

# Communication Barriers to Applying Federal Research in Support of Land Management in the United States

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## Abstract

Barriers to effective communication between researchers and managers can ultimately result in barriers to the application of scientific knowledge and technology for land management. Both individual and organizational barriers are important in terms of how they affect the first three stages of the innovation-decision process: (1) knowledge, where an individual is exposed to innovation and develops an understanding of how it works; (2) evaluation, where an individual evaluates advantages and disadvantages and forms a favorable or unfavorable attitude toward innovation; and (3) decision, where an individual engages in activities that lead to a choice to either adopt or reject the innovation. Communication studies provides insight into potential influences to the communication and use of research results by federal land managers. Effective communication refers to the development of a common understanding between the research communicator and the manager or practitioner about both the existence and utility of an innovation. Communication research reveals that people frequently report leaving the same encounter with different perceptions of that encounter. So, it is not surprising that a scientist presents results in what they perceive to be clear terms and then the land manager returns to their daily tasks with a modified perspective of what the scientist intended to communicate, with continued uncertainty, or with lack of interest that leads to passive rejection of

innovations. By understanding contextual influences to communication within target audiences, research communicators may be able to plan for and minimize potential causes of misunderstanding within different target management audiences. Recognizing that science delivery and application approaches are often developed on an ad hoc basis, this paper emphasizes the need to understand specific influences to the communication process within these audiences. Understanding influences to communication within target audiences will help applied researchers, research application specialists, and upper level managers prioritize limited delivery and application resources and increase the likelihood that these efforts result in application.

Keywords: Innovation-decision, science communication, research application, diffusion.

## Introduction

A federal research scientist (researcher), charged with developing knowledge to support federal land management, develops a new tool to help land managers accomplish their objectives. To make the tool relevant and useful to managers, the researcher works closely with managers throughout all stages of development. The managers she interacts with not only demonstrate enthusiasm for the new approach, but also identify additional ways in which it will be useful. After the tool is developed, the researcher publishes a manuscript and gives several presentations at conferences and workshops about how it works. With the exception of answering specific requests for additional information, the researcher then switches to focus on developing other potentially useful knowledge and techniques. If this tool,

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which represents many hours of labor and creative thought by both researchers and managers, is like many innovations, it will be used locally by the few managers who contributed to its development and by some of their colleagues. Other managers who happen to see the publication or hear a talk about the innovation might think it sounds like a good idea but continue to do their jobs without using it. An astute observer questions, “What keeps federal land managers from using many of the scientific innovations that will either make their jobs easier or increase the likelihood that they’ll achieve desired outcomes?”

### **Why Focus on Federal Research and Land Management?**

In the United States, federal land managers are required to base decisions such as those that affect fire, fuels, wildlife habitat, and invasive plants on the best available science. The U.S. Departments of Agriculture and the Interior regularly allocate funding toward developing and delivering scientific knowledge and tools in support of this mandate. However, the U.S. Office of Management and Budget recently expressed concern about whether the full benefit of this investment is being reached. This funding, and subsequently the scientific information available for land management, may be jeopardized if the federal research and management agencies cannot demonstrate that managers are both aware of and using federally funded research.

The goals of federal management and research programs can be achieved only if scientific knowledge and tools are effectively transferred to land managers. Many researchers in U.S. federal agencies work closely with managers during an iterative process that identifies research needs and ensures results are relevant. Once research results are complete and tools are developed, researchers make them available by publishing results, hosting information on Web sites, and giving presentations to management audiences. In addition, U.S.

agencies work to improve the awareness of and access to completed research by offering online publication distribution (e.g., <http://www.treesearch.fs.fed.us>), library and document delivery services (e.g., <http://www.nal.usda.gov/digitop>; <http://library.doi.gov/ill.html>), and searchable Web syntheses (e.g., <http://www.fs.fed.us/database/feis>; <http://forestencyclopedia.net>).

