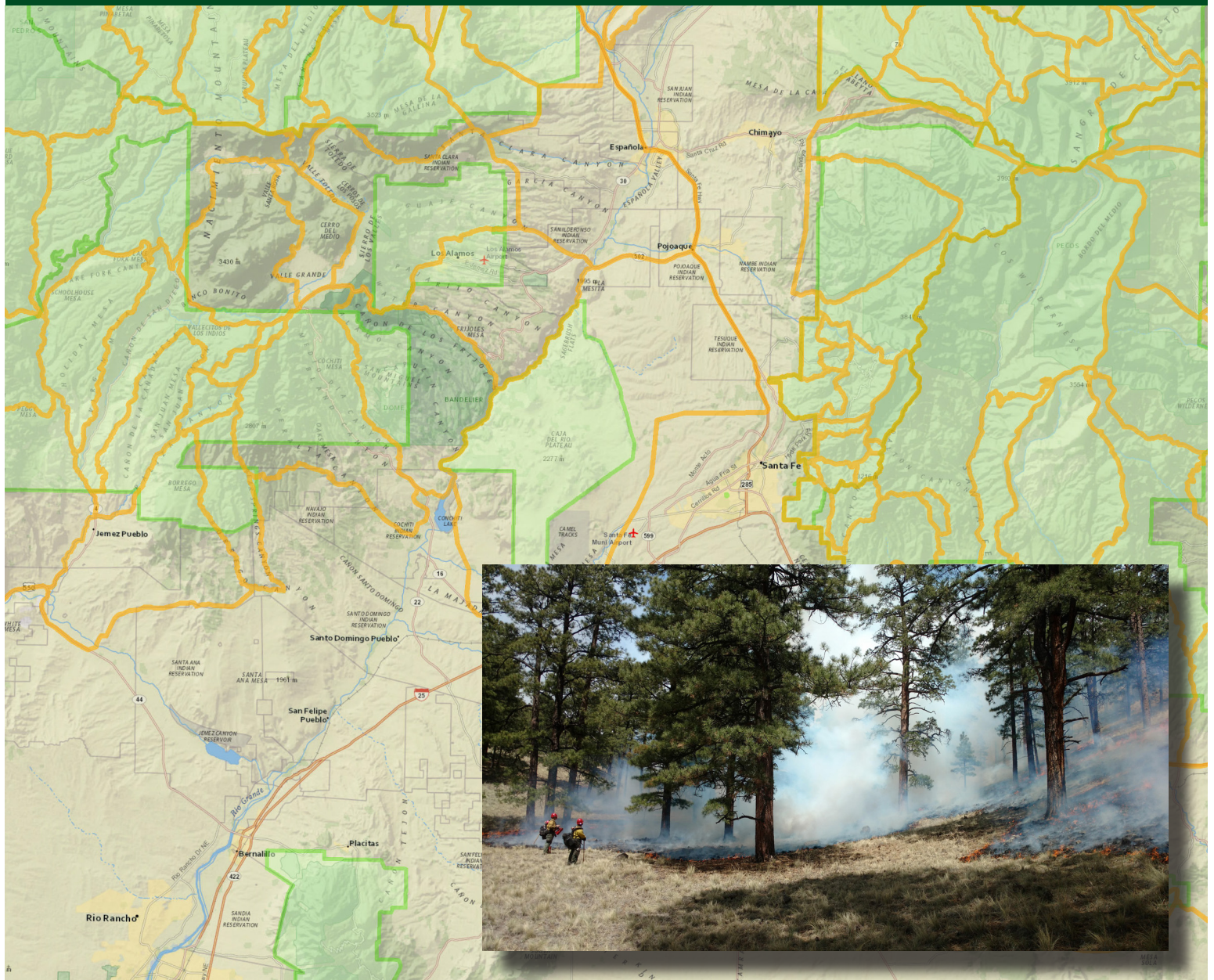


Potential Operational Delineations and Northern New Mexico's 2019 Fire Season



February, 2020
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Publication date: February, 2020

Cover photo credit: Mike Caggiano

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Please use the following citation when referring to this paper:

Caggiano, MD, O'Connor, CD, & Sack, RB (2020). Potential Operational Delineations and Northern New Mexico's 2019 Fire Season. CFRI-2002.

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Colorado State University is an Equal Opportunity/Affirmative Action Institution.

Acknowledgments

This project is supported by Promoting Ecosystem Resilience and Fire Adapted Communities Together, a cooperative agreement between The Nature Conservancy, USDA Forest Service and agencies of the Department of the Interior. This institution is an equal opportunity provider.



Table of Contents

RISK-INFORMED ECOLOGICAL FIRE MANAGEMENT	1
INTRODUCTION TO PODS AND QUANTITATIVE RISK ASSESSMENTS	1
THE 2019 FIRE SEASON	2
Weather outlook and resource availability	2
Operational POD use	2
A typical scenario	3
POD CASE STUDIES	4
Conejos Fire	4
Cueva & Naranjo Fires	4
Amole Fire	5
DEVELOPING PODS IN NORTHERN NEW MEXICO	5
Origins of the POD framework	5
Collaboratively developing PODs	5
NEXT STEPS	6

Risk-informed ecological fire management

Land managers in fire-adapted ecosystems must consider a variety of dynamic and interrelated ecological and societal processes. This is especially true for decisions related to wildfire management, where decision-making is complicated by the compartmentalized nature of land and fire management, and general uncertainty associated with fire weather. The inherently hazardous nature of wildland fire management further underscores the need to improve decision-making tools that can both help reduce risk to incident responders and the public, and account for the interrelated processes. Potential Operational Delineations (PODs), combined with other risk assessment tools, provides a framework that empowers science-informed decision making, improves communication, and facilitates the integration of land and fire management, during both wildfire incidents and preplanning efforts more generally.

