FIREARC

The Nine BlindSpots of Wildfire Resilience

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Introduction

Canadian communities face far greater wildfire risks than they realize, driven by outdated maps, hidden unknowns, and rapidly changing fire behavior. High-profile cases like Jasper and Fort McMurray show that visibility gaps not just response limitations can turn threats into disasters. Most municipalities lack a shared understanding of their true perimeter exposure, leaving them vulnerable in ways that traditional models and FireSmart do not address. The Nine BlindSpots framework emerged from reviewing after-action reports on major WUI fires, where it became clear that unseen factors physical, operational, and societal shape outcomes long before a fire reaches the community. By naming and resolving these BlindSpots, communities can move from reactive to proactive wildfire resilience, making critical conditions visible and actionable before the next emergency.

Wildfire does not become a disaster everywhere at once. It becomes a disaster at specific locations, under specific conditions, when fire behavior intersects with unresolved perimeter BlindSpots. This paper reframes wildfire risk not as probability, but as breach potential: where a wildfire would overwhelm response, infrastructure, evacuation, or governance systems if it reached that point.

The barrier isn't knowledge, it's that no one is responsible for making the case in a way that decisions can actually move. That is where we start.

Wildfire Breach (FireArc definition)
A breach occurs when a wildfire crosses from the landscape into a condition where:

- Initial attack is no longer reliable
- One or more evacuation or lifeline systems become compromised
- Decision-makers lose viable time, options, or clarity
- Consequences escalate non-linearly beyond suppression capability

Wildfire breach setups occur outside municipal boundaries but inside the functional perimeter that governs ember transport, response access, and evacuation viability. As a result, many of the most consequential breach conditions fall outside traditional planning scopes, funding models, and governance boundaries.

Communities do not fail because they ignore wildfire risk. They fail because breach conditions emerge outside their field of view along the perimeter where responsibility is diffuse, visibility is low, and decisions are delayed until options collapse.

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Purpose

The Nine BlindSpots are location-specific uncertainties that exist before FireSmart or other actions can be effectively prioritized or sequenced. Each BlindSpot represents a pathway through which a wildfire breach can occur at the community or perimeter scale, making it difficult to operationalize established wildfire resilience practices and, once a breach occurs, significantly increasing consequences and costs.

Resolving a BlindSpot does not mean eliminating wildfire risk or predicting outcomes. It means making a location-specific condition sufficiently visible, understood, and shared that it can be consciously planned around before decision windows compress. In practice, resolution involves improving visibility, clarifying interactions between conditions, and enabling better sequencing and coordination across planning, response, and governance functions. A resolved BlindSpot becomes decision-ready: it can be discussed, prioritized, and addressed deliberately rather than discovered under emergency pressure.

FireArc's intent in naming these BlindSpots is to create a shared, practical language that helps leaders better understand where readiness gaps exist. By resolving BlindSpots, communities are better positioned to apply comprehensive wildfire mitigation strategies in a targeted and effective way.

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Layer 1: Fire Drivers

(Physical BlindSpots)

These BlindSpots shape *where* a fire is most likely to arrive with force.

These are physical conditions that influence how wildfire can initiate and spread. They are well-studied in the literature, but can be difficult to applied at the community level.

1. Ignition-Prone Areas

Locations where wildfire ignition is statistically more likely to occur. Common examples include rail corridors, power transmission lines, industrial zones, and high-use recreation areas. There are also geological and environmental factors that can impact fire susceptibility. In eastern Manitoba, the start of the Canadian Shield is clearly marked by a higher number of lightning-caused fires compared to surrounding areas, despite similar lightning frequency.

Unknown:
While communities prepare broadly for wildfire risk, some do it better than others, **specific ignition pathways are not always mapped or mitigated with local precision**, limiting the effectiveness of prevention and preparedness measures. Precise and accurate mapping of ignition pathways will improve effectiveness of these measures.

Identifying these areas supports FireSmart disciplines related to risk assessment, emergency planning, and interagency coordination.

