

CHANGE AS A FACTOR IN ADVANCING FIRE-MANAGEMENT DECISIONMAKING AND PROGRAM EFFECTIVENESS

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Abstract.—Wildland fire management—as evidenced by its nature, historical growth, and development—can be characterized as a program of constant change. To become better able to meet changing conditions and complexity, fire management must be agile, flexible, and able to embrace change. But many challenges and limitations to acceptance continue to hamper moving fire management advances into practice. Recent innovations in science and technology present opportunities to improve the organizational performance and effectiveness of fire management. The Wildland Fire Decision Support System application is one example of an effort to increase flexibility and agility and improve fire-management decisionmaking and program effectiveness.

1.0 INTRODUCTION

Since the start of the 20th century, fire management's very nature, historical growth, and development have been subject to change. In fact, fire management has involved such continual change that it has been described as a "change-centric" program. DeBruin (1974) linked the shift from fire control to fire management with the constant nature of change, stating that "fire management is change" (p. 11).

Factors driving continual change in fire management are directly related to program scope and magnitude. As the fire environment, social and political expectations and requirements, economic concerns, and physical capabilities change, challenges and

risks regarding wildland fire management increase in both complexity and extent. Temporal ranges of fire activity, spatial extent of burned areas, and threats from wildland fires grow each year as long-term effects of land use and fire management dominate natural vegetation communities. In addition, current land-use practices allow the building of structures with ever-escalating property values, which compound fire management concerns and, at times, limit management options.

Williams (2010) addressed the increasing complexity of wildland fire management and the need for change during a fire conference presentation. He stated that the environmental, economic, social, and physical factors affecting fire management today and into the future are shifting the calculus of fire protection in the United States and worldwide. The trajectory of these factors suggests that challenges facing wildland fire management require changed business processes and improved organizational effectiveness to keep pace. The case for change has also been reinforced by projections of strategic burned area and costs made in the Quadrennial Fire Review (National Wildfire Coordinating Group 2009a).

1.1 What is Change?

Change represents a movement from areas of experience, comfort, and practice into areas with different rules, direction, and procedures, and even strategic thinking and philosophical views that are uncommon or cause discomfort. However, change does not imply elimination of positive program experience, accomplishments, or strategic thinking that has led to success. Successful change is based on logic that adapts to development of new practices, incorporates new science and technology, and builds on lessons learned to promote organizational growth, advanced capability, and organizational efficiency. In most situations, change is seldom well embraced or easily implemented.

Change can be difficult to effect, especially when common knowledge and behaviors that feel comfortable become culture. Once a culture is established, processes to change it can be long and arduous (Schein 2004). The new overall goal and what it will take to achieve it tend to come as a shock to the planned audience (Collins and Porras 1998).

Kotter (1998) presents a set of steps common to all successful change or transformation efforts (Table 1). These eight steps must be implemented over time; moving too fast, giving too little attention to each, or skipping steps can derail the entire change effort.

Table 1.—Eight steps to effect change or organizational transformation (Kotter 1998) and descriptions of the steps.

Steps	Description, Actions
Establishing a sense of urgency	Organizational realities and efficiencies must be assessed and evaluated to determine whether the vision and goals are still on track or whether organizational alterations are needed to maintain the desired trajectory.
Forming a powerful guiding coalition	Once the need for change is identified, the group must be assembled with sufficient power to lead the effort and overcome barriers.
Creating a vision	A vision must be created that will frame and guide the change effort. If the vision is followed, strategies for achieving that vision will eventually be developed. Kotter (1998) emphasizes that failed transformations are characterized by an abundance of plans and programs, but no clear and achievable vision.
Communicating the vision	All existing communication delivery methods must be used to disseminate the vision.
Empowering others to act on the vision	Gaining support for the vision and encouraging people to act on it requires removal of obstacles, changing incompatible systems or structures, taking risks, and utilizing non-traditional ideas, procedures, and activities. Empowerment means giving people permission and, more importantly, the ability to do something differently.
Planning for and creating short-term wins	The change process cannot only start and end; it must be a planned, progressive action. Visible performance improvements and advances in organizational efficiency must be designed and included in plans. Short-term goals must be built into the process and periodically achieved.
Consolidating improvements and producing more changes	Once successes begin to be realized, they must be capitalized on and used to support continued changes in systems, structures, and procedures. Short-term successes build credibility and can be used to launch efforts to change other and bigger problems.
Institutionalizing new approaches	Institutionalizing change is a prerequisite to long-term success. The connection between altered practices, procedures, and policies and success, organizational efficiency, and increased performance must be direct and verifiable. As Kotter (1998) explains, “In the final analysis, change sticks when it becomes ‘the way we do things...’” (p. 18)

