|-----|-----|-----|

28. What is the highest level of formal education that you have completed?

- | | |
|-----|--|
| 7% | <input type="checkbox"/> Some high school |
| 22% | <input type="checkbox"/> High school graduate |
| 29% | <input type="checkbox"/> Some college |
| 9% | <input type="checkbox"/> Associate's degree |
| 14% | <input type="checkbox"/> Bachelor's degree |
| 7% | <input type="checkbox"/> Some graduate course work |
| 12% | <input type="checkbox"/> Graduate or professional degree |

29. In what industry does your household derive its primary income? (if retired, check both retired and the industry in which you worked previously).

- 38% Retired
 11% Construction
 14% Agriculture
 11% Public Administration or Government
 18% Manufacturing and Processing
 18% Forestry Industry
 18% Business and Professional Services
 1% Finance, Insurance or Real Estate
 6% Education or Academics
 1% Conservation
 4% Homemaker
 6% Retail
 1% Tourism or Recreation
 7% Other _____
 (please specify)

30. What is your current annual household income before taxes?

- | | | | |
|-----|--|-----|--|
| 2% | <input type="checkbox"/> Under \$5,000 | 24% | <input type="checkbox"/> \$35,000 - \$49,999 |
| 3% | <input type="checkbox"/> \$5,000 - \$9,999 | 24% | <input type="checkbox"/> \$50,000 - \$74,999 |
| 3% | <input type="checkbox"/> \$10,000 - \$14,999 | 8% | <input type="checkbox"/> \$75,000 - \$99,999 |
| 8% | <input type="checkbox"/> \$15,000 - \$24,999 | 7% | <input type="checkbox"/> \$100,000 - \$149,000 |
| 18% | <input type="checkbox"/> \$25,000 - \$34,999 | 3% | <input type="checkbox"/> \$150,000 or more |

31. What are your biggest concerns about management of streams and rivers in the Lower South Santiam, Crabtree Creek and Thomas Creek watersheds?

Thank you for taking the time to complete this survey!

Please use the back of the survey form or additional paper to comment on any questions or issues that you think deserve more attention.

Appendix B: Main Themes From Exploratory Interviews

Main Themes From Exploratory Interviews

Ten exploratory interviews were conducted during the summer of 1998. Five of the interviews were with active members of the South Santiam Watershed Council; three were with inactive members; one was with the watershed council coordinator and one was with a nonmember who had worked on a project with the council. The interviewees represented a variety of different land uses, including non-industrial private forestry, rural residential, conservation, recreation, and agriculture. The interviews were semi-structured and included questions on watershed management concerns; benefits associated with streams and the surrounding areas; and experiential and technical knowledge about local streams. All interviews were confidential therefore any quotes used in this document will remain anonymous.

The main themes that emerged from the interviews are shown in Table 1. Within the main themes, the three that were mentioned most often were private property rights, frustration with current management practices, and water quality concerns. Frustration with current management practices includes opposition to the lack of flexibility in rules and regulations and the use of "big stick" management, disappointment with the lack of local involvement, and a belief that natural resource policy places a disproportionate burden on rural landowners. These three key themes will be discussed in more detail below.

Key Themes

This section presents a more detailed discussion of the key themes from the interviews. For each theme I will summarize the comments I received and allow the landowners to speak for themselves through quotes from the interviews.

Table 1. Main Themes from Exploratory Interviews.

Main Themes	Issues
Private property rights:	Need to protect private property rights Compensate for loss of rights
Water quality:	To much pesticide/fertilizer runoff Need to measure current conditions, data is old Pollution not a problem, long distance between residences Streams were never as cold as they want them
Frustration with management practices:	One rule doesn't fit all Lack of flexibility "Big stick" management/landowners afraid to ask for help Educate and assist rather than attack
Local knowledge	People making the rules don't know the land Officials don't listen to local people
Rural burden:	Rural people punished while urban areas do what they want
Forestry:	Lack of enforcement of rules/regulations Foresters singled out
Fish:	What's the big deal about salmon, especially wild salmon Need to increase hatchery production Real problem is in the ocean
Science:	Need to use verifiable science Managers/scientists don't really understand problem

Private Property Rights

A common theme throughout the interviews was that private property rights are being eroded. Landowners feel that they are losing their constitutional rights and their freedom.