In this report, we examine a case study in northern New Mexico that demonstrates how PODs can be created collaboratively to integrate land and fire management objectives into coordinated, risk-informed planning and response. We provide a short introduction to PODs and associated Quantitative Wildfire Risk Assessments (QWRAs), examine how PODs were used in New Mexico during the 2019 fire season, discuss the process of collaboratively developing PODs, examine their value as a communication tool, and offer several lessons learned and next steps.

Introduction to PODs and Quantitative Risk Assessments

PODs and QWRAs are both applications of strategic wildfire risk planning that can be developed together, as they were in northern New Mexico. PODs combine advanced fire modeling and spatial analysis with expert knowledge to identify potential locations where fire suppression is most likely to be effective, irrespective of ownership boundaries. Connecting and mapping these control locations on a landscape forms a POD network. The lines that make up a POD show where existing natural and constructed features can most effectively contain fires, and, conversely, where fire behavior makes containment less likely. PODs help managers identify when and where firefighting can be most successful before the fire season begins, and can help prioritize areas that would be good candidates for mechanical treatments, prescribed burning, or management of natural ignitions for resource benefit and restoration objectives. PODs enable managers to plan at scales commensurate with wildfires.

Like PODs, QWRAs are a valuable planning tool. QWRAs map the probability of fire occurrence, intensity of burning, and likely effects of fire on highly valued resources and assets (HVRAs), measured as conditional net value change (Figure 1). The QWRA identifies areas where important values are at risk under a variety of conditions. Managers can leverage PODs and QWRAs together to quickly summarize control opportunities, land management objectives, current conditions,

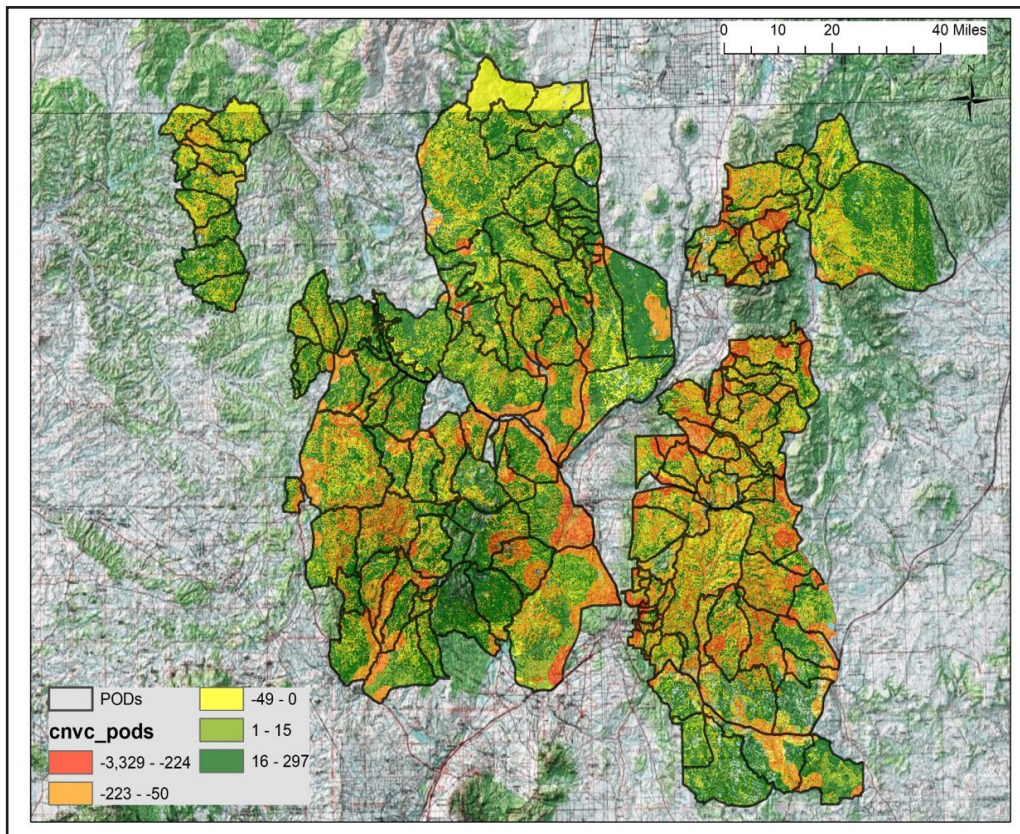


Figure 1. Quantitative Wildfire Risk Assessment results for the Greater Santa Fe landscape. Results depict the conditional net value change of pooled HVRAs assuming exposure to wildfire. Negative values (red and orange) represent damage to values, positive values (light and dark green) represent improvements to values and neutral values (yellow) are dependent on fire conditions.

hazards, likely fire behavior, and values at risk within a POD, all at an operational scale. Numerous publications and resources exist which provide additional information about both tools. (Table 2).

PODs and QWRAs can be combined to create Strategic Response Zones (SRZs), which articulate potential fire response strategies based on management goals and landscape condition. For example, PODs with strategic response designated as ‘restore,’ might benefit from fire under moderate conditions, while those designated ‘protect’ rarely benefit from fire under most conditions. On the ground, PODs, QWRAs, and SRZs are often used in conjunction with one another to inform land and fire management decisions, as illustrated by this case study in northern New Mexico.

