Wildfire Communications

Wildfires create some of the most challenging communication environments: rapidly changing conditions, disrupted infrastructure, and urgent coordination needs across large areas. LoRa mesh is increasingly used for both community alerting and field operations.

> **Mesh is a supplement, not a lifeline.** LoRa mesh is a best-effort system: messages may silently fail to arrive, there is no guaranteed delivery, the shared channel can saturate under load, and coverage depends on the mesh's own nodes surviving, staying powered, and remaining in range. In a wildfire, fire can destroy the very nodes you depend on. Never rely on mesh as the sole life-safety channel. For any life-threatening situation use 911 and official alerts (Wireless Emergency Alerts, EAS, NOAA Weather Radio, local responders) first; use mesh only as a supplementary or fallback channel when those are unavailable.

Why mesh works during wildfires

- **Independence from cell towers and the grid:** Cell towers near fire zones are often the first infrastructure to fail - whether from power loss, fire damage, or overload as residents attempt to reach family. Mesh operates independently of cellular networks and the grid - but only where its own nodes survive, have power, and remain in range, and delivery is best-effort. Fire can destroy the nodes you depend on, so plan redundant nodes and a non-mesh backup for evacuation-critical traffic.
- **Mobile coverage:** Portable nodes in vehicles, on firefighters, or at incident command posts create a mesh network that moves with the response operation.
- **Position tracking:** GPS-enabled nodes let incident command see crew positions as supplemental situational awareness without a dedicated tracking system. Note that mesh GPS positions can be delayed by minutes (or missing entirely) due to range, hops, and congestion, and a node in a coverage hole won't report at all - so do not rely on mesh GPS as a primary life-safety crew-tracking system.
- **Resilient backbone:** Solar-powered repeaters on hilltops with adequately sized batteries can continue operating during extended power outages, provided the site survives the fire and smoke does not starve the panels of light.

Community alerting use case

A community mesh network with established repeater infrastructure can be activated as a grassroots alerting layer during a wildfire:

- Road conditions and evacuation route updates can be carried over the mesh - but mesh delivery is not guaranteed, so it must supplement, never replace, official alerts (Wireless Emergency Alerts, EAS, NOAA Weather Radio, local responders) for any evacuation instruction
- Nodes in affected neighborhoods can provide "eyes on the ground" status reports
- Air quality readings from BME680-equipped sensor nodes provide hyperlocal data
- Resource availability (shelters open/full, fuel, supplies) can be distributed across the mesh

Field operations use case

For organized response teams (volunteer fire, SAR, CERT):

Minimum viable field kit

- Net control operator with T-Deck Plus (MeshOS) or laptop + Pi room server
- 1 - 2 hilltop or elevated relay nodes (portable solar)
- Personal nodes for each field team (T-Echo or T1000-E, pocketable)

Operating procedure

1. Deploy hilltop relay node(s) at the highest accessible points overlooking the operational area
2. Net control establishes the operations channel and verifies all teams are visible in contacts
3. Field teams broadcast GPS position updates at roughly 5-minute intervals. The position interval is configurable, but the firmware may automatically lengthen it on busy or congested meshes, so a fixed 5-minute cadence may not hold under load; frequent position broadcasts also increase airtime and battery use.
4. All significant events are logged as messages (not just voice) for accountability records
5. Net control maintains a position board (GPS positions from all team nodes on map view)

Specific challenges and mitigations

Challenge	Mitigation
Smoke reduces solar panel output	Heavy wildfire smoke can cut solar charging for a week or more. Size battery for several days of autonomy (for example 5 days) appropriate to your load, latitude, and worst-case smoke/overcast duration, with margin - do not assume solar will keep nodes running through a major fire on a fixed buffer.
Fire destroys repeater nodes	Document all site coordinates; prioritize replaceable hardware (RAK4631 over specialized boards)
Rapid terrain changes (burn areas)	Have portable relay nodes ready to deploy at new high points as conditions change
Crew unfamiliarity with mesh devices	Train before deployment; include device setup in team training exercises

A note on smoke and RF range

Smoke particulate has negligible effect on 915 MHz LoRa propagation, so RF range is largely unaffected by smoke itself. But fire can still destroy nodes and antennas, and heat can disturb propagation - so don't treat the link as guaranteed even when smoke is heavy. Range loss in a fire comes from damaged or destroyed infrastructure, not from the smoke attenuating the signal.

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