"I guess we feel like if we own a piece of ground we have the right to say who and what should be done on it and the public has a different idea."

"We own private property in a country that you didn't share property rights with anybody but your own because you pay taxes on it."

"As population grows those rights [private property] diminish. As much as possible individual property owners need rights guaranteed."

"They're infringing terribly, terribly with that riparian law."

While the landowners interviewed generally believe that compensation is necessary for any loss of property rights, the infringement is still not acceptable to most.

"The government is obligated to compensate for takings."

"I'd be concerned with the arbitrary taking even with compensation it might not be enough."

"It [compensation] would encourage people, but I'd be concerned about the strings attached."

Frustration with Management Practices

The interviewees were frustrated with several aspects of current management. A number of the interviewees expressed aversion to "big stick" management that focuses on punishing landowners rather than helping and educating them.

"... if managers would manage without the club. So you could call for help and not be afraid to get clobbered... You try to do the right thing by asking for help but then they get you and punish you by forcing you to do expensive restoration."

"We have to educate and assist rather than attack"

Many interviewees also feel that current rules, regulations and management practices are too rigid and impose a one-size fits all approach. They would prefer a more flexible approach that considered the individual characteristics of the landscape.

"We think that each place is individual and each place reacts to good management and that management is different on each piece of land."

"...it isn't black and white and . . . the rules, there's no bending"

"... they lack flexibility, new ideas, and maybe some active experimentation."

"There is no one rule to cover everything."

Landowners were also concerned that management and regulatory agencies and policy makers ignored local knowledge and experience. They believe that they know the lands best and that they are the best equipped to manage them.

"We don't want to do something that is harmful to other people. Not very many landowners do, because their living depends on it, so all these rules and regulations are made by people that haven't the faintest idea of what they're doing and when you talk to them they don't know"

"Officials won't listen to people that have been there for 20 years. . . some of the old timers that have been out there."

"... some happy go lucky decides these rules and they don't fit."

Several of the interviewees feel that rural landowners are being singled out while more urban areas were not making any sacrifices. They believe that rural landowners bear a disproportionate share of the burden of watershed restoration and saving salmon.

"If we're kicking in so much, what's the guy in Portland kicking in?"

"We're struck by the irony that foresters have to protect riparian areas but people with private homes can clear cut it and mow it and make a lawn clear to the stream; fertilize, and spray right down to the stream but if it's zoned forest you can't do anything."

"... I can't spray herbicides on the weeds to make sure I get trees growing but the Portland Airport dumps its deicing fluid in the Columbia."

"The Governor doesn't want to disturb Portland and other urban areas."

Water Quality

Lastly, landowners were concerned with water quality. Many of the interviewees expressed concern about herbicide, pesticide and fertilizer runoff from agricultural operations and residential lawn care.

"...people don't realize that a lot of the pollution in the river comes off of city lawns and not off the farmers fields. Farmers get a bad rap I think"

"... I'm afraid they're putting way too much pesticides and fertilizers into streams."

Other landowners did not think pollution was a problem.

"I don't think it's been polluted because you see upstream from us it's a long way to the next residence. ... so we wouldn't have any runoff from any pollution up there and all it is, is just like here, they're running cattle."

Many of the interviewees are skeptical about the basis of Oregon's stream temperature regulations. Several of the streams in the South Santiam watershed are listed on the Oregon Department of Environmental Quality's (ODEQ) 303(d) list for high summer stream temperatures. However, many of the landowners believe that the streams in the South Santiam were historically warm in the summer months.

"... the stream temperature is a one number fits all and that isn't true, I mean it can't be."

"The South Santiam prior to the dams was a warm water algae pool mess, that they couldn't do anything with but it still had huge salmon runs."

"I don't think anyone has enough data to really say we need certain temperatures for salmon and steelhead to survive."

"... this stream [Hamilton Creek] has always been very warm because the water comes from local sources rather than snow pack."