Within most organizations, the dynamics of management and of change are very similar. As organizational efficiency is lost, the multiple phases associated with change processes become very involved and not easily accomplished. When any organization, especially wildland fire management, steadily incorporates new scientific information and emerging technology, matches changing policy, and bases its foundation on the best available knowledge, it can sustain a high level of organizational efficiency. If the organization does not maintain dynamic growth, however, it can lose efficiency quickly. Figure 1 shows that efficiency is eroded through one of two pathways: either a chronic degradation or an acute disruption. Progressing through a chronic degradation leads the organization to situation blindness and

passive awareness, and eventually to active awareness. Situation blindness occurs when the organization has significant problems but does not know it has problems. Passive awareness develops when an organization realizes it has problems but either does not know what to do about them or refuses to acknowledge them. Eventually, as the phase of active awareness is reached, the organization recognizes its problems and develops solutions to them.

An acute disruption occurs when a significant single event drives the organization to passive or active awareness, usually the latter. Something has happened that clearly illustrates that the current state of organizational efficiency is no longer acceptable.

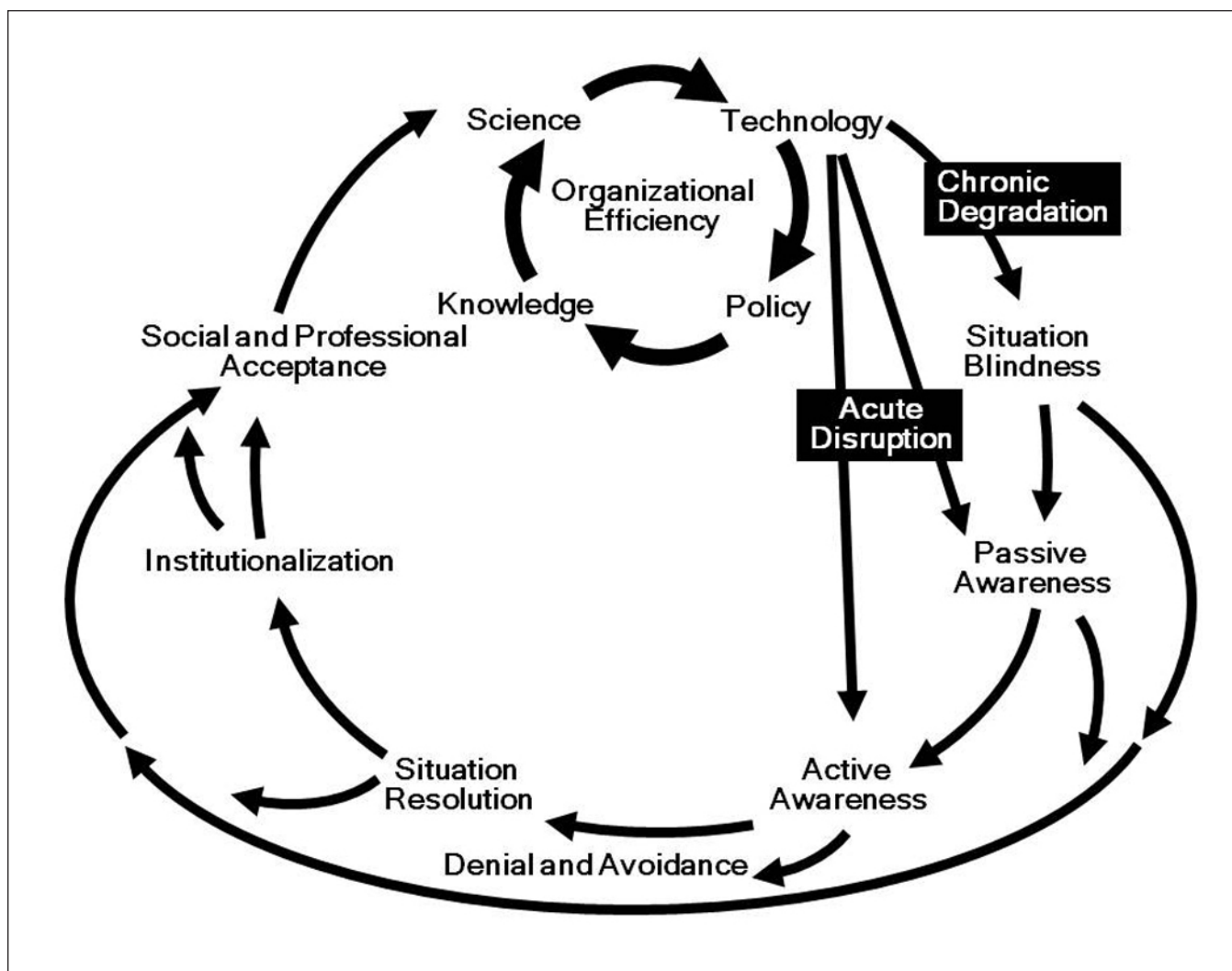


Figure 1.—Generalized change dynamics model.

Once active awareness is reached, the organization develops methods to correct the problems. Problem resolution procedures, practices, and methods are developed and implemented. The process then advances to the institutionalization stage, where new practices, procedures, and changed policy are documented in guiding principles, directives, or policies and become mandated business rules. From this point, the process moves toward professional and social acceptance, where endorsement is acquired from organization personnel; external groups including the public, media, and political groups; and prior organization employees, either retired or otherwise separated from the current organization. Although the new direction has been institutionalized, this stage is particularly important because without full endorsement, change implementation can stall, languish, and fail to support re-establishment of full organizational efficiency.

Once social and professional acceptance is achieved, the organization moves back into the desired high level of organizational effectiveness. An important point is that at every stage in the process, denial and avoidance can (and usually does) occur, delaying or blocking implementation and progression back to full effectiveness. Denial and avoidance lose energy and dissipate once social and professional acceptance is achieved.