Most of these approaches improve access for managers who actively search for scientific knowledge and tools. However, the adoption and use of innovations by land managers is dependent on more than information accessibility. In British Columbia, Hollstedt and Swift (2000) identified the following categories of barriers to the communication and adoption of scientific research into forest policy and management: information sources (not knowing what information is available), information access (not knowing where to find the information), cultural differences (between researchers and research users), technology (limited access or incentives), and capacity (time, money, skills, desire). Kearns and Wright<sup>2</sup> found similar personal, organizational, and external barriers among USDA Forest Service fire, range, and recreation managers. Additionally, during a Forest Service Roundtable on science-policy integration that was sponsored by Deputy Chiefs for Research and the National Forest System, prominent research scientists and agency decisionmakers also acknowledged barriers posed by different cultures and perspectives of researchers and managers (USDA Forest Service 1995). Finally, recent interviews of field-level researchers and managers in the Forest Service’s Rocky Mountain Region noted that communication problems arise from managers’ and

<sup>2</sup> Kearns, S.A.; Wright, V. 2002. Barriers to the use of science: USFS case study on fire, weed, and recreation management in wilderness. Unpublished report. On file with: Aldo Leopold Wilderness Research Institute, 790 E Beckwith Avenue, Missoula, MT 59801.

researchers' perceptions of each other, ineffective use of communication channels, and a paucity of time, awareness, interest, and mutual understanding.<sup>3</sup>

Although each of these efforts identified individual and social barriers to the communication and use of research results, none of them drew upon the existing body of knowledge from communication studies to help improve understanding of or develop strategies for reducing these barriers. Additionally, established efforts, such as the aforementioned Web sites, that aim to make information accessible do not generally address many of the contextual barriers to the communication of research results. Drawing from the communication literature, this paper introduces potential influences on the effectiveness of communication between managers and researchers and on practitioners' decisions about whether to adopt scientific knowledge and tools. It does not address the preferred information sources or methods that managers use to access information.

### **Innovation—Decision Process**

The *Diffusion of Innovations* theory (Rogers 1995, Wright 2004) describes what happens once an individual gains initial knowledge of new ideas (i.e., innovations) such as those presented by the scientific community. This can be either a passive process where a person is exposed to new information through any of a variety of communication channels, such as face-to-face, written, and mass communication, or an active process where the individual searches for innovations to meet their needs. If a person's interest is piqued by exposure to the innovation, the individual actively begins the "innovation-decision" process by gathering information. According to the theory, an individual initially works toward understanding how the innovation works. Then the individual

gathers information to weigh the potential advantages and disadvantages of using the innovation and uses this to develop either a favorable or an unfavorable attitude toward it. If uncertainty is reduced to a tolerable level and a person develops a favorable attitude, the individual decides to try incorporating the innovation into ongoing practices.

This overarching theory, often used to understand or facilitate social change, recognizes that it takes time for individuals, and communities, to incorporate innovative concepts and techniques into established approaches and practices. The amount of time depends in part on individual characteristics of the potential adopters, social values and expectations, and communication networks. The innovation-decision process is distinguished from other types of decisionmaking based on the inherent uncertainty associated with deciding whether to use new ideas or to stick with existing, known, practices. Individuals have different levels of comfort with uncertainty that affect how they obtain their information and how quickly they adopt new ideas. They are also influenced by the culture and norms of the communities in which they work. Rogers (1995) reminds us that communities function as social systems, with interrelated units, communication networks, and established social norms. Federal researchers can use a better understanding of land managers, including individual and social influences on the innovation-decision process in different management communities, to reduce barriers to the use of scientific innovations.

The discussion here focuses on communication barriers that are likely to influence the first three stages of the innovation-decision process as described by Rogers (1995): (1) knowledge, where an individual is exposed to innovation and gains an understanding of how it works; (2) evaluation, where an individual evaluates advantages and disadvantages and forms a favorable or unfavorable attitude toward innovation; and (3) decision, where an individual engages in activities

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<sup>3</sup>Lundquist, J. 2004. Communicating fire science research between the Rocky Mountain Research Station and national forests within Region 2. Unpublished report. On file with: USDA Forest Service, Rocky Mountain Research Station, 240 West Prospect Road, Fort Collins, CO 80526-2098.

that lead to a choice to either adopt or reject the innovation. These stages occur along a continuum rather than as separate stages.

### Effective Communication

Communication, as both the cooperative construction and exchange of ideas, is fundamental to how individuals navigate through the innovation-decision process. Managers obtain information that increases their awareness of and ability to evaluate innovations by communicating with researchers, technology transfer or application specialists hired to communicate results, and other managers. Face-to-face communication among researchers and managers takes place in a variety of venues. Research is commonly presented at professional conferences and symposia, where results are communicated both during professional presentations and during formal and informal interactions outside presentations. Additionally, research results are communicated at smaller workshops, meetings, and training courses focused on specific management issues. Finally, once managers are aware of and interested in innovations, researchers participate in onsite or phone consultations with individual management units to answer questions about the relevance of research results to specific units and their management issues.