Summary

The landowners interviewed are concerned about the loss of private property rights. They are looking for change in management practices. They want more flexibility in rules and regulations, meaningful local involvement in management, and less punitive enforcement practices that focus more on education and assistance. Interviewees also believe that it is time urban areas start carrying their share of the burden of salmon restoration. Lastly, many interviewees are concerned about water quality. They feel that herbicide, pesticide and fertilizer use needs to be curbed both on agricultural lands and residential properties. They are also skeptical of Oregon's stream temperature standards and believe additional research is needed on historical stream temperatures.

Appendix C: Comparisons Between Watershed Council Members And Landowners

Table 2. Respondent Characteristics.

Respondent Characteristic	Watershed Council Mean	Landowner Mean	<i>t</i>	Significance (2-tailed)
Stream Ownership ^a	.60	.39	-2.432	.018
Years Residence	21.64	31.23	2.794	.006
Acres Owned ^b	3.14	3.25	.370	.713
Gender ^c	1.29	1.32	.352	.725
Age ^d	3.83	3.87	.246	.806
Level of Education ^e	5.33	3.46	-7.904	.000
Income ^f	6.71	5.96	-2.274	.024
Retired ^g	.35	.39	.497	.620

^a1 = Own stream, 0 = Do not own stream

^b1 = < 1 acre, 2 = 1-2 acres, 3 = 3-10 acres, 4 = 10-50 acres, 5 = >50 acres

^c1 = Male, 2 = Female

^d1 = 18-24, 2 = 25-35, 3 = 36-48, 4 = 49-65, 5 = 65 +

^e1 = Some high school, 2 = High school graduate, 3 = Some college, 4 = Associate's degree, 5 = Bachelor's degree, 6 = Some graduate course work, 7 = Graduate or professional degree

^f1 = < \$5,000, 2 = \$5,000-\$9,999, 3 = \$10,000-\$14,999, 4 = \$15,000-24,999, 5 = \$25,000-34,999, 6 = \$35,000-49,999, 7 = \$50,000-74,999, 8 = \$75,000-99,999, 9 = \$100,000-149,000, 10 = >150,000

^g1 = Retired, 0 = Not retired

Table 3. Attention and Level of Information Regarding Watershed Management Issues.

Question	Watershed Council Mean	Landowner Mean	<i>t</i>	Significance (2-tailed)
How Much Attention do you give to watershed management issues? ^a	4.22	2.69	-9.730	0.000
How many years have you given attention specifically to watershed management issues? ^b	3.93	2.93	-5.303	0.000
How well informed would you say you are about watershed issues? ^c	3.78	2.28	-10.041	0.000

^a 1 = Not much, 2 = Moderate amount, 3 = Great deal

^b 1 = Not applicable, 2 = 1-3 yrs., 3 = 4-7 yrs., 4 = 8-12 yrs., 5 = More than 12 yrs.

^c 1 = Not informed, 3 = Moderately informed, 5 = Very informed

Table 4. Usefulness of Information Sources (No basis for opinion responses are not included in the analysis).

Information Source	Watershed		<i>t</i>	Significance (2-tailed)
	Council Mean	Landowner Mean		
SSWC	3.55	2.19	-9.531	0.000
Personal experience	3.49	2.93	-3.916	0.000
USFS	2.97	2.41	-3.934	0.000
Community organizations	2.97	2.19	-5.103	0.000
University scientists	2.90	2.18	-3.956	0.000
Environmental groups	2.61	1.86	-4.740	0.000
ODFW	2.91	2.41	-3.191	0.002
Newspapers	2.58	2.21	-2.821	0.005
ODF	2.76	2.49	-1.869	0.063
NMFS	2.29	1.95	-1.687	0.095
OSU Extension service	2.87	2.57	-1.643	0.102
Agriculture industry	2.31	2.57	1.578	0.116
Courses in school	2.70	2.42	-1.441	0.153
BLM	2.52	2.34	-1.059	0.291
Forest industry	2.47	2.59	0.708	0.480
ODEQ	2.20	2.10	-0.590	0.556
TV and radio	2.19	2.12	-0.522	0.602
Relative, friends, neighbors	2.26	2.30	0.318	0.751
Fishing industry	2.35	2.35	0.012	0.991

1=Not Useful, 2=Slightly Useful, 3=Useful, 4=Very Useful

Table 5. Opinions on Watershed Management.