2. High-Risk Fuel and Behaviour Zones

Areas where fuel conditions can significantly amplify fire behavior. Examples include dense forest stands, drought-stressed vegetation, and fuel-rich perimeter zones adjacent to communities. When we combine weather factors and wind patterns with topography we start to see risks in an active vs static way.

Unknown:
The forest surrounding communities is often not uniform. Fuel characteristics vary significantly by location and can influence fire intensity and spread.

Clarifying where high-risk fuel zones exist helps prioritize vegetation management actions within FireSmart programs.

3. Ember Exposure Sectors

Areas susceptible to ember transport and deposition during wildfire events. Embers can travel well ahead of the main fire front, typically 2 to 3km under Canadian conditions, though documented extremes in major wildfire events, including cases in the United States, have reached significantly

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farther. Either range is often enough to place structures that appear safely outside a fire's path directly in an ember's path, making embers a leading cause of structure ignition. By looking at these structures, we can provide insights as to where FireSmart hardening may be an important priority.

Breach condition: When ember exposure intersects with un-hardened structures or critical infrastructure beyond suppression reach, ignition becomes distributed and uncontrollable.

Unknown:
Planning efforts often emphasize direct flame contact, while **ember exposure patterns are not always clearly understood or visualized at the community scale**.

Resolving this Unknown enables more effective application of FireSmart guidance related to home hardening, land-use planning, and infrastructure protection.

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Layer 2: Operational Constraints

(Response-Related BlindSpots)

These BlindSpots directly influence time-to-breach by constraining suppression, access, and evacuation options.

These BlindSpots relate to **time, terrain, access, and system dependencies** that influence how effectively response resources can be deployed. They do not reflect deficiencies in response capability, but rather **contextual factors that can limit operational options**, even for well-prepared agencies.

Breach condition: When response delays extend beyond the effective initial-attack window, a wildfire can transition from a controllable incident into a breach event before suppression resources can meaningfully engage, eliminating the opportunity to contain spread outside the perimeter.

Understanding these conditions in advance helps communities align emergency planning, infrastructure protection, and interagency coordination within established FireSmart guidance.

4. Response-Delay Terrain

Areas where response delays limit the effectiveness of initial attack.
These areas are characterized by factors that extend the time between ignition and the arrival of suppression resources. Examples include remote or difficult-to-access locations, steep or complex terrain that restricts ground access, limited road networks, long distances to reliable water sources, and reliance on aviation resources constrained by daylight, smoke, or crew duty limits.

Response delays may also result from detection and reporting challenges, multiple simultaneous ignitions, or limited resource availability due to higher-priority incidents elsewhere.

Unknown:
Communities often lack localized insight into how detection time, access constraints, and resource availability combine to reduce the practical window for effective initial attack.

Identifying and clarifying these response delay factors supports FireSmart disciplines related to emergency planning, access management, water supply planning, and coordination with response agencies.

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5. Evacuation Route Reliability

Transportation corridors that may be vulnerable during wildfire events. This can include single-access highways, bridges, narrow corridors, or routes exposed to vegetation and topography.

Breach condition: When evacuation routes are exposed, constrained, or fail under fire conditions, a wildfire breach shifts rapidly from a suppression challenge into a life-safety emergency, forcing decisions under compressed timelines and limited alternatives.

Unknown:
Evacuation planning typically assumes route availability, but **the reliability of specific corridors under fire conditions is not always assessed with local precision**.

Identifying these constraints enables more robust emergency planning, public communication, and infrastructure prioritization consistent with FireSmart principles.

6. Critical Infrastructure Exposure

Essential systems that support community safety and recovery. These include hospitals, schools, grocery stores, gas stations, hardware and supply providers, power, water supply, telecommunications, transportation, and other lifelines that are necessary for response and post-fire recovery.

Unknown:
The wildfire exposure of critical infrastructure is often **understood in general terms**, but **site-specific vulnerabilities and interdependencies may not be clearly documented or prioritized**.

Resolving this Unknown helps communities apply FireSmart guidance related to infrastructure protection, continuity planning, and interagency collaboration.