The change dynamics model in Figure 1 encompasses a wide range of steps in the change process. Kotter's (1998) eight steps do not enter the model until the active awareness phase. It is desirable to keep the organization in the highest organizational efficiency level—but if that is not possible, it is important to pass through problem recognition and definition quickly so as to reach the active awareness stage. Until the problem is fully recognized, there is no sense of urgency. Communication is vital to all efforts and once a vision is created and action steps are developed, communication must occur throughout the process; it is especially important to professional and social acceptance.

2.0 WILDLAND FIRE MANAGEMENT – A CENTURY OF CHANGE

2.1 Program Development

Wildland fire is a fundamental program element within the larger field of natural resources management. In contrast with wildland fire management, companies in the private sector respond to change by remaking themselves in order to maintain competitiveness in highly dynamic market environments. But in wildland fire management, market share and competition are not relevant and change is not forced by constant pressure to grow, expand, and gain greater efficiency. Instead, there is a basic need to update management strategies to respond to an increasingly complex and challenging program environment.

Since the inception of organized fire suppression in the early 1900s, wildland fire management has progressed from a one-dimensional program focusing on fire control and immediate extinguishment to a multi-dimension program that uses the full spectrum of management responses to accomplish both protection and ecological objectives. The constant growth of wildland fire management is illustrated conceptually in Figure 2.

Early on, fire management focused on resource protection. As fire management matured, fire suppression methods became more organized and refined and the expansion of capabilities began to take precedence. Prescribed fire, the intentional application of fire to achieve beneficial objectives, began as an important program component but remained subordinate to fire suppression for some time. Gradually, however, use of prescribed fire in resource management gained importance and acceptance as it increased knowledge about fire effects and the role of non-anthropogenic fire. Prescribed fire and fire suppression eventually converged into a single fire management program with a focus on organizational efficiency and decisionmaking (Fig. 2). This convergence occurred from 1968 to 1974, when federal wildland fire management agencies moved from fire control to fire management to better reflect