The 2019 Fire Season

Weather outlook and resource availability

Moderate conditions in northern New Mexico before and during the 2019 fire season provided numerous opportunities for managing fire for ecological objectives,

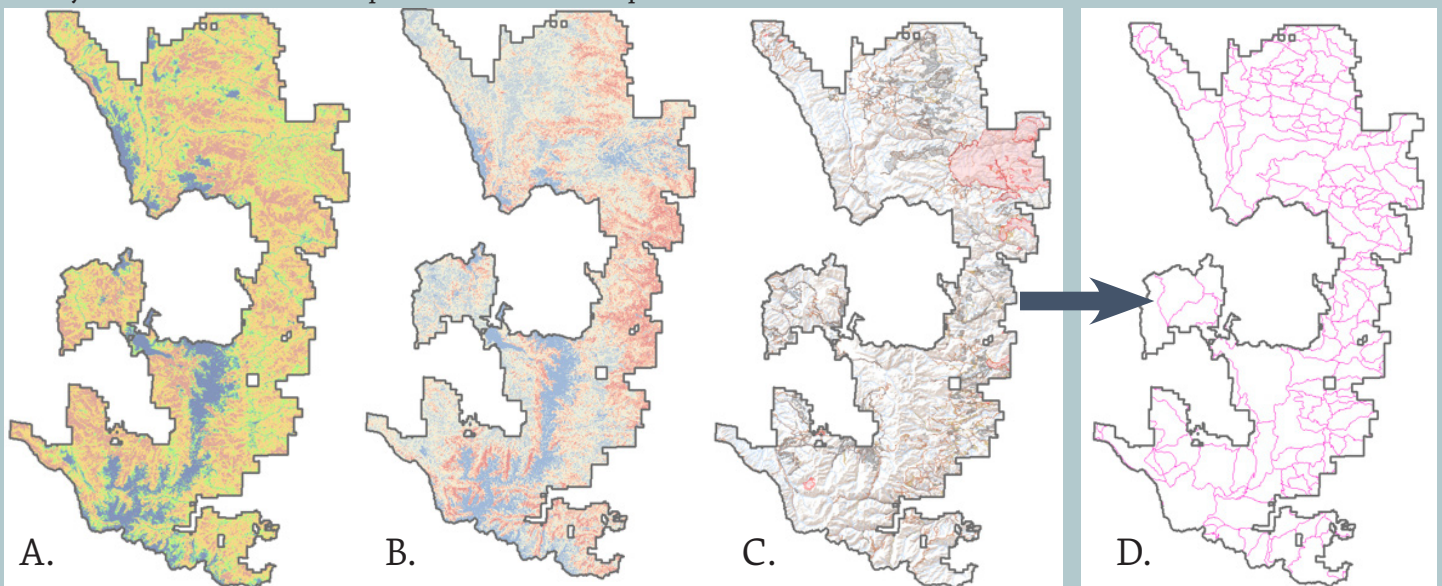
and the first opportunity to utilize PODs to inform fire response. The fire season was preceded by a cool, wet spring with above-average precipitation in April and May. During peak fire season, precipitation was average, and average temperatures were near or below normal. The summer monsoon was comparably brief relative to recent years, with precipitation totals below normal for July -September. Because the 2019 fire season was slow nationally, regional firefighting resource commitment was relatively low and local resources were available to assist on fires. Almost all of the seven fires where PODs were used in the 2019 season started either just before or just after seasonal monsoons, which further moderated both fuel conditions and fire behavior. (Table 1). The full PODs network was loaded into the Wildland Fire Decision Support System (WFDSS), which facilitated its use for planning and decision support on multiple fires.

Operational POD use

Operationally, PODs and their pre-determined SRZs helped line officers and fire managers determine and communicate overall incident strategies. PODs were

Analytical Products that Support PODs Development

To help fire managers determine which locations on a landscape represent the safest and most effective control opportunities, PODs leverage maps of potential control locations (PCL), and suppression difficulty index (SDI). Together, these products help visualize the best and worst opportunities for fire containment and relative difficulty of suppression operations. In the hands of local fire managers, these tools can be assessed, interpreted, and combined with local knowledge to map out the best available fire control locations which, when linked, create a network of POD boundaries. This network of “best” control locations can then be mapped as a series of fire containment polygons known as PODs (Potential wildfire Operational Delineations). It is important to note that fire containment opportunities often do not align with jurisdictional or ownership boundaries. The POD network is designed to represent operational fire suppression opportunities, and is not constrained by ownership. When a POD includes lands owned by two or more agencies, groups, or individuals, it is imperative that all parties discuss safety considerations and expectations of fire response.



The POD Development Process: Workshop participants use maps with Suppression Difficulty Index (A), Potential Control Locations (B), and reference layers (C) to hand draw lines identifying effective control lines across the landscape, irrespective of land ownership. Hand drawn POD boundary lines are then digitized into an electronic format using Geographic Information Systems (D).

used on seven fires totaling 12,000 acres in Northern New Mexico during the 2019 fire season. Fires that utilized PODs were located across five ranger districts over two Forests (Figure 2). They occurred both in remote areas and areas adjacent to private land. Six of the seven wildfires occurred in PODs where the SRZ indicated that fire could be used to restore desired ecological conditions under specific conditions given a pre-determined range of acceptable fire behavior. The pre-identified POD boundaries, consisting of existing control lines, were used to inform initial planning efforts and the official planning area as recorded in the WFDSS. For each fire, managers conducted additional detailed analyses to predict how resources and assets would likely respond to fire based on observed and predicted weather conditions. Half of the fires incorporated POD boundaries as tactical control lines. In many cases, fire managers used indirect attack strategies and burn out operations to remove fuel between POD boundaries and the approaching fire.