Statement	Watershed Council Mean	Landowner Mean	<i>t</i>	Significance (2-tailed)
Stream and streamside conservation projects are important for fish and wildlife habitat.	4.68	4.03	-5.000	0.000
Scientists are trying to fix problems they don't understand.	3.00	3.37	1.968	0.050
Good watershed management increases property value.	4.00	3.69	-2.080	0.038
Endangered species laws should be changed to preserve jobs.	2.29	3.08	3.766	0.000
The government should protect public resources such as fisheries, water supply and wildlife on private lands as well as on public lands.	3.27	2.75	-2.462	0.014
The government doesn't care about the rights of rural landowners.	2.73	3.63	4.974	0.000
Natural resource policy focuses on punishing landowners rather than helping them.	2.78	3.45	3.314	0.002
Vegetated buffers should be required along all streams, not just those on forest land.	3.95	3.35	-3.044	0.003
Watersheds should be one of our highest local management priorities	4.05	3.44	-3.691	0.000
Statewide stream and streamside rules help people take better care of their land.	3.51	3.10	-2.380	0.018
I would support community consensus even if it goes against my personal views	3.00	2.86	-0.851	0.396

1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree

Table 6. Perception of Problems in the Watershed.

Statement	Watershed Council Mean	Landowner Mean	<i>t</i>	Significance (2-tailed)
Lack of streamside vegetation	3.71	2.98	-4.250	0.000
Poor fishing	3.49	3.16	-2.114	0.035
Low stream water levels during summer	3.40	3.22	-1.093	0.275
Run-off from residential lawn care	3.51	2.85	-3.731	0.000
Stream bank erosion	3.95	3.47	-3.324	0.002
High stream temperatures	3.50	3.06	-2.363	0.022
Water pollution	4.12	3.37	-5.238	0.000
Cattle in the streams	3.78	2.91	-4.895	0.000
Logging practices	3.56	3.13	-2.334	0.020
Wasteful irrigation practices	3.61	3.19	-2.457	0.015
Herbicide, pesticide and fertilizer runoff into the streams	3.90	3.42	-2.734	0.007
Loss of private property rights	3.17	3.69	2.929	0.004
Too many management agencies involved	3.53	4.00	2.478	0.017

1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree

Table 7. Tradeoffs Between Environmental and Economic Considerations.

Watershed Council Mean	Landowner Mean	<i>t</i>	Significance (2-tailed)
3.00	3.77	3.187	0.002

1 = Highest priority should be given to protecting environmental conditions,
4 = Environmental and economic factors should be given equal
consideration, 7 = Highest priority should be given protecting economic
considerations

Table 8. Number of Information Sources Used.

Watershed Council Mean	Landowner Mean	<i>t</i>	Significance (2-tailed)
9.07	5.34	-5.923	0.000

Table 9. Knowledge of Technical Terms.

	Know Meaning		Heard, but Don't Know Meaning		Never Heard	
	WC	L	WC	L	WC	L
Streamside buffers	98%	74%	2%	15%	0%	11%
Large woody debris	98%	76%	2%	13%	0%	11%
Riparian zone	98%	48%	2%	18%	0%	35%
Biodiversity	93%	53%	7%	20%	0%	27%
Non-point source pollution	88%	38%	12%	29%	0%	34%
Anadromous	85%	23%	10%	18%	5%	58%
Habitat fragmentation	83%	48%	15%	26%	2%	27%
Geomorphology	73%	16%	17%	27%	10%	57%
Redd	63%	13%	22%	11%	15%	76%
303(d) list	56%	4%	27%	9%	17%	87%
Refugia	42%	7%	22%	17%	37%	76%

WC = Watershed Council, L = Landowner

Table 10a. Watershed Knowledge Results.

