Wildfire risk and response in Jasper National Park, Alberta: Application of an adaptation readiness framework

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Environmental change associated with warmer temperatures is creating unprecedented conditions in natural regions and ecosystems. In Jasper National Park, Alberta, climate change, historical fire management practices, and the mountain pine beetle infestation are combining to increase the risk of a major wildfire. The intent of this short commentary is to provide a primer for decision-makers. The application of an adaptation readiness framework highlights areas where the Park's level of preparedness for wildfire adaptation is well developed and areas in need of further attention. Areas where adaptation is well developed include political leadership, decision making, and stakeholder engagement. Further attention is necessary around institutional organizations, funding, and public support.

   Keywords: climate change, fire suppression, mountain pine beetle, planning, adaptation action

Key Messages

- Risk of wildfire in Jasper National Park is increasing due to combined impacts of climate change, historical fire management practices, and mountain pine beetle infestation.
- There is need for a long-term adaptation strategy, including engagement and collaboration between planners, industry professionals, and the community to reduce the risk of wildfire.
- Areas where adaptation is well developed include political leadership, decision making, and stakeholder engagement. Further attention is necessary around institutional organizations, funding, and public support.

Introduction

Climate plays a key role in forest ecosystems by influencing species distribution, productivity, and overall health (Gauthier et al. 2014). Uncertainties in forest resiliency are increased as climate change exacerbates the impacts of changing temperatures and precipitation (Wang et al. 2019). These changing conditions are influenced by a mean global temperature increase of 1°C since 1900, facilitating conditions for droughts, wildfires, and pests (Gauthier et al. 2014; Chavardès et al. 2018). Across Canada approximately 8,000 wildfires occur annually, burning a yearly average of 2.25 million hectares (Tymstra et al. 2020). The Government of Canada (2020) recognizes that as impacts of climate change increase in magnitude and occurrence, the cost of inaction will also rise. Forests are valued both economically and environmentally; therefore, degradation and loss of these ecosystems would be a major detriment, making the need for adaptation to climate change important and timely, particularly for forest dependent communities and industries (Government of Canada 2020).

In Jasper National Park, Alberta, human intervention coupled with climate change has created difficult conditions for forests to maintain historic growth patterns. Further, increased temperatures have facilitated conditions ideal for long-distance dispersal of mountain pine beetles, leading to the current Park infestation (Huapeng and Jackson 2017). The beetles have caused widespread mortality of pine, resulting in alterations to fuel complexes as they increase biomass availability (Bourbonnais et al. 2013). Jasper is an important area economically and environmentally; as challenges amplify the risk of wildfire, the necessity of adaptation increases in importance.

The increasing risk of a major wildfire requires collaboration between planners, Indigenous representatives, industry professionals, and the community in order to achieve successful long-term adaptation (MacDonald and Birchall 2019; Johnston and Mason 2020). This short commentary explores the history and impacts behind these conditions, and the current level of adaptation readiness in the Park.

Setting

Jasper National Park, located in western Alberta, is the largest national park in the Canadian Rocky Mountains, extending over 11,000 square kilometers (CivicPlus 2021). It is dominated by coniferous forests with some grasslands and mixedwood forests (Chavardès et al. 2018). Jasper Forest Park was formed in 1907, attaining national park status and the name Jasper National Park in 1930. Within the park boundaries lies the Municipality of Jasper, with a population of approximately 5,000 residents (CivicPlus 2021). The Park is part of the UNESCO Canadian Rocky Mountain Parks World Heritage Sites, attracting more than 1.8 million visitors annually (CivicPlus 2021).

Fire History

Wildfires became more frequent due to anthropogenic pressure after 1826 (Chavardès et al. 2018). From 1916 to 2011, there was a decrease in wildfire due to the Park's regulations on fire suppression, as a method to preserve the forest ecosystem (Chavardès et al. 2018). However,

studies have shown that preserving forest ecosystems has created an accumulation of biomass contributing to an increased risk of wildfire (Chavardès et al. 2018; Parisien et al. 2020). Wildfire is a natural part of a forest's life cycle; removing biomass, allowing certain species to propagate, and facilitating forest rejuvenation (Davis et al. 2018). However, the increased availability of biomass, from fire suppression and beetle infestation, combined with increasing temperatures create a major risk of wildfire in the area (Krawchuk and Cumming 2011). In 2015 such conditions facilitated the Excelsior wildfire, burning 1000 hectares of forest within the Park, causing over 1000 people to evacuate, and spreading within 15 kilometers of the Municipality of Jasper (Clarke 2015).

