

Pre-planning for Post-wildfire Rehabilitation: A Summary of Key Points to Consider

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Editor's note: This article presents excerpts from FORREX Series 19: Key Points to Consider When Pre-planning for Post-wildfire Rehabilitation (URL: <http://www.forrex.org/publications/forrexseries/fs19.pdf>). Please refer to this document for a comprehensive bibliography of references and more thorough discussion of the subject.

Introduction

Forested watersheds are frequently valued for the natural services they offer as well as for the resources they contain. Watersheds provide a convenient unit within which multiple, and sometimes conflicting, resource values are managed and protected. Across British Columbia, wildfire can be a major threat to watershed values even though it is a natural part of many forest ecosystems. The risk that wildfires can negatively affect watershed values has led to a provincial policy of aggressive wildfire suppression. However, many years of fire suppression have increased fuel loads in some watersheds, which increase the likelihood of more damaging fires, and subsequently, risks to watershed values.

Increased forest fire burn severity may result in greater exposure of soils to erosion (i.e., loss of vegetation cover), and in some cases the formation of water-repellent soil conditions (Scott and Pike 2003). Values in burned watersheds are at risk if precipitation events following wildfire result in flooding, severe erosion, and mass movements. Sometimes, these effects can pose a hazard to public safety; cause substantial damage to property

and infrastructure (such as roads and drainage structures); and (or) degrade drinking water quality and valued ecosystem characteristics, such as fish habitat in fisheries-sensitive watersheds. As demonstrated in 2003 by the Okanagan Mountain Park Fire near Kelowna, BC, watershed impairments can occur well downstream of the burned area and in suburban areas.

Where the consequences of wildfire are a concern, humans can intervene to address damage and prevent (or minimize) additional post-wildfire effects. Post-wildfire responses fall into three main categories:

1. emergency stabilization of areas where post-wildfire conditions pose an immediate hazard to public safety, drinking water, property, infrastructure, and (or) other watershed values;
2. rehabilitation of areas directly affected by wildfire suppression activities; and
3. rehabilitation of burned areas for longer-term goals, such as establishing preferred vegetation (composition and structure) and (or) minimizing erosion potential.

Considerable research in emergency stabilization and rehabilitation has been undertaken in the United States through the activities of the Burned Area Emergency Response (BAER) program (see Neary *et al.* 2000; U.S. Department of Agriculture Forest Service 2002). Professionals are increasingly recognizing that a rapid response similar to the BAER approach is required to protect key watershed values and public safety before a storm event that might trigger undesirable post-wildfire conditions occurs. In such cases, planning and preparing for emergency stabilization and rehabilitation *in advance* could save valuable time and dictate success and failure.

This summary article sets out key points to consider when planning for post-wildfire rehabilitation. Ideally, such planning is part of a larger framework of wildfire risk assessment, and preparedness planning and programs. Many of the points in this article are based on input obtained from a working session held June 9, 2005, in Kelowna, BC. This one-day working session brought together professionals with a range of experiences in post-wildfire erosion control, forest hydrology, and geosciences. The goals of the working session were to stimulate discussion on the topic, and to obtain professional input on sample elements for a preparedness plan for post-wildfire rehabilitation in a forested drinking-water supply catchment area. The authors subsequently developed and refined key points from the workshop.

Key Points from the Working Session

Strategic Planning, Definitions, and Goals

Keep pre-wildfire planning simple and assemble information

The primary goal of pre-planning is to prepare for a strategic, effective, and rapid post-wildfire response. A pre-wildfire plan should focus on

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assembling information rather than attempting to predict and prepare for every possible event. Information assembly could include identifying key watershed characteristics, watershed values, and factors relating to risk; clarifying roles, responsibilities, and contact information; developing scenarios; setting goals and objectives; and identifying resources and training requirements. The information could also include maps, data, and photographs relating to biophysical characteristics and (or) infrastructure and maps that illustrate key watershed values and sensitive site factors. This information can help expedite the post-wildfire assessment and offers context for determining priorities and prescriptions for post-wildfire emergency stabilization and rehabilitation.