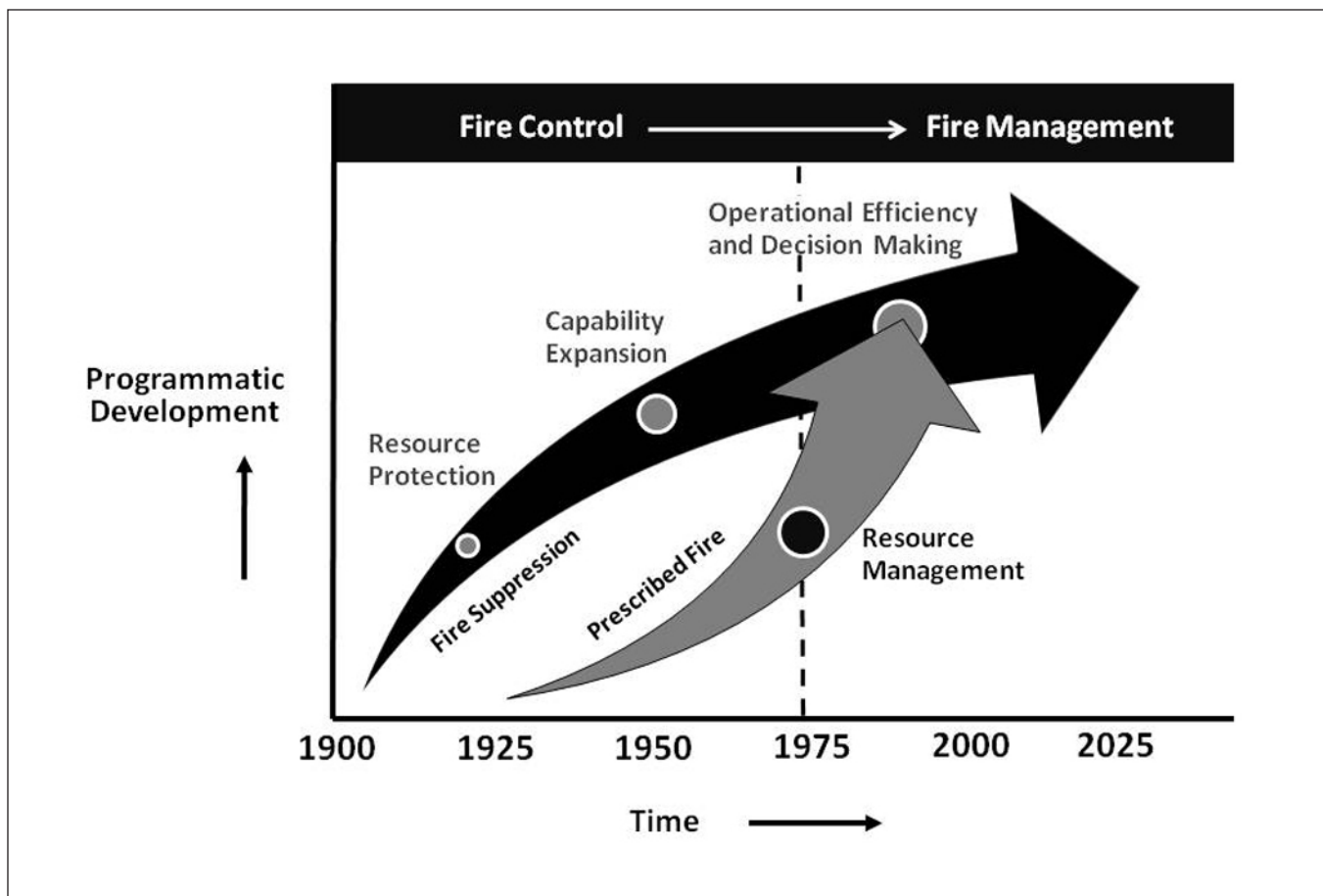


Figure 2.—Programmatic development of the wildland fire management program.

the range of management activities and objectives (DeBruin 1974, Gunzel 1974, van Wagtenonk 2007).

As fire management moves into the future, it will need to focus on improving program efficiency while still accomplishing protection and other resource management objectives. Improved decisionmaking capability will be of particular importance and can be gained by: adding new knowledge and capability from fire research; incorporating ecological, economic, and social considerations into decision analysis; creating new tools to aid situational analysis and risk assessment; and connecting decisions to land and resource management. Cleaves (2010) states that despite significant milestones since 1910, future wildland fire management research must change and take new directions. In support of land and resource management, Williams (2010) says that “the next century of fire management needs to have a commitment to a more mature, more sophisticated land management strategy in fire dependent ecosystems.”