A typical scenario

A typical scenario where PODs are utilized goes as follows: after initial size-up by the Incident Commander, fire managers and agency administrators consult with

resource specialists to assess the values at risk and evaluate the potential effects of fire on the landscape. Considerations during these discussions include the unique circumstances surrounding each fire, firefighter and public safety, natural and cultural resources, and other values at risk. Those involved discuss management strategies, and consider the potential ecological, social, and legal implications of each fire.

PODs and SRZs are then used to confirm that the fire is in a POD that supports use of fire for resource benefit—these PODs are easily identifiable on a map as green (benefits from fire) or yellow (can benefit from fire depending on conditions). From the agency administrator perspective, the green/yellow designation indicates both that the natural resources within the POD could benefit from fire, and any risk to assets could be mitigated effectively. In other words, the PODs framework in concert with the SRZ validates incident strategy by providing a simplified categorization that quickly distills all the fire modeling, spatial analysis of resource concerns, risk assessment work, pre-season stakeholder engagement, and public outreach into a simple visual. Combined with SRZs, PODs create a common operating picture used to sync and communicate incident objectives between firefighters,

Fire Name	Jurisdiction	Date	Size (acres)	POD	Strategic Response Zone	POD Use
Amole	Carson NF: Camino Real District	8/29/2019	1,956	D4 11	Restore	The western and northeast perimeter control lines and planning area followed the POD boundary.
Conejos	Santa Fe NF: Jemez District	7/29/2019	778	West 12	Restore	POD boundary was used as primarily as the control feature on north, west, and east sides. Fire managers decided to exclude fire from certain HVRAs and deviate from POD boundary. Southern POD boundary was not used due to crossing jurisdictions (Pueblo of Jemez Lands). The fire was kept on the responsible agency's land to reduce incident complexity (Joint delegation of authority, cost-share etc) and potential risk to HVRAs of the adjacent Ownership Agency.
Cueva	Santa Fe NF: Coyote District	8/6/2019	1,176	West 29	Restore	This POD is very large and the fire perimeter was located near the center of the POD. No boundaries were used in perimeter control. Instead, control lines were constructed and improved mainly using existing roads and or trails.
Francisquito	Carson NF: El Rito District	7/13/2019	2,021	WZ 28	Restore	POD boundary was used as an initial starting point for developing WFDSS Planning Area.
Gurule	Carson NF: El Rito District	6/7/2019	2,260	WZ 20	Restore	The western fire perimeter and control lined largely followed the POD boundary. The POD was used as an initial outline for developing a WFDSS Planning Area which was later refined to follow the outline of the western half of the POD.
Montoya	Carson NF: Canjilon District	8/29/2019	2950	WZ 26	Restore	POD boundary was used as an initial starting point for developing WFDSS Planning Area.
Naranjo	Santa Fe NF: Cuba Ranger District	7/3/2019	1,010	West 22	High Complexity	This POD is very large and the fire perimeter was located near the center of the POD. No boundaries were used in perimeter control. Instead, control lines were constructed and improved mainly using existing roads and or trails.

Table 1: Fires in northern New Mexico that utilized PODs during the 2019 fire season