Climate Change Impacts

Research indicates that climate change will increase frequency and severity of droughts and wildfires in Canada (Boucher et al. 2018). As climatic conditions change, forests naturally adapt through adjustments in species compositions, vegetation density, and growth patterns (Gauthier et al. 2014). However, the rate and magnitude of climate change is predicted to result in unprecedented forests conditions (Gauthier et al. 2014).

The mountain pine beetle population has thrived due to increasing temperatures, contributing to its proliferation throughout the Park and resulting in increased biomass availability (Bourbonnais et al. 2013). Historically, extended cold temperatures controlled the population. In 2006, the beetles migrated from British Columbia into Alberta where the infestation continues (Parks Canada 2010). Extreme cold temperatures in the 2019-2020 winter season resulted in slowing the infestation, with an estimated kill of 95% in some areas (Bell 2020). Despite this positive outlook on the infestation, the increased biomass availability escalates the risk of wildfire spread in the Park.

Fire management approaches are shifting as the systematic use of fire suppression can be environmentally and economically unsustainable in areas where wildfire should be considered beneficial (Bowman et al. 2013; Parisien et al. 2020). Moreover, there remains a lack of understanding around the combined effects of increasing temperatures, wildfire, and harvest activity to correctly manage the future of forest ecosystems (Krawchuk and Cumming 2011). It is important to continue working toward understanding drivers of forest conditions to develop effective long-term adaptation management plans and policies in response to the increasing risk of a major wildfire (Chavardès et al. 2018).

Adaptation Readiness

The management of wildfire within national parks is the responsibility of the Parks Canada Agency (Tymstra et al. 2020). Within Jasper, management is collaborating with Indigenous communities to increase their participation and representation in planning (Johnston and Mason 2020). The Park has experienced a number of fire management strategies including prescribed burning and fire suppression (Parks Canada 2016). Since 2013, Jasper's FireSmart Project has been working to mitigate the risk of wildfire through the development of a firebreak, reduced biomass, and general assessment, for example via Wildfire Hazard Evaluations (CivicPlus 2021).

Conditions within the Park highlight the need for long-term strategies to reduce the risk of wildfire. Adaptive capacity and strategies are influenced by several factors including political leadership, institutional organizations, decision making and stakeholder engagement, useable science, funding, and public support (Ford and King 2015). These factors contribute to adaptative readiness, whether an area is prepared for adaptation.

Decision-makers need to expand their existing capacity for adaptation readiness to facilitate proactive action. A systematic approach, such as Ford and King's (2015) can be used to identify a starting point to initiate discussions on adaptation readiness and policy priorities. This can provide an initial estimate for the overarching conditions that affect readiness, in turn shedding light on factors essential for adaptation to occur.

Political Leadership

Strong political leadership, from a mayor or chamber of commerce, plays a critical role in initiating and maintaining momentum for risk reduction and adaptation strategies (Moser and Ekstrom 2010). Leadership can facilitate awareness and adaptation by providing strategic direction, easing bureaucratic resistance, and promoting community acceptance (Termeer et al. 2012). Political leadership for wildfire adaptation is clear in the Park, as evidenced through public addresses, events, and funding boosts organized by public figures (Weber 2019). By continuing the practice of strong leadership, the Park's ability to create policies that respond to long-term challenges such as wildfire is greatly enhanced.

Institutional Organizations

Institutions can facilitate readiness for adaptation through the creation of political and administrative structures that focus on risk minimization (Moser and Ekstrom 2010). They play a critical role in developing and maintaining cohesive long-term planning that allows climate adaptation to be incorporated into relevant policies across government departments (Biesbroek et al. 2010). Barriers are created when strategic priorities or management plans do not adequately reflect the goal of adaptation.