2.2 Factors Driving Change in Fire Management

Multiple factors have become increasingly important over time in forcing changes in fire management. The changing temporal and spatial extent of fires; increasing operational complexity; decreasing management capability; growing ecological significance of fire effects; escalating seriousness of potential fire consequences; rising social, economic, and political concerns; evolving policy; innovations in science and technology; climate change impacts; and organizational learning have all changed fire management. Organizational learning—the aggregation of experiences; acquisition of new information; analysis of activities; application of knowledge, processes, technology, and proven practices; and archiving of overall processes and results—is of particular relevance (Zimmerman and Sexton 2010).

2.3 Barriers to Change

Change in fire management, while commonplace, is not easy or quick and is associated with numerous challenges and limitations to acceptance. These limitations present barriers, delay progress, or block movement and are generally a function of “reinvention tension.”

Most of the factors that constrain change result from an inability to cope with risk, uncertainty, and movement outside a zone of comfort and security. Many are related to human nature and human dimensions and show ties to Kotter’s (1998) eight steps. Common barriers to change include:

- Uncertainty – Individuals may be uncertain about what the outcome of change will be and how they and their organization will be affected.
 - o Movement outside comfort zone – It is extremely difficult to move people out of their comfort zones. Cultural traditions and biases can lead to divisiveness. Schein (2004) says that when substantial change comes up against significant culture, culture always wins.
 - o Lack of vision – The absence of a sensible vision fuels uncertainty, and efforts to implement change can dissolve into a list of confusing and incompatible projects that take programs in the wrong direction or nowhere at all.
 - o Experience – Discomfort and lack of support often occur when change involves moving outside the parameters of past experience. Change should involve creating a new possibility for a powerful future, which can often mean a future that experience and predictions indicate is impossible.
 - o Predictability – Predictability tends to offer a sense of security and even a degree of control. Without stated intentions, ground rules, clear direction, identified procedures, and timeframes, people cannot predict and anticipate the future, which promotes discomfort and reluctance to continue.
- Trust – Without trust, involved individuals will not believe that goals can be achieved.
- Lack of communication – Without active communication, the vision and urgency of the case for change cannot be understood, and the process will quickly degrade and likely be unsuccessful.
- Human nature – The limitations of human nature influence individuals’ responses to change and an organization’s ability to effect change. Specific limitations include the following (adapted from Los Alamos National Laboratory [2006]):
 - o Limited working memories – Memories are keyed to information in terms of key words, phrases, and pictures, which can lead to oversimplified views of processes, procedures, and practices and cause change processes to lose momentum.
 - o Limited attention – The ability (or inability) to focus on multiple issues varies among individuals, can be hindered by stress, and may cause people to miss or overlook information.
 - o Limited perspective – Usually only some parts of an issue or problem receive attention. This limited perspective, leads to the formulation of inaccurate mental pictures or models, which are preclude support of change efforts.
 - o Susceptibility to emotion – Anger, embarrassment, social anxiety, pride, insecurity, and motivation to succeed and accomplish goals are all important elements that cannot be overlooked during change efforts. Individuals faced with change will be highly susceptible to emotional responses, and failure to recognize and respond to emotions will promote discord and limit group progress.
- Organizational Learning – Organizational learning is based on the integration of program analysis and documentation of both successes and failures in order to build better practices and improve program effectiveness. Organizations’ failure to learn and respond can limit perspective, retain cultural traditions or biases, and severely impede change efforts.

- Leadership – Traditional fire management leadership and governance models of command-and-control conflict with newer goals of transparency, shared decisionmaking and acceptance of risk, and collaborative leadership.

3.0 WILDLAND FIRE DECISION SUPPORT SYSTEM (WFDSS)

Federal agency policy has required documentation and analysis of wildland fire suppression decisions for nearly 30 years. The Wildland Fire Situation Analysis (WFSA), which required managers to evaluate different suppression strategies, previously met this requirement. The WFSA was a complex decision-analysis tool based on decision-science principles that were fundamental to suppression efforts. Unfortunately, use of the WFSA frequently occurred at times of highest uncertainty, time sensitivity, workload escalation, and associated elevated stress levels. Additional processes emerged over time for documenting and analyzing alternatives for managing wildland fire for resource benefits—the Wildland Fire Implementation Plan (WFIP)—and for long-duration wildland fires—the Long-Term Implementation Plan (LTIP).