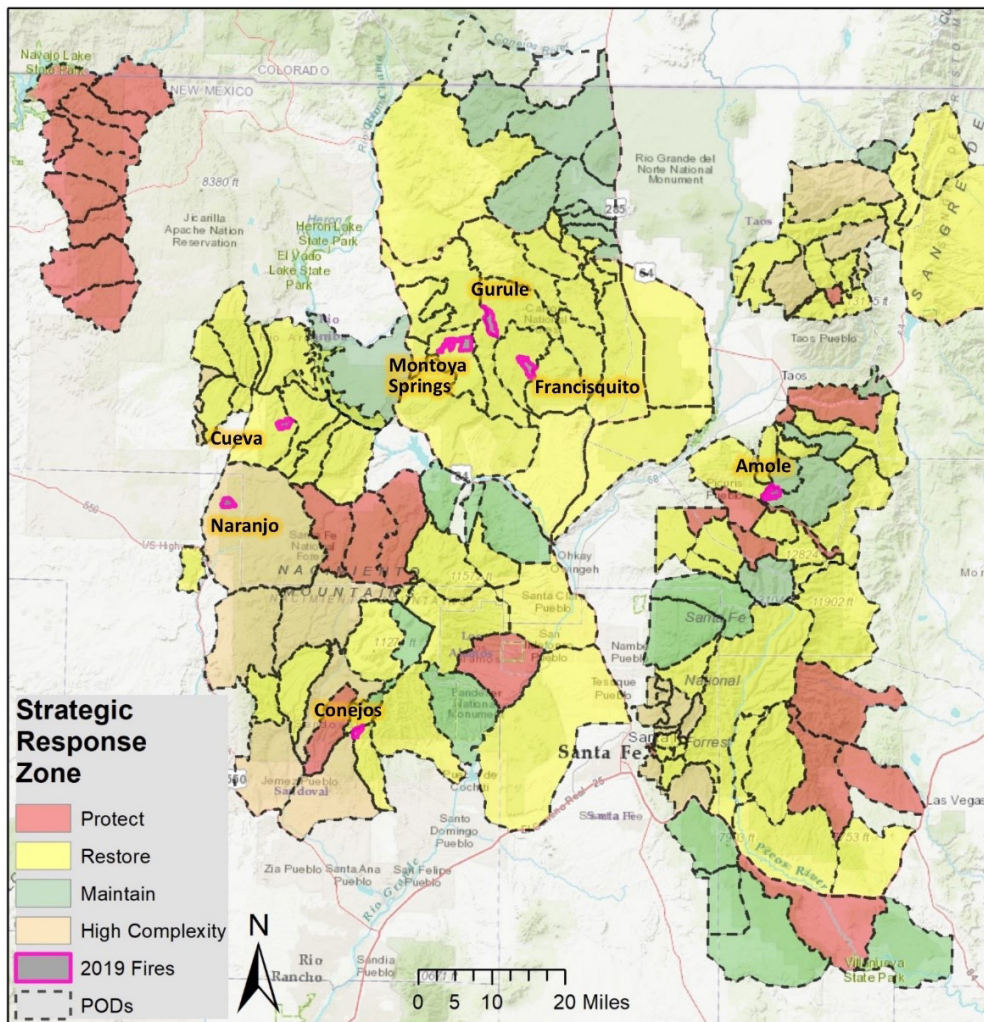


Figure 2. Strategic Response Zones summarized from QWRA results, and the seven fires managed using PODs on the Santa Fe and Carson National Forests over the summer of 2019.

line officers, resource specialists, regional leadership, the public, and other stakeholders.

POD use during the 2019 fire season in northern New Mexico illustrates the utility and flexibility of the framework, and each fire on which PODs were used provides a helpful case study. The management strategy for all of the fires discussed below included resource benefit objectives. Additional information on each fire can be found archived at Inciweb.nwgc.gov and NMFireinfo.com, clearinghouses for fire related information.

POD case studies

Conejos Fire

The lighting-caused Conejos fire was managed to mimic historical low-to-moderate-intensity fire. The fire started in a POD that crossed jurisdictional boundaries onto Pueblo of Jemez lands. The POD boundary was used on the north, west, and east sides of the fire, and there the fire achieved resource benefit objectives. Fire was excluded from some areas to avoid damaging resources, and from Pueblo of Jemez Lands to the south. The decision to exclude the fire from Pueblo lands was made to avoid potential damage to resources and reduce incident complexity (joint delegation of authority, cost-

share etc.). While PODs are designed to facilitate cross-boundary fire management, agencies must first discuss and agree on management objectives, incident strategies, and formalize agreements if necessary. Ideally, these conversations take place in the preseason before smoke is in the air.

Cueva & Naranjo Fires

Both the Cueva and Naranjo fires occurred in the center of large PODs. The fires were managed to improve forest resiliency and reduce surface fuel loading. POD boundaries were used as the initial planning area in WFDSS. The local ranger district used PODs to integrate and improve their communication with both regional leadership and the local public. Instead of using POD boundaries as tactical control lines, managers identified and used alternative control features including existing roads and trails to contain the fires. Such additional control lines can be seen as sub-PODs, or secondary control features, which are leveraged to contain a fire before it reaches the POD boundary. These may be effective under moderate conditions. Attributing POD boundaries (and other control features on the landscape) and categorizing them according to the conditions under which they are likely to be effective has been identified as an important next step for developing and using PODs.

The Naranjo fire was located in a High Complexity POD; this designation indicates that the POD contains resources that would be negatively impacted by fire interspersed with areas where resources could benefit. There were few viable opportunities to further delineate POD boundaries since this POD encompasses the San Pedro Parks Wilderness. During initial consultation, managers determined that the fire was in an area of the POD where HVRAs would benefit from fire.

Amole Fire

The Carson National Forest used existing agreements to request initial response personnel from Taos Bureau of Land Management (BLM) after this ignition was reported. BLM staff responded and observed moderate fire behavior and beneficial effects. They had previously been provided with spatial data on Forest Service PODs and SRZs, and noted the fire was located in a “restore” POD. This fire was ultimately managed using indirect response strategies, and resulted in reintroduction of fire to over 1,900 acres. This result helped meet forest restoration and fuel reduction objectives. This case in particular demonstrates how incorporating PODs and information sharing into preseason interagency planning facilitates shared stewardship and cooperative decision making.

Developing PODs in Northern New Mexico

Origins of the POD framework

The above case studies illustrate how PODs were used, and highlight their utility in helping facilitate risk-informed fire response and the reintroduction of fire in fire adapted ecosystems. These case studies were a result of a multi-year effort from multiple partners. The US Forest Service Rocky Mountain Research Station (RMRS), academic institutions, and other partners have been developing PODs and QWRAs to advance planning on a number of landscapes for several years. While the Santa Fe and Carson National Forests were responsible for the development of PODs and their use during wildfire incidents, organizations including RMRS, the Colorado Forest Restoration Institute (CFRI) and the New Mexico Nature Conservancy (TNC) played critical roles during preplanning efforts. RMRS and CFRI are leading the development of PODs on numerous Forests, and have developed spatial fire modeling and analysis products that support both POD development and use on individual Forests—these products include Suppression Difficulty Index (SDI), atlas of potential control locations (PCL), and POD dashboard summaries. RMRS and CFRI work together by leveraging resources to host POD workshops that directly engage managers to develop new POD-related products. These products are intended to assist with spatial decision support, and integration of

land management objectives into incident management. As another valuable partner, TNC contributed spatial data and expertise associated with their Rio Grande Watershed all-lands risk assessment. Data from this parallel effort was used to inform SRZs assigned to PODs on both the Santa Fe and Carson National Forests.