The Municipality of Jasper Strategic Priorities 2018-2022 addresses its commitment to expanding FireSmart programs and initiatives to mitigate wildfire risk (Municipality of Jasper 2011). The 2011 Jasper Community Sustainability Plan outlines continuation of the FireSmart program, including thinning of surrounding forests (Parks Canada 2011). The 2010 Jasper National Park Management Plan recognizes the success of prescribed fires and the actions occurring to improve protection from major wildfires (Parks Canada 2010). The Mountain Pine Beetle Management Plan outlines mitigative measures including prescribed fires and working with programs including FireSmart to achieve conservation goals which decrease the risk of major wildfires (Parks Canada 2016).

While efforts are moving in the right direction, further attention is necessary to revisit plans and policies to ensure they are facilitating long-term adaptation readiness to the threat of major wildfires.

Decision Making and Stakeholder Engagement

Wildfire management is shifting to include a greater focus on stakeholder participation to understand and integrate public values (Williams et al. 2018). Social engagement, including both social involvement and education, is demonstrated in the Park through public information sessions, emergency preparedness seminars, and guides, such as the Jasper Evacuation Guide, the Jasper Emergency Guide, and 72-hour Emergency Guide (CivicPlus 2021). Through on-going engagement, such as the extensive involvement in the development of the Jasper 2020 Management Plan, the Park builds trust and cooperation with stakeholders, which is critical for incorporating adaptations for wildfire risk into operational decision making (Ford and King 2015). Multi-stakeholder planning minimizes conflict, enhances creativity, and facilitates diverse interests (Brummel et al. 2010). Therefore, by continuing current decision making and engagement practices adaptation to the risk of a major wildfire is supported.

Useable Science

Effective and knowledge-intensive policies for managing wildfire risk must be developed from research outlining the cost of action and fundamentals of adaptation (Ford and King 2015). There is an abundance of research exploring the wildfire dynamic in the Park, including studies predicting the increase in fires attributed to climate change, the mountain pine beetle infestation, and management practices (Huapeng and Jackson 2017; Boucher et al. 2018). Wildfire management differs from other emergency management as management must decide which wildfires to suppress or keep based on positive and negative impacts, including competing land uses and smoke management (Tymstra et al. 2020). New research is necessary to increase understanding on the combined effects these factors have on wildfire risk (Krawchuk and Cumming 2011). This knowledge is critical in developing practical and comprehensive policies for managing risk adaptation (Ford and King 2015).

Funding

Adequate funding is required for the execution and maintenance of policies and strategies for wildfire adaptation; few policies generally can be implemented successfully using existing funding streams (Ford and King 2015). With authority delegated by the Minister of Agriculture and Forest, the Forest Resource Improvement Association of Alberta (FRIAA) offers funding to communities, such as Jasper, to prepare for wildfires through the FireSmart program (CivicPlus 2021). Renewed funding allowed for a three year plan from 2018 to 2020 to treat over 50 hectares of forest to protect the community, critical infrastructure, and evacuation routes within the Park (CivicPlus 2021). Funding is also available to support wildfire emergency guides and public education seminars (CivicPlus 2021). Funding for these programs and updating of policies and plans, must increase to achieve more timely results, and should include cost of implementation, monitoring, and continued research.

Public Support

Public support affects decision making by influencing the development and implementation of adaptation programs/plans, and the development of institutional capacity (Boykoff et al. 2013). This is shown by Park user participation in climate protests and online platforms. The acceptance of climate change has been an ongoing process for citizens as views, beliefs, and the perceived need for adaptation become increasingly recognized (Ameztegui et al. 2018). Public support through collaboration allows stakeholders to constructively examine their differences and minimize conflict, which can facilitate effective action moving forward (Brummel et al. 2020). Park leadership needs to seek continued public support and awareness for wildfire adaptation, to influence the effectiveness of programs and policies.

Conclusion

The Park is becoming increasingly vulnerable to the risk of a major wildfire through the impacts of climate change, historical fire management practices, and the ongoing mountain pine beetle infestation. The intent of this short commentary is to provide a primer for decision-makers. The application of an adaptation readiness framework highlights areas where the level of preparedness for wildfire adaptation is well developed and areas in need of further attention. Areas where adaptation is well developed include political leadership, decision making, and stakeholder engagement. Further attention is necessary around institutional organizations, funding, and public support. Ongoing research and understanding of the local environmental situation are also important to improve resilience in the Park.

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