From the researcher perspective, effective communication about innovations leads to their use by land managers. In fact, researchers often express frustration that managers do not incorporate research results into management decisions and practices, even after they hear about them. Rogers (1995) explained that rejection of an innovation can occur at each stage in the innovation-decision process, and that many innovations are rejected passively despite exposure to the innovation (i.e., use of the innovation is never really considered).

From the perspective of land managers, effective communication with researchers reduces uncertainty about how to use innovations to achieve their goals

(Rogers 1995). This includes two types of uncertainty: general uncertainty about the best approach for achieving their goals, and uncertainty regarding specific messages conveyed about an innovation during communication with a researcher or research application specialist. For instance, uncertainty can exist about what the innovation is, how it works, and why it works. According to *Diffusion of Innovations* theory, once individuals become aware of and interested in innovations, they spend the evaluation stage actively seeking information that reduces uncertainty about the advantages and disadvantages of using those innovations (Rogers 1995).

Overcoming different primary communication goals, effective communication leads to the development of a common understanding between the research communicator and the manager about the existence and utility of an innovation. Knowledge from communication studies offers insight into how face-to-face communication between researchers and managers occurs and what influences the outcome of communicative interactions about innovations (e.g., whether managers pursue the use of research to which they are exposed). In sum, the outcome of communicative interactions depends on the individual and social contexts in which they occur.

### Potential Misunderstanding

#### Ambiguity

Communication research reveals that people frequently report leaving the same encounter with different perceptions of that encounter. So it is not surprising that a researcher presents results in what they perceive to be clear terms and then the land manager returns to their daily tasks with a modified perspective of what the researcher intended to communicate, with continued uncertainty, or with lack of interest that leads to passive rejection of innovations.

Traditionally, communication refers to the process of transferring information from a sender to a receiver. Communication scholars refer to this as the transmission,

or conduit, model of communication. It is a simplistic model where people understand each other by encoding and decoding messages based on shared language rules (Jacobs 2002, Roberts and Bavelas 1996). However, most communication researchers subscribe to a different model, called the inferential model, which acknowledges that a speaker's intended meaning cannot be entirely understood through language rules (Jacobs 2002). Further, meanings can evolve and conversations can lead to shared meaning that is created during the course of conversation that goes beyond a communicator's original intent. In this view, the meaning of a conversation is negotiated between communicators (Roberts and Bavelas 1996). Regardless of the communication model one subscribes to, communication researchers agree that ambiguity exists and misunderstanding is likely pervasive.<sup>4</sup>

Sillars (2002) defined misunderstanding as "intentions, meanings, thoughts or feelings" attributed to a speaker that are different from those intended by the speaker. There are a variety of factors that contribute to misunderstanding during communication. For instance, people generally understand messages based in part on shared language rules; however, these rules are often incomplete, and messages can incorporate the rules in an infinite number of ways. As a result, there is always some degree of ambiguity that requires inference when interpreting verbal or written messages (Jacobs 2002). Inference results from the "layered knowledge beneath, behind, or within" sentences that can lead speakers and listeners to understand messages in different ways (Duck 2002). Additionally, inference is necessary because people often use language unconsciously, both when conveying and when interpreting messages, and so people are not always aware of their communication

choices. Finally, communicators can have multiple goals, which leads to the ambiguity of underlying, implicit messages that are inadvertently expressed (for instance, through nonverbal cues) and sometimes contradict explicit verbal messages. Inferences about a speaker's goals are likely to influence the understanding of that speaker's messages (Berger 1997).

### Selective Attention and Context

Misunderstanding can also result from selective attention. All people are selective about the messages they hear for a variety of reasons. The "cognitive miser" metaphor used by social psychologists suggests that people strive to achieve "the greatest possible cognitive effect for the smallest possible processing effort" (Sillars and Vangelisti 2006). In other words, people conserve mental resources by being extremely selective about the signals to which they attend. This reduces mental stimuli to the point where individuals can feasibly process them; the consequence is that it also creates the potential for different individuals to pay attention to different signals.

People are more likely to pay attention to messages about scientific findings and products if they perceive the messages to be relevant to their goals or needs. Managers are often driven to learn about innovations as a result of dissatisfaction with current approaches; however, it is also possible for needs to develop once a person is exposed to an innovation. Rogers (1995) used the example of a new clothing fashion, where a person decides they need fashionable clothing only after being exposed to it, to demonstrate that needs are not always identified in advance. Part of the lack of understanding between researchers and managers may stem from a problem or need that is perceived by the researcher but not the manager. This situation is reflected in the following statement, "We may want food and not need it. And we may need vitamins and minerals and fail to want them" (Edgar Dale quoted in Rogers 1995). In other

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<sup>4</sup>Sillars, A.L. 2002. For better or worse: re-thinking the role of "misperception" and communication in close relationships and families. 17<sup>th</sup> annual B. Aubrey Fisher Memorial Lecture, University of Utah.

words, researchers and physicians who study how the human body works know that people need vitamins, but someone working outside these professions may not identify vitamins as a priority. As a result, people in the latter group may not pay attention to messages about how to incorporate vitamins into their daily routines.