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Layer 3: Systemic Stressors

(Societal & Governance-Related BlindSpots)

These BlindSpots influence whether breach conditions are recognized and managed before cascading failure occurs.

These BlindSpots relate to **social, economic, and information dynamics** that influence a community's ability to prepare for, respond to, and recover from wildfire. They often develop gradually and may not be immediately visible during technical risk assessments, yet they can significantly shape outcomes before, during, and after an event.

Understanding these factors helps communities apply FireSmart guidance in ways that are socially equitable, economically resilient, and operationally informed.

7. Economic & Insurance Exposure

Financial conditions that affect long-term community resilience.
This includes changes in insurance availability, shifts in perceived risk, impacts on property values, and pressures on local businesses and investment.

Unknown:
Wildfire risk can influence economic stability **well in advance of an actual fire**, yet these effects are not always incorporated into resilience planning or recovery strategies. This is done by looking at disruptive potential of wildfires. FireArc examines this disruptive potential through a financial and behavioural lens built from analysis of past impacts and cost elements.

In several fire events, insurance withdrawal and delayed rebuild financing became secondary crises that extended displacement and strained municipal systems long after suppression ended.

Clarifying this exposure supports FireSmart disciplines related to planning, governance, and long-term community sustainability.

8. Population Vulnerability

Groups with reduced capacity to respond to or recover from wildfire impacts.
This may include seniors, children, care-dependent populations, people with mobility or health limitations, and residents facing economic constraints.

Unknown:
Emergency and resilience plans are often developed around general population assumptions, while **the location and needs of more vulnerable populations may not be**

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clearly mapped or integrated into preparedness measures.

Resolving this Unknown strengthens FireSmart applications related to emergency planning, public education, and inclusive community protection.

9. Situational Awareness & Information Continuity

The availability of timely, shared, and locally relevant wildfire information for decision-makers.
This includes perimeter awareness, fire progression context, map relevance, and common operational language across agencies and leaders.

Unknown: During wildfire events, decision-makers may operate with **partial, delayed, or fragmented information**, particularly at the community scale, which can complicate coordination and prioritization.

Breach condition: Loss of shared situational awareness increases breach likelihood by delaying recognition of escalation until response, evacuation, or infrastructure systems are already compromised.

Improving situational awareness supports FireSmart objectives related to interagency cooperation, emergency planning, and effective communication.

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Why This Framework Matters

Compound BlindSpots and Non-Linear Risk

Wildfire disasters rarely result from a single unresolved BlindSpot. They occur when two or more BlindSpots overlap spatially or temporally, for example, high-hazard fuels combined with response-delay terrain, or evacuation route fragility combined with population vulnerability. These intersections dramatically increase breach probability and reduce decision time.

A Typical Breach Setup

A wind-driven fire enters a high-hazard fuel zone beyond municipal boundaries (BlindSpot 2), where access constraints delay initial attack (BlindSpot 4). Ember exposure extends into a neighbourhood served by a single evacuation route (BlindSpot 5), while situational awareness is fragmented across agencies (BlindSpot 9). Individually manageable risks combine to produce a rapid breach with limited options.

1. It Makes Critical Conditions Visible

Communities often work diligently on wildfire preparedness, yet some location-specific factors remain difficult to see until a fire event brings them into focus. The **Nine BlindSpots** help surface these less visible conditions early, allowing leaders to address them proactively rather than under emergency pressure.

By naming these BlindSpots, communities gain a clearer picture of where additional attention, sequencing, or coordination may be needed.

2. It Connects Disciplines That Are Often Addressed Separately

The Nine BlindSpots provide a **shared integrative view** that helps leaders understand how these perspectives interact at the community scale, reducing fragmentation and improving coordination across departments and partners.

3. It Establishes a Common, Practical Language

Well-known frameworks succeed because they give decision-makers a simple way to organize complex issues. In the same way, the Nine BlindSpots offer leaders a **practical diagnostic lens**:

- Which BlindSpots have we addressed?
- Which remain unresolved?
- Where should we focus next?
- What are the cascading impacts of each blindspot?