Clearly define terms in plans

Sometimes confusion and misuse of terms (e.g., fire intensity vs. burn severity) can negatively affect communication. Plans should include a glossary of clearly defined terms.

most appropriate emergency stabilization and (or) rehabilitation activities to match planned goals.

Watershed Values and Characteristics

Identify key watershed values and risks

It is vital to identify and map risks to key watershed values from wildfire or post-wildfire hazards. Key watershed values at risk may include residences and businesses, drinking water sources, infrastructures, managed forest land, and valued ecosystem



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Consider historical wildfire regimes and changes in fire frequency and intensity

The frequency and intensity of natural fire regimes vary considerably across British Columbia. Most recently, climate change may have altered the historical frequency, intensity, and length of fire season in many areas. Fire suppression has also altered regional and local fire regimes leading to changes in vegetation patterns, and a general increase in forest fuel loadings and the potential for burn severity. These factors need to be considered when assessing risk and planning for response.

Triggers for Post-wildfire Hazards

Recognize that severely burned slopes do not necessarily have to be steep to generate substantial post-wildfire erosion potential

Knowledge from the BC

Southern Interior has demonstrated that erosion, flooding, and debris flows/floods can occur on relatively low-slope gradients. Therefore understanding the hydro-geomorphic characteristics of the watershed and considering the potential for debris flows, debris floods, or flood events on low-slope gradients are important.

Use permanent or portable climate stations and (or) Doppler radar to help understand and characterize local precipitation regimes that might trigger slope hazards in a watershed

A variety of rainfall events (e.g., rain-on-snow, high intensity/short duration, moderate-low intensity/long duration rainfall events) can be important triggers causing slope hazards in burned watersheds in British Columbia. Understanding local precipitation regimes (seasonality, frequency, duration, and intensity) is an important part of pre-wildfire planning.



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components (e.g., fish habitat in fisheries-sensitive watersheds). Recognizing potential hazards arising from wildfire and post-wildfire conditions is necessary for risk analysis and management, and can supply the rationale for additional resources focused on mitigating and (or) preventing fire and post-wildfire effects.

Match planned activities to goals

There are three categories of emergency stabilization and rehabilitation: (1) short-term emergency stabilization; (2) rehabilitation of fire suppression related effects; and (3) long-term watershed rehabilitation. These activities have very different requirements regarding jurisdictional issues, time scales, and, subsequently, effectiveness. Therefore, select the

Review how local watershed characteristics relate to wildfire and post-wildfire conditions

Consider how local watershed characteristics may influence weather and wildfire behaviour and, hence, the potential for post-wildfire effects. If there are information gaps, the pre-wildfire plan should set out strategies for obtaining required data.

Prediction of Post-wildfire Erosion

Use physical watershed parameters to assist in identifying the potential for post-wildfire erosion and mass wasting deposition

Advance planning for post-wildfire stabilization and rehabilitation would benefit considerably from identifying areas most susceptible to post-wildfire mass wasting erosion and deposition. Factors such as existing (pre-wildfire) slope stability, surface erosion potential, channel morphology, and sediment transport potential may be useful to consider in pre-wildfire hazard assessment. However, any attempt to predict susceptible areas does not reduce the need to perform a post-wildfire assessment of conditions by a qualified professional. Such an assessment is required to validate potential hazards created by the wildfire before developing site-specific prescriptions for emergency stabilization and rehabilitation.

Priority Areas for Action and Jurisdictional Issues

Use a detailed hazard and risk analysis to identify priority areas for fire suppression and post-wildfire emergency stabilization and rehabilitation activities

In undeveloped areas of a watershed, it may be appropriate to let a wildfire burn un-suppressed and allow the site to naturally recover. However, in many areas, fire suppression and post-wildfire emergency stabilization and rehabilitation activities will be critical in protecting key watershed values. Pre-planning should identify priority areas in watersheds for fire suppression and post-wildfire stabilization and rehabilitation based on the results of a hazard and risk analysis.