Utilizing three distinct fire decision-analysis processes resulted in process redundancy, excess work, and a lack of continual inclusion of emerging and improving technology, fire modeling, and geospatial analysis. WFDSS was created as a single system to replace all previous processes and is intended to streamline and improve wildland fire decisionmaking for line officers, fire managers, and analysts.

WFDSS is a Web-based system for documenting decisions, supporting analysis, and completing operational plans. This system utilizes fire behavior modeling, fire weather information, economic principles, and information technology to support effective wildland fire decisions consistent with Land and Resource Management Plans and Fire Management Plans for all wildland fires. WFDSS greatly reduces text input requirements by using spatially oriented and graphically displayed information. The system incorporates a progressive

decision documentation and analysis process that can be scaled and adapted to match situational changes. Through WFDSS, information is assembled, consolidated, and processed for decision-makers in a way that fosters collaboration and, ultimately, provides opportunities to improve large wildland fire strategic decisionmaking.

WFDSS has many attributes that make it different from other decision systems previously used in wildland fire management. These differences, along with implementation swiftness, represent a significant change in fire management practices. Fire managers initially reacted to the introduction of the WFDSS with uncertainty, consternation, avoidance, and reluctance to support. Because of these early reactions, WFDSS represents a prime example of a process and policy change in action and is a useful illustration of how change is successfully being implemented.

4.0 MEASURING SUCCESS

Success of WFDSS development can be assessed in several ways. First, in relation to Figure 1, the WFDSS development steps can be easily equated to the generalized change dynamics stages. Development of WFDSS progressed through these steps, moving decision analysis and documentation toward levels of higher organizational efficiency. As historic decision analysis methods evolved into multiple processes, limitations regarding the processes and understanding and implementation of them led to chronic degradation. The situation blindness and passive awareness stages were relatively short-lived as it became quickly apparent that the old (pre-WFDSS) processes were not meeting managers' needs. In the active awareness stage, fire-management leaders clearly identified the issues and the need for change. In the situation resolution stage, the vision for a new process was clarified, assignments were made for development, and WFDSS was developed and delivered to managers for use. Federal fire-management policy modifications eventually identified WFDSS as the single process for decision analysis and documentation for all wildland fires (National Wildfire Coordinating Group 2009b, USDA Forest Service-U.S.Department of Interior 2009), which,

in combination with amended agency manuals and directives, represented the institutionalization necessary for full implementation. The amount of accelerated training, application during active fire situations, and outside interest gives an indication of professional and social acceptance.

Since the initial release, training for WFDSS has been provided through a variety of delivery methods, including webinars, face-to-face regional and national training courses, instruction in other courses, and presentations at agency and interagency meetings. Through these sessions, more than 5,000 individuals have been trained to date. Use of WFDSS has increased substantially. From 2007 to 2010, the number of incidents recorded annually in WFDSS has grown from 218 to 12,433. An additional indicator of professional acceptance is provided by the number of fire-related managers and other professionals with an authorized WFDSS logon (users). Currently, there are nearly 7,000 authorized WFDSS users.

Some denial and avoidance occurred during this process, but they were minimal because of strong support, a clear vision, and fire management agencies' inability to delay acceptance as other cooperators moved forward. All five federal wildland fire management units have now endorsed WFDSS and accepted it as their standard for decision analysis and documentation.

Describing WFDSS development and implementation in relation to Kotter's (1998) eight steps to transformation also provides a measure for WFDSS's success to date (Table 2). A sense of urgency was developed at the beginning of the process and the initial managing agency responsible for WFDSS development actually accelerated the initial delivery date by 1 year. A powerful coalition was established through the interagency community and its level of support for WFDSS was evident in subsequent fire policy directives (National Wildfire Coordinating Group 2009b, USDA Forest Service-U.S. Department of Interior 2009). A clear vision was established and communicated to all affected agencies and users. The nature of an analytic-deliberative system and the

need for a network of users and support personnel empowered a large number of others to learn, act on, and use WFDSS. Short-term wins have not been well planned for and created but did occur during the development process. Although agencies initially sought to slow implementation of WFDSS and take a phased-in approach, fire season realities pushed accelerated use by field units, resulting in increased support for use and more rapid movement to acceptance. Consolidating improvements and producing more changes are ongoing activities and the large network of users provides a consistent, reliable, and dynamic feedback process for identifying needed system improvements. Institutionalization of WFDSS has been occurring and will continue as agencies refine interagency and agency policy and directives regarding decision analysis and documentation.

