



# A Good TWIG:

Evaluating the Treatment and Wildfire  
Interagency Geodatabase Viewer

## Southwest Ecological Restoration Institutes

**(SWERI):** The Southwest Ecological Restoration Institutes include three university-based restoration institutes: the Ecological Restoration Institute in Arizona, the Colorado Forest Restoration Institute, and the New Mexico Forest and Watershed Restoration Institute. SWERI were authorized by the Southwest Forest Health and Wildfire Prevention Act of 2004 (PL108-317). As a Congressionally authorized program, SWERI deliver actionable knowledge across a wide spectrum of affected entities to inform cross-boundary forest restoration and wildfire mitigation that spans management, ecology, policy, and research. For more info, visit [www.sweri.org](http://www.sweri.org).

**Ecological Restoration Institute (ERI), Northern Arizona University:** ERI is nationally recognized for mobilizing the unique assets of a university to help solve the problem of unnaturally severe wildfire and degraded forest health throughout the American West. ERI serves diverse audiences with objective science and implementation strategies that support ecological restoration and climate adaptation on western forest landscapes.

**Colorado Forest Restoration Institute (CFRI), Colorado State University:** CFRI is a science-based outreach and engagement organization that serves as a bridge between researchers, managers, and stakeholders working to restore and enhance the resilience of forest ecosystems to wildfires in Colorado, the Southern Rocky Mountains, and the Intermountain West. CFRI leads collaborations between researchers, managers, and stakeholders to generate and apply locally relevant, actionable knowl-

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edge to inform forest management strategies. CFRI's work informs forest condition assessments, management goals and objectives, monitoring plans, and adaptive management processes.

**New Mexico Forest and Watershed Restoration Institute (NMFWRI), New Mexico Highlands University:** NMFWRI collaborates with citizen stakeholders, academic institutions, NGOs, and professional natural resources managers to establish prescriptions and monitoring protocols for forest and watershed restoration. They promote ecological restoration and forest management efforts in ways that keep New Mexican homes and property safe from wildfire, lead to a more efficient recharge of New Mexican watersheds and provide local communities with employment and educational opportunities.

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# Executive Summary

Congress has appropriated substantial resources to federal land agencies and their state and local partners to reduce the occurrence and impacts of catastrophic wildfire through fuel reduction treatments (i.e., removing trees and brush through mechanical, manual, and controlled burning methods). Congress has also required and appropriated funds for federal land agencies to compile data and report on fuel treatment activities. Despite these investments, information about their location, size, cost, and effectiveness are not easily accessible and usable. The Southwest Ecological Restoration Institutes (SWERI) were identified in the 2021 Infrastructure Investment and Jobs Act (IIJA) to compile and display existing federal data on fuel treatments and wildfires, to coordinate and facilitate the use of these data to assess the interactions between fuel treatments and wildfires, and to analyze and report on the effects of fuel treatments. This program of work is called ReSHAPE and includes the Treatment and Wildfire Interagency Geodatabase (TWIG). SWERI has partnered with contractor Innovate! Inc. to advance TWIG by developing a publicly accessible web viewer (TWIG Viewer), allowing non-federal agency audiences to access information about the geographic locations, types, sizes, and timing of fuel treatments

conducted by federal agencies relative to wildfires. In many geographies, the data date back 25 years or more. This report is the first in a series of efforts by CONNECT, the social science team of ReSHAPE, to evaluate the TWIG Viewer with identified audiences.

The CONNECT team conducted a preliminary study by interviewing 37 potential users of the TWIG Viewer across federal, state, and non-governmental organizations involved in land management in Arizona, Colorado, Utah, Idaho, and California. The goals were to: 1) understand and identify potential audiences for the TWIG Viewer; 2) understand and identify potential TWIG Viewer use cases; 3) better understand what tools managers and professionals are currently using; and 4) provide feedback to the TWIG development team to improve the tool use and effectiveness while still in development.

In our results, four major themes emerged. First, the TWIG Viewer allowed easier access and sharing of federal fuel treatment data, though the lack of accompanying state, tribal, and private landowner data limited the TWIG Viewer's applicability to participants that work at the local level. Second, participants perceived the TWIG Viewer to be a useful tool to facilitate communication



ReSHAPE team retreat to Durango, Colorado, June 2025. Photo credit Aidan Franko.



Medicine Lake Highlands Volcanic Area, showing treated and untreated forested areas. *Photo credit Bob Wick.*

about past, ongoing, and future fuel reduction treatments in multi-party collaborative settings. Third, the TWIG Viewer can assist non-federal managers in compiling the information necessary for strategic documents like grant proposals or Community Wildfire Protection Plans (CWPP). And fourth, the TWIG Viewer's automated data compilation can reduce the overhead necessary to maintain an up-to-date picture of fuel treatment progress and support further research efforts to analyze what makes fuel treatments effective in reducing wildfire risk.