Identify organizations and individuals with an interest or role in the pre-wildfire plan, establish lines of communication, and clarify roles and responsibilities

Understand which organizations and individuals protect and manage watershed values, and who is responsible for fire suppression and post-wildfire activities. Identify and meet with organizations within and adjacent to the planning area. Identify key contacts in these agencies before any watershed emergency (such as a large wildfire). Clarifying agency interests, roles, and responsibilities, location and risk to key watershed values, as well as agreeing upon an incident command structure in advance, should minimize the potential for conflict, confusion, and inefficiencies.

Consider the potential for downstream effects

Post-wildfire conditions can amplify and accelerate effects, such as flood-

ing, erosion, and mass wasting, that could affect downstream areas. Yet, these areas may be outside the jurisdiction of the agency responsible for the lands where a wildfire occurs.

Consider such scenarios in pre-wildfire planning to identify and clarify downstream values and appropriately co-ordinate inter-jurisdictional responsibilities and activities in response to an emergency.

Mitigation Strategies and Management of Risk

Develop post-wildfire strategies that are linked to key watershed values and public safety

Given the need for quick action, and the substantial resources that are often required for post-wildfire emergency stabilization and rehabilitation, match the intensity of these activities with the level of risk (and consequence) to key watershed values and public safety, and resources available. Also, consider the potential risks to

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watershed values associated with access, machinery, and materials in post-wildfire interventions.

Match stabilization and rehabilitation techniques to the protection of watershed values and public safety, site objectives, and seasonal considerations

A number of techniques, such as seeding non-native grass mixes to control erosion, are almost universally applied in post-wildfire stabilization and rehabilitation. However, grass seeding may not effectively control first-year erosion if rains arrive before a good cover crop has become established. Thus, consider if such techniques are appropriate given the site-specific risk to watershed values and public safety, the objectives for the site, physical site characteristics, the potential for native vegetation to re-establish on the site, and seasonal and timing concerns. For example, seeding non-native grasses may not be appropriate in native

grasslands with high conservation values, where native vegetation is fire-adapted and will recover, or where there is not sufficient time for grass to establish before the onset of fall and winter precipitation. In such cases, an alternate approach to erosion control may be more optimal.

Identify long-term targets for post-wildfire vegetation

Stabilization, and some rehabilitation, focuses on short-term goals and objectives, such as quickly re-establishing vegetation cover to prevent or minimize erosion. However, some short-term actions (such as seeding non-native grasses) may interfere with establishing more desirable species (such as conifers) over the long term. Incorporating long-term goals and objectives into pre-planning can help ensure that these targets are considered when addressing immediate needs. Also, identify how long-term targets for vegetation composition

and structure in the watershed may differ from the existing (current) vegetation on the site. Prescriptions for stabilization and rehabilitation should focus on desired targets for vegetation composition and structure, not just on re-establishing the pre-wildfire conditions.

Proactive Approaches to Reducing Risk

Consider reducing the level of burn severity where key watershed values may be at risk

A wide range of options for reducing potential burn sever-

ity (e.g., forest fuel reduction, creation of fuel breaks) are available to protect watershed values. Other options, such as wetting areas in the path of a wildfire, may also be useful in reducing burn severity in areas of concern.

Barriers to Success and Communication Needs

It may not be possible to prevent the worst-case scenario

Comprehensive applications of emergency stabilization techniques may not be 100% successful in preventing all undesirable effects in every situation. Some watersheds may have serious constraints to effective stabilization and rehabilitation, and trade-offs may be required. In such cases, a structured approach, such as a cost-benefit analysis, should be incorporated into pre-planning for post-wildfire stabilization and rehabilitation.