5.0 SUMMARY

Change is fundamental to improving organizational effectiveness. Within wildland fire management, change is relentless and has been a part of the development of this program since its inception. As the program has matured, many variables combined to increase complexity, and efficient decisionmaking has become increasingly important. Managers need to be able to acquire as much information as possible as quickly as possible to support their analysis and deliberation during decisionmaking. A progressive and swift decision documentation and analysis process that allows immediate responses to changing situations or scales was determined to be necessary to improve fire management decisionmaking.

The Wildland Fire Decision Support System was developed to meet this need as a single system applicable for all wildland fires. The development and application of WFDSS is an example of a basic change process in fire management. It represents a significant shift from traditional methods and is part of fire management's attempt to improve performance and meet increasingly complex challenges. WFDSS has changed the fire management process, the kind and amount of information available, and the speed with which data can be acquired, analyzed, and utilized.

Table 2.—WFDSS implementation actions and measures of success associated with Kotter’s (1998) eight steps to transformation.

Steps	WFDSS Implementation Actions and Measures of Success
Establishing a sense of urgency	Fire managers from all federal agencies reached a consensus that the three independent decision documentation processes in wildland fire management were inadequate and needed to be consolidated into a single process, applicable to all wildland fires as soon as possible. The associated sense of urgency was cause to charter a group to lead development of a new system—the Wildland Fire Decision Support System.
Forming a powerful guiding coalition	A powerful guiding coalition was formed when senior wildland fire-management managers agreed to support development of a new system. At that time, the National Aviation and Executive Board and senior managers from all federal wildland fire management agencies pledged support.
Creating a vision	A vision was created stating that the new process would be linear, progressive, scalable, consistent, flexible, inclusive of fire-behavior and economic-analysis models, geospatially based, less reliant on text inputs, and hosted on the Web.
Communicating the vision	The vision was communicated to all agencies through numerous presentations, workshops, agency directives and information bulletins, and eventually through established on-line training, information sharing, and presentations at national and international symposiums, national and regional federal and state training courses, and agency and interagency meetings. Communication will remain an ongoing activity for the duration of system development.
Empowering others to act on the vision	Because WFDSS has numerous authorized user roles, the likelihood that thousands of users will understand their specific roles and use parts of the system is high. It is important that many individuals act on the vision, develop varying levels of proficiency, and disseminate information to others about the system. A network of individuals, currently exceeding 7,000 registered users, cascades from the national level down to local units and is serving to advance system understanding.
Planning for and creating short-term wins	Short-term wins have occurred through endorsement by all agencies; some agencies issued direction in 2009 to utilize WFDSS on all fires and eliminate previous processes. Other agencies took a more phased-in approach and implemented WFDSS over longer periods. The ability to use old systems was curtailed by their phase-out. Other short-term wins included the volume of use by all agencies (over 7,700 wildland fires during the first calendar year of implementation; use by all five federal agencies, 17 states, and some private entities such as Alaska Native Corporations; and use on over 12,000 wildland fires during the second year of implementation) and endorsement by senior level managers in all agencies and national budget oversight organizations.
Consolidating improvements and producing more changes	During WFDSS implementation, suggestions about enhancement and modification have continuously been received. These suggestions range from minor modifications to user interface appearances and function to movement beyond a post-ignition decision documentation system. The system will continue to develop and expand beyond the original vision.
Institutionalizing new approaches	The institutionalization of WFDSS has been occurring and will continue as agencies document its required use through directives, manuals, and policies. WFDSS is currently on the way to characterization as “the way we do business here.”

WFDSS development has progressed rapidly, has mirrored change dynamic stages and accepted transformation steps, and represents a much-improved system that serves to modernize situational analysis, risk assessment, and complex decisionmaking.

6.0 ACKNOWLEDGMENTS

The author would like to acknowledge Krista Gebert, U.S. Forest Service, Northern Region; Ivan Pupilidy, U.S. Forest Service, Washington Office Fire and Aviation Management; and Laura Calendrella Kalifeh, U.S. Forest Service, Southern Region, for providing constructive reviews of this paper.

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