Perception is also important in determining the outcome of communication events. Perception refers to the way individuals interpret messages and provide order and meaning to their environments (Bowditch and Buono 2005). Humans have a natural tendency for long-established perceptions to become ingrained, which means they often hear what they expect to hear rather than what the speaker conveys. This can be especially true when there are stereotypes (e.g., conventional beliefs about the “typical” researcher or the “typical” manager). Furthermore, people can be motivated to maintain inaccurate impressions despite explicit information that contradicts these impressions (Sillars and Vangelisti 2006). For example, people tend to interpret information so it is congruent with existing beliefs and attitudes because hearing messages that are incompatible with existing beliefs can lead to cognitive dissonance, or internal conflict, which is troubling (Rogers 1995). By hearing what they expect to hear, people can protect their worldviews and identities and reduce the stress associated with changing deep-rooted views.

According to the *Diffusion of Innovations* theory, individuals are most likely to interact with others who they perceive to hold similar personal and social characteristics (e.g., personal or cultural beliefs, education, work experience, social status). Communication among such individuals, described as homophilous, is more comfortable and more effective because these individuals share common understandings and subcultural language. In contrast, heterophilous individuals are perceived to differ in these social characteristics (Rogers 1995). Researchers and managers are often

heterophilous. In addition to increased technical understanding of an innovation, researchers often have different levels of education and are motivated by different priorities than many of the managers who are responsible for adopting and implementing innovations. According to Rogers (1995), communication among heterophilous individuals can be problematic when it causes internal conflict for those who find messages to be inconsistent with the beliefs or the environments in which they are used to operating. Such differences can result in misunderstandings (Rogers 1995).

Much of the understanding gained during interactions depends on the individual and social contexts in which communication occurs. Individual contexts that are likely to influence the communication and adoption of research results include a person’s prior knowledge, beliefs, attitudes, and comfort with risk/uncertainty. Sillars and Vangelisti (2006) note that social, cultural, and historical factors also influence the ways people interpret messages. This includes social norms such as an agency or administrative unit’s organizational values, assumptions, and expectations. Messages can also have different meanings when conveyed in different social and institutional settings or by different messengers (e.g., a supervisor, well-respected peer, disrespected peer, friend, or spouse) (Knapp et al. 2002). Bateson (1978) went so far as to say, “Without context, words and actions have no meaning at all.” According to this view, messages about research results can only be interpreted, and meaning can only be generated, in relation to the context in which they are delivered (Duck 2002, Knapp et al. 2002); research communicators will be more effective if they understand this context.

In summary, which signals are selected depends in part on the context created by background knowledge and beliefs that exist as a result of the message interpreter’s history. These can change as communication patterns between people evolve over time and as relationships develop. A longer history of communicating

together, or of participating in the same cultural environment, is likely to lead to shared knowledge, memories, and principles of inference that can either enhance understanding during an interaction or result in patterns of continued misunderstandings (Duck 2002, Sillars and Vangelisti 2006). Duck (2002) noted that, “No one talks without reference to things that they believe to be commonly understood,” because references to shared notions facilitate the development of common understanding.

## **Conclusion**

Much of the communication about innovations is initiated by researchers and research application specialists (e.g., during presentations at professional conferences or workshops). With so much potential for misunderstanding owing to the inherent ambiguity of communication, inference, and selective attention, researchers and others who strive to communicate research results need to understand contextual influences to the outcome of communication between researchers and managers. Researchers, research application specialists, and upper level managers can use knowledge of potential influences of misunderstanding to develop strategies aimed at achieving greater mutual understanding between these two groups. In fact, Berger (1997) discussed the need to predict the beliefs and actions of message recipients in order to produce effective messages. He suggested some uncertainty about these can be reduced in advance by acquiring information about message recipients as well as the social context in which messages are likely to be received. In summary, by understanding contextual influences on communication within target audiences, researchers and others who communicate research results may be able to plan for or minimize potential causes of misunderstanding with these audiences. Reducing misunderstanding will ultimately increase the effectiveness of communication about innovative knowledge and tools.

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