Ensure everyone involved in fire suppression and post-wildfire stabilization and rehabilitation activities has the awareness and training required to minimize undesirable effects on watershed values

Fire suppression and post-wildfire activities involve personnel with a wide range of expertise, skills, and backgrounds. Because many fire and post-wildfire activities involve contract work, it is often difficult to verify the training of all employed personnel in emergency situations. Yet, pre-wildfire planning must include strategies to ensure that all personnel involved are aware of the location and characteristics of key watershed values and the best approaches and techniques (such as machine-free areas) to protect key values. Timely information sharing and (or) daily briefings can effectively ensure continued professional development, and maintain clear lines of communication as an event unfolds. Annual end-of-season debriefing sessions (e.g., sharing case studies) can also help disperse useful information. Post-treatment field trips to identify treatment successes and failures and (or) additional threats to watershed values not identified during the original post-wildfire assessment might also be useful learning opportunities.

Develop a list of qualified professionals cross-referenced by services such as post-wildfire assessments, risk analyses, emergency stabilization and rehabilitation

Having a list of professionals readily at hand will facilitate a rapid response to emergency situations. Update this list annually before the fire season. The administrative and financial policies and procedures for retaining contract services in emergency situations should also be in place and well understood.

Learn from Existing Experience

Review information from case studies on documented post-wildfire events, existing predictive models, and

post-wildfire stabilization and rehabilitation trials

Much of what is known in British Columbia about undesirable post-wildfire conditions, such as flooding, erosion, and mass movements, comes from recent experiences in the Southern Interior of the province and from the western United States. While differences in climate and biophysical characteristics exist between these areas, it is worth investigating case studies outside of the region. A review of the growing literature on post-wildfire effects, and the types and effectiveness of stabilization and rehabilitation techniques, can offer a wide range of options to include in a pre-wildfire plan. Understanding which techniques are most effective will help planners and practitioners use limited resources most efficiently.

Summary and Conclusions

In British Columbia, advanced planning (pre-planning) for post-wildfire emergency stabilization and rehabilitation is a relatively new concept that requires further exploration. Pre-planning facilitates a rapid post-wildfire assessment and ensures an appropriate response before an event occurs that might trigger undesirable post-wildfire effects. Assembling information in advance allows for the rapid refinement of planned strategies for emergency stabilization and short- and long-term rehabilitation. Therefore, pre-planning needs to be kept relatively simple.

Not all of the key points presented here will be applicable to agencies attempting to better address the potential negative effects of wildfire on watershed values. However, we hope these points will stimulate thought and discussion, and serve as a useful list to consider when planning. ~

Acknowledgements

We thank the participants of the June 9, 2005, working session in Kelowna,

BC. Their ideas and expertise form the basis of this discussion. We also thank the following reviewers whose comments greatly improved the original document: Patrick Daigle, Don Dobson, Carolyn Napper, Rob Scherer, Dave Scott, Tim Smith, and Kevin Turner. Preparation of FORREX Series 19 was funded in part by the BC Ministry of Forests and Range through the Forest Investment Account–Forest Science Program.

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References

BC Ministry of Forests. 2005. *Wildfire regulation sections 16 and 17*. URL: <http://www.for.gov.bc.ca/tasb/legsregs/wildfire/wildfirereg/wildfirereg.htm#section16>; and <http://www.for.gov.bc.ca/tasb/legsregs/wildfire/wildfirereg/wildfirereg.htm#section17>

Neary, D.G., P.R. Robichaud, and J.L. Beyers. 2000. *Burned area emergency watershed rehabilitation: program goals, techniques, effectiveness, and future direction in the 21st century*. U.S. Department of Agriculture Forest Service, Proceedings RMRS-P-13. URL: http://www.fs.fed.us/rm/pubs/rmrs_p013/rmrs_p013_375_378.pdf

Scott, D. and R.G. Pike. 2003. *Wildfires and watershed effects in the Southern BC Interior*. Streamline Watershed Management Bulletin 7(3):1–4.

U.S. Department of Agriculture Forest Service. 2002. *Burned Area Emergency Response – BAER*. URL: <http://www.fs.fed.us/biology/watershed/burnareas/background.html>