This shared language supports clearer discussions at council tables, with staff, and with external partners.

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Why the Nine BlindSpots Matter for Emergency Management

1. They clarify where wildfire risk becomes an emergency management challenge.

Emergency management is responsible for preparedness, coordination, evacuation, and consequence management often under time pressure and incomplete information. The Nine BlindSpots translate broad wildfire risk into specific, place-based conditions that can affect readiness, response, and recovery before a fire occurs.

2. They align with how emergency systems actually operate.

Each BlindSpot maps naturally to responsibilities already managed or coordinated through emergency management systems, including municipal preparedness, evacuation planning, infrastructure readiness, interagency coordination, and continuity planning. This helps emergency managers see where action is possible, where coordination is required, and where escalation may occur without clear ownership.

3. They strengthen the emergency use of existing wildfire frameworks.

The Nine BlindSpots do not replace established wildfire guidance or mitigation programs. They provide additional visibility into how those frameworks interact at the community and perimeter scale, helping emergency management teams apply existing tools more effectively under real local conditions.

4. They support clearer prioritization and funding alignment.

Emergency management organizations are often required to justify investments in preparedness, mitigation, and response capacity. The Nine BlindSpots provide a simple structure for linking observable local conditions to planning priorities, strengthening the clarity and defensibility of funding requests and interdepartmental decisions.

5. They reframe responsibility in a practical, empowering way.

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Rather than placing responsibility solely on individuals or responders, the Nine BlindSpots highlight system-level readiness conditions. This supports a clearer understanding of where planning, partnerships, and infrastructure investments can meaningfully reduce consequences before an emergency unfolds.

The Nine BlindSpots do not predict wildfire outcomes. They help emergency management organizations see where local conditions could accelerate escalation, while there is still time to act.

The Core Insight

Communities don’t struggle with wildfire because of a lack of knowledge or commitment. The Nine BlindSpots shine a spotlight on conditions that can be difficult to see at the local level due to limitations in awareness, capacity, or resources while there is still time to act.

The purpose of resolving BlindSpots is not prediction, but prevention, by identifying where a wildfire would cross from a manageable event into a disaster, while there is still time to intervene.

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About FIREARC

We started by asking the same question governments face: how do you make perimeter conditions visible early enough to matter? FireArc exists because we couldn't find a consistent way to do that at the community–perimeter scale.

FireArc™ is a Canadian wildfire intelligence company that provides perimeter-focused readiness insight designed to help emergency management organizations see where wildfire conditions could escalate into consequence before ignition.

FireArc focuses on the 10–15km zone surrounding communities, where wildfire risk most often transitions into evacuation, infrastructure disruption, and system-level impact. Using satellite data and, where appropriate, targeted high-resolution aerial imagery, FireArc creates clear, place-specific visibility into conditions that influence escalation and decision timing.

FireArc translates raw observation into decision-relevant foresight through a layered set of capabilities:

HaloStart™ delivers a community's first exposure picture: a FRIZ grid built from satellite and public data, walked through live in a working session with local leadership.

HaloScan™ delivers high-resolution aerial imagery that grounds risk discussions in visual evidence.

EdgeScan™ captures ground-level conditions at the wildland-urban edge, resolving the detail that satellite and aerial imagery cannot.

FlameRisk™ in development interprets directional and compounding wildfire conditions.

FRIZ™ zones structure wildfire exposure spatially at the community–perimeter scale.

SmartMoat™ supports readiness, coordination, and mitigation planning by translating insight into practical action.

Together, these components help emergency managers, municipal partners, and insurers resolve critical local BlindSpots that can limit situational awareness, constrain coordination, or compress decision windows if left unexamined. FireArc does not replace established wildfire mitigation frameworks, including FireSmart; it helps ensure they are applied with greater local visibility and confidence.

Through clear visuals, structured analysis, and a shared language focused on readiness rather than prediction, FireArc makes wildfire risk easier to understand, prioritize, and act upon while there is still time to intervene.

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