Collaboratively developing PODs

In the fall of 2018, staff from Rocky Mountain Research Station (RMRS) and the Colorado Forest Restoration Institute (CFRI) led a strategic wildfire risk planning workshop for the Carson and Santa Fe National Forests and adjacent land management agencies which included staff from both forests, The Nature Conservancy (TNC), Bureau of Indian Affairs, US Geological Survey, and National Parks Service (Figure 3). The three-day workshop introduced PODs to fire managers and natural resources staff, and participants delineated POD boundaries across the landscape by combining local knowledge with maps of SDI and PCL (Figure 4). Participants also developed an exhaustive list of mapped HVRAs, and determined response functions for a range of modeled fire behavior for each identified value. In a subsequent meeting with Forest leadership, the full list of HVRAs was ranked and weighted for use in the QWRA. This information was used to develop SRZs across Santa Fe and Carson National Forests, National Park lands, and the surrounding interface with BIA lands (Figure 2). Subsequently, additional meetings hosted by USFS and TNC were held with non-federal cooperators, including New Mexico State Forestry, local fire departments, and county emergency services. In these meetings, USFS staff introduced and discussed the POD concept with cooperators, and discussed how PODs were developed, how risk assessments informed the SRZs, and how the Forests planned to utilize PODs for planning and incident response purposes.



Figure 3: POD workshop participants considering results from the atlas of potential control locations to identify potential POD boundaries.

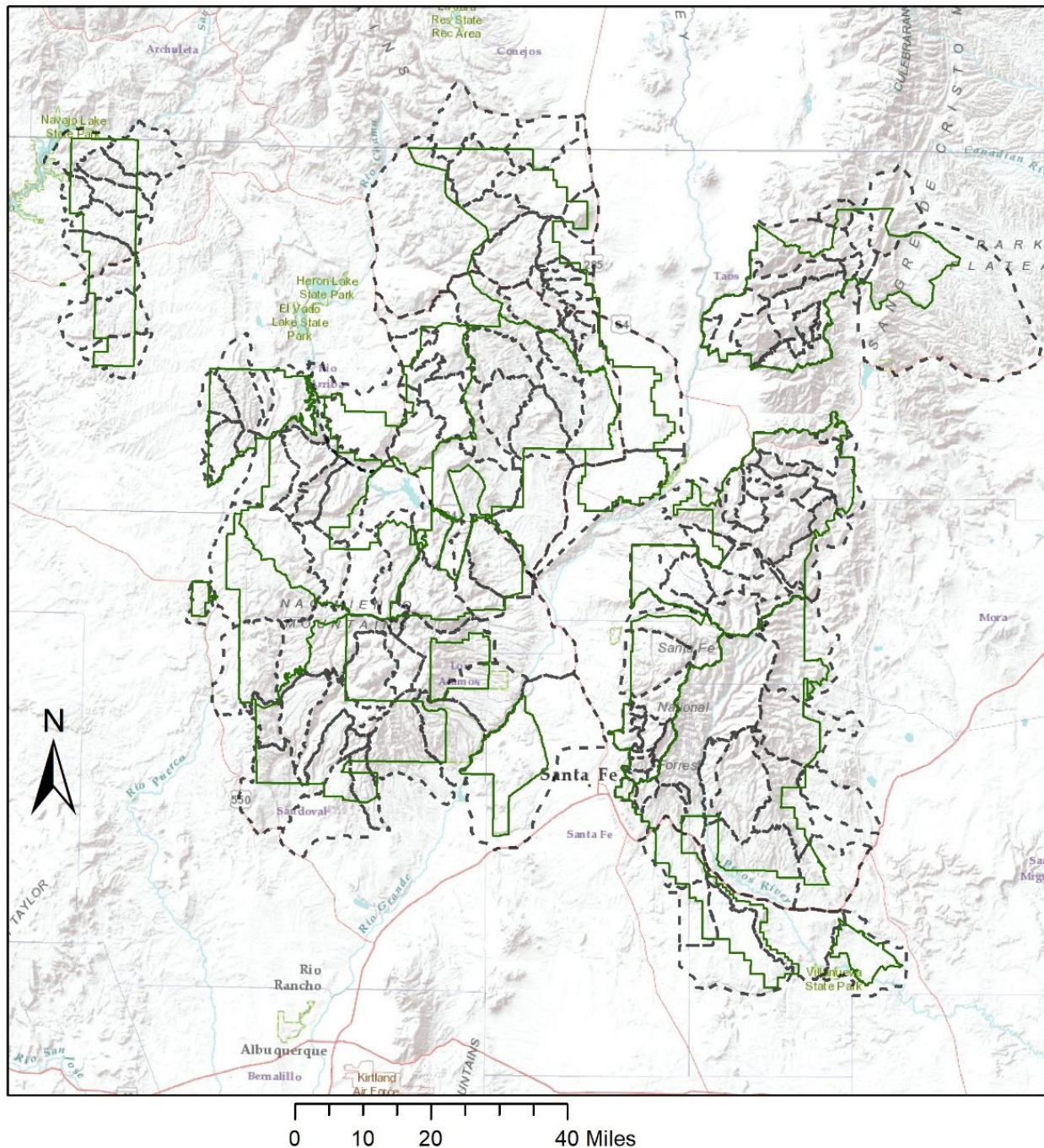


Figure 4. POD network developed by fire managers participating in the workshop. PCL and SDI products help to both inform and validate the POD network delineated by managers with on-the-ground knowledge.