	Correct		Incorrect		Not Sure	
	WC	L	WC	L	WC	L
<i>True or False Questions</i>						
Most water pollution today comes from factories	73%	46%	5%	26%	22%	28%
Vegetation along stream banks helps improve water quality	98%	88%	0%	3%	2%	9%
Large woody material (logs, trees, etc.) in streams blocks fish passage and should be removed whenever possible	93%	79%	5%	10%	2%	11%
There are no biological differences between wild salmon and hatchery salmon	63%	50%	22%	17%	15%	33%
Healthy rivers require inputs of sediment, gravel, and small rocks	66%	57%	20%	15%	15%	28%
<i>Multiple Choice Questions</i>						
The biggest source of erosion from forested land is...	55%	18%	34%	65%	11%	17%
State standards say that stream temperature in salmon producing streams should not exceed _____ degrees Fahrenheit to ensure healthy habitat for fish	76%	22%	12%	23%	12%	55%
Streams and streamside areas are most altered in...	76%	50%	20%	20%	5%	29%

WC = Watershed Council, L = Landowner

Table 10b. Watershed Knowledge Results: Endangered Fish Species.

		Chinook*	Coho	Bull Trout	Steelhead*	Not Sure
		What fish species is/are proposed for listing as threatened species under the Endangered Species Act in the South Santiam watershed	WC	66%	36%	28%
	L	36%	30%	18%	32%	48%

WC = Watershed Council, L = Landowner

*Correct answers

Table 11. Basic Environmental Knowledge Results.

	Correct		Incorrect		Not Sure	
	WC	L	WC	L	WC	L
There are many different kinds of animals and plants, and they live in many different types of environments. What word is used to describe this idea?	100%	69%	0%	2%	0%	29%
Which of the following is a renewable resource?	100%	96%	0%	0%	0%	3%
Most electricity in the United States is generated from what source of power?	60%	24%	30%	62%	10%	14%
What is the most common reason that plant and animal species become extinct?	80%	65%	15%	17%	5%	18%
What is the largest source of carbon monoxide in the United States?	83%	77%	8%	7%	10%	17%

WC = Watershed Council, L = Landowner

Table 12. Summary of Knowledge Measures.

Knowledge Measures	Watershed Council Mean	Landowner Mean	<i>t</i>	Significance (2-tailed)
Familiarity with Terms (Range: 0-22)	18.90	9.82	-14.947	0.000
Watershed Knowledge (Range: 0-10)	7.43	4.75	-7.004	0.000
Environmental Knowledge (Range: 0-5)	4.23	3.27	-6.457	0.000

Table 13. Percent Not Sure Responses.

Watershed Council Mean	Landowner Mean	<i>t</i>	Significance (2-tailed)
8.86	24.21	-3.5784	0.002

Table 14. Trust in Information Sources.

Information Source	Watershed Council Mean	Landowner Mean	<i>t</i>	Significance (2-tailed)
SSWC	4.38	3.35	-11.079	0.000
University scientists	4.00	3.40	-4.821	0.000
GWEB	3.56	2.78	-4.498	0.000
Environmental groups	3.00	2.35	-3.359	0.001
OSU Extension Service	4.15	3.71	-3.142	0.002
USFW	3.64	3.18	-2.757	0.006
Agriculture industry	2.87	3.23	2.253	0.025
ODEQ	3.21	2.82	-2.066	0.040
BLM	3.41	3.10	-1.921	0.056
NMFS	3.36	3.08	-1.733	0.084
Community leaders	3.21	2.95	-1.667	0.097
ODFW	3.64	3.38	-1.540	0.125
ODF	3.68	3.46	-1.423	0.156
USFS	3.46	3.25	-1.313	0.190
Forest industry	3.03	3.24	1.168	0.249
Newspapers	2.87	2.81	-0.380	0.704
Relatives, friends, neighbors	3.31	3.29	-0.137	0.891
Television and radio	2.77	2.75	-0.102	0.919

1 = Distrust Completely, 2 = Distrust Somewhat, 3 = Neutral, 4 = Trust Somewhat, 5 = Trust Completely