Next steps

Northern New Mexico’s 2019 fire season illustrated the utility of PODs for helping to integrate land management objectives into incident management. PODs helped managers articulate the need to use fire to achieve ecological objectives identified by the QWRA and POD development process, and communicate those objectives to nearby communities and interested stakeholders. After the fire season, fire managers have continued to work with RMRS and CFRI to identify next steps and new products to assist with decision making. Staff from RMRS, CFRI and wildfire risk assessment research firm Pyrologix are developing a decision support tool that will quickly summarize expected fire behavior, hazards, and HVRAs within PODs across a range of

potential fire conditions (Figure 5). As of winter 2020, analysts are developing the first iteration of the tool and will meet with managers to showcase the product and solicit feedback in the spring of 2020. Staff have also highlighted the need for continued public outreach and stakeholder engagement. Cooperator engagement will be critical to continued successful implementation of PODs as a decision support tool. Additionally, RMRS is working with researchers at Colorado State University to conduct a third party assessment on POD usage and the framework’s influence on decision-making on several landscapes, including northern New Mexico. This assessment will evaluate how PODs are currently being used and will serve to guide future POD development throughout the West.

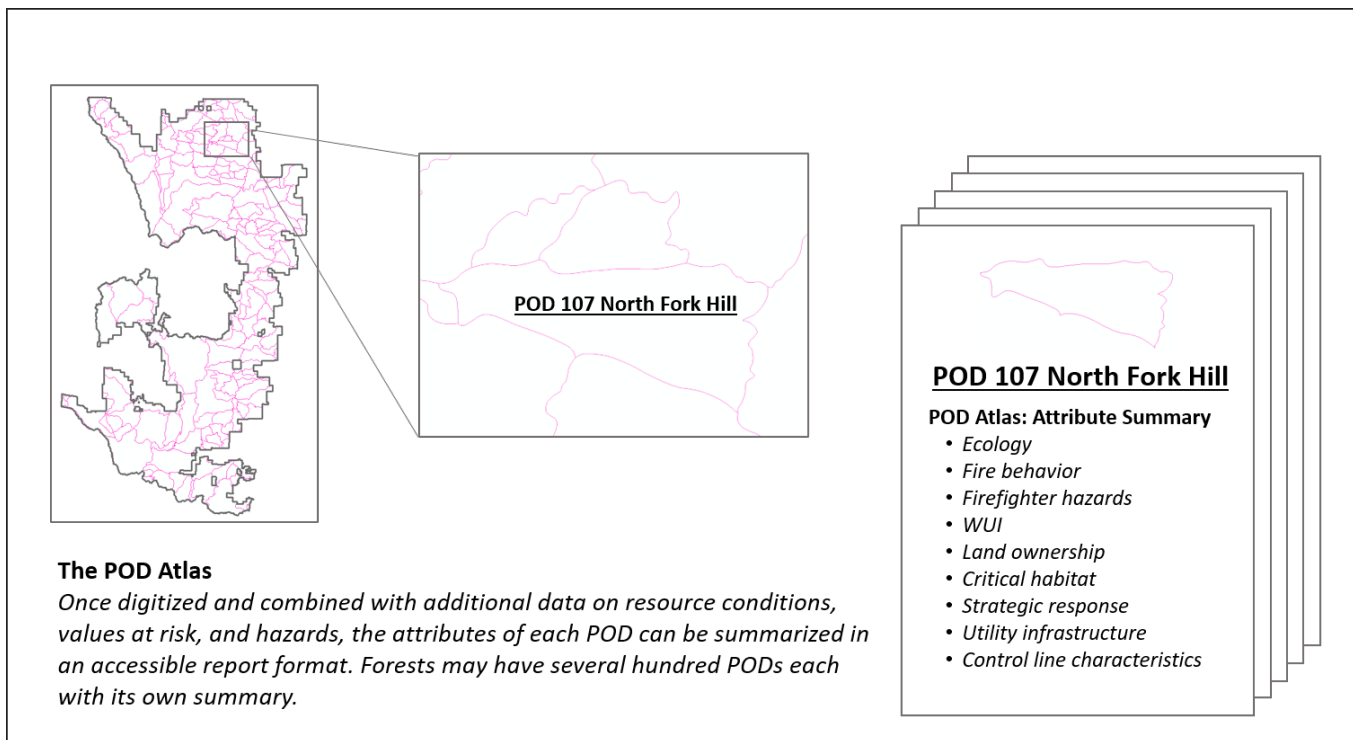


Figure 5: POD atlas summarizing spatial data within each POD.

Using PODs in the USFS

U.S. Forest Service national leadership calls for the integration of land and fire management and risk-informed fire response. PODs are a valuable tool to help accomplish this objective. Former USFS Chief Tidwell’s March 2017 Letter of Intent for Wildland Fire articulated a new paradigm of wildfire management. Tidwell instructed wildfire managers and responders to: “implement strategies and tactics that commit responders only to operations where and when they can be successful, under conditions where important values actually at risk are protected with the least exposure necessary while maintaining relationships with the people we serve.” This message was reiterated by current USFS Chief Christiansen in her April 2018 letter, which contains additional guidance calling for a new focus on risk-informed decision making to meet these challenges, and for greater implementation of wildland fire use to meet ecological restoration and risk reduction objectives when and where appropriate. PODs and the SDI and PCL tools that support their development clearly address directives from USFS leadership. SDI and PCL speak to identifying areas where suppression is likely to be difficult, and alternatively where control lines are likely to be effective. Integrating PODs with results from the QWRA, PODs can help incorporate ecological objectives into operational fire management.



PODs and QWRA Resources

Caggiano, M. D. (2019). Collaboratively engaging stakeholders to develop potential operational delineations. Colorado Forest Restoration Institute Publication.

O’Connor, C. D., & Calkin, D. E. (2019). Engaging the fire before it starts: A case study from the 2017 Pinal Fire (Arizona). *Wildfire*, 28 (1): 14-18., 28(1), 14-18.

O’Connor, C. D., Calkin, D. E., & Thompson, M. P. (2017). An empirical machine learning method for predicting potential fire control locations for pre-fire planning and operational fire management. *International Journal of Wildland Fire*, 26(7), 587-597.

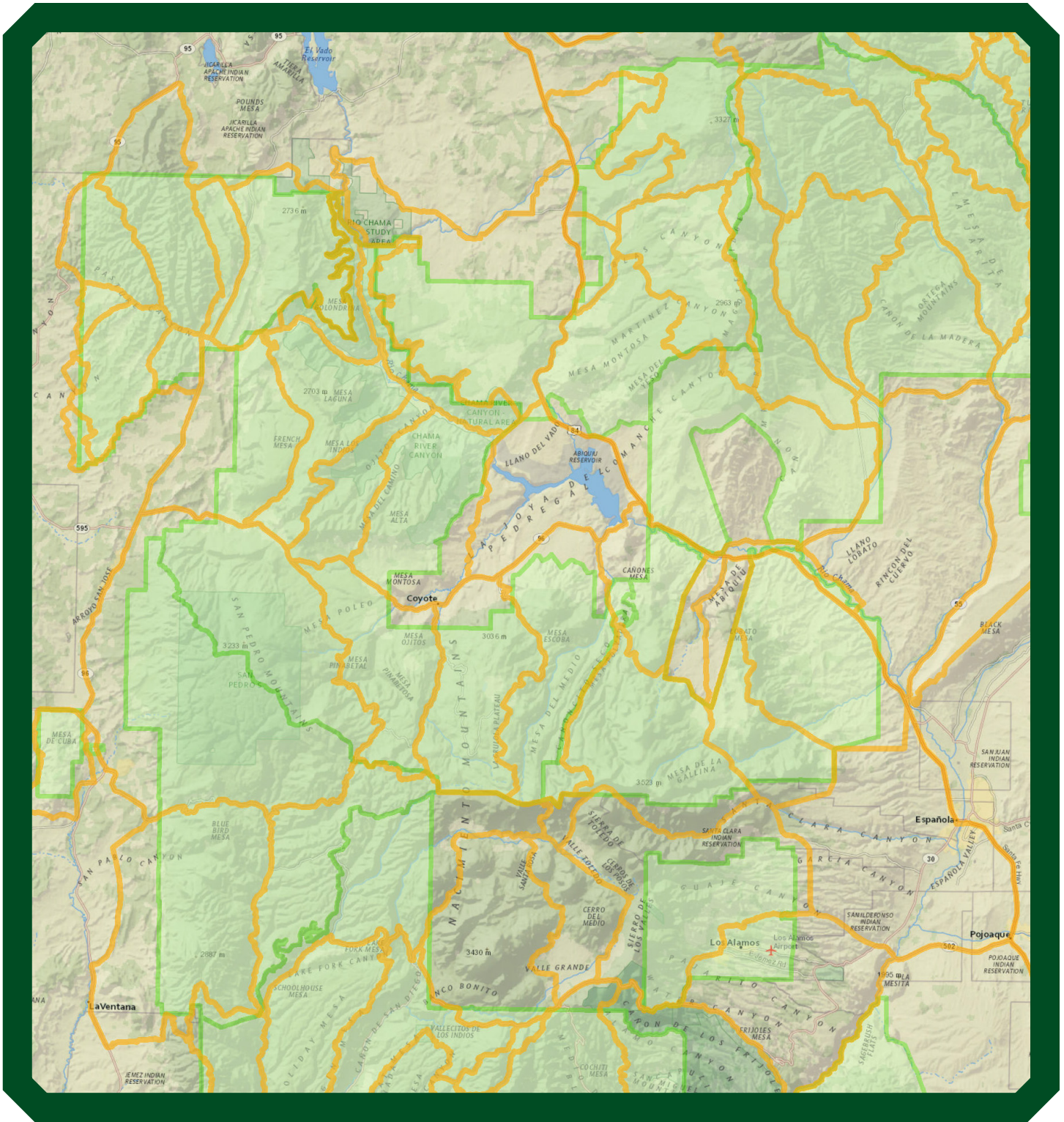
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Stratton, R.D (2020) The path to strategic wildland fire management planning. *Wildfire* 29(1): 24-31.

Thompson, M. P., Bowden, P., Brough, A., Scott, J. H., Gilbertson-Day, J., Taylor, A., Anderson, J., Haas, J. R. (2016). Application of Wildfire Risk Assessment Results to Wildfire Response Planning in the Southern Sierra Nevada, California, USA. *Forests*, 7(3), 64.

Table 2. These resources include documents, reports and research on: the POD development process; Suppression Difficulty Index (SDI) and Potential Control Location Analysis (PCL)—two of the spatial products used to help develop PODs; how PODs can be developed collaboratively; and how PODs are being used in operational and preplanning contexts.



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