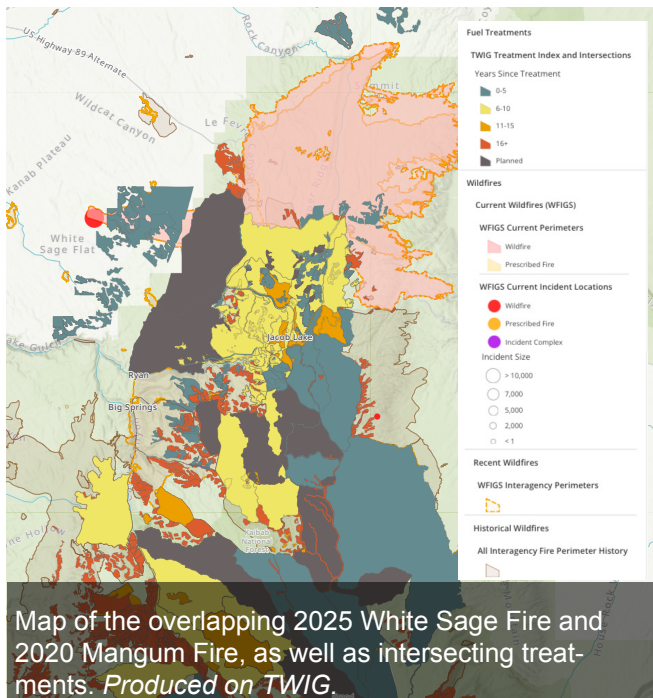
Limitations of the TWIG Viewer include items within and outside the control of ReSHAPE and its development team, including, but not limited to, known data quality issues with the systems of record it collates and a lack of data from state and private landowners to paint a more complete picture of past fuel treatments. Additionally, this study

is limited to the anticipated use cases of the TWIG Viewer, as it is a recent tool that has not yet accumulated a large, consistent user base. Once such a user base exists, future research can investigate actual uses of the tool to contribute to the growing body of literature around fuel treatment and wildfire decision support tools.

Despite these limitations, through developing the TWIG Viewer, ReSHAPE has met the provisions stipulated by IIJA to compile and display federal fuel treatment and wildfire data. Furthermore, ReSHAPE has ongoing efforts to iteratively develop the TWIG Viewer in response to user feedback and to facilitate the use and understanding of that data in land management efforts across the United States.

# Background

Congress has appropriated substantial resources to federal land agencies and their state and local partners for work to reduce the occurrence and impacts of catastrophic wildland fire. Despite these investments and more specific allocations to compile data and report on these activities, information about treatment location, size, cost, and effectiveness are not easily accessible (GAO 2003; GAO 2007; GAO 2019). Furthermore, research and management efforts to understand effectiveness lack a common language and have many conditions, geographies, and jurisdictions to consider when establishing a definition of effectiveness (Vorster et al. 2024). As a result, the Southwest Ecological Restoration Institutes (SWERI) were identified in the 2021 Infrastructure Investment and Jobs Act (IIJA) to compile and display existing federal data on fuel treatments and wildfires, to coordinate and facilitate the use of these data to assess the interactions between fuel treatments and wildfires, and to analyze and report on the effects of fuel treatments. The resulting effort led by SWERI is the ReSHAPE program (hereafter “ReSHAPE”), which developed the Treatment and Wildfire Interagency Geodatabase (TWIG) and an open-access web viewer (TWIG Viewer), built using ArcGIS, alongside contractor Innovate! Inc.



The term “fuel treatment” refers to defined management actions designed to reduce the quantity or arrangement of accumulated fuels (Call et al. In review), including mechanical thinning, mastication, and a variety of other methods. TWIG and the TWIG Viewer compile and display federal fuel treatment data from existing federal systems of record: the US Department of Agriculture Forest Service’s Forest Activity Tracking System (FACTS) and the US Department of Interior (DOI) National Fire Plan Operations and Reporting System (NFPORS). As of the writing of this report, the DOI has also created the Interior Fuels and Post-fire Reporting System (IFPRS), and is migrating NFPORS data into it, as IFPRS will replace NFPORS as the DOI system of record.

For wildfires, TWIG and the TWIG Viewer compile and displays data for both past and currently active wildfires. Past wildfires are sourced from the Interagency Wildland Fire Perimeter History and the Wildland Fire Interagency Geospatial Services (WFIGS) Interagency Fire Perimeters datasets (NIFC 2025a; NIFC 2025b). TWIG sources data on currently active wildfires from the WFIGS Current Interagency Fire Perimeters dataset (NIFC 2025c). The TWIG Viewer also includes data such as burn severity data via Monitoring Trends in Burn Severity (MTBS), collating these data into a single open source, open access platform that allows users to download any of these data.

In addition to developing TWIG, ReSHAPE is also coordinating and facilitating the use of TWIG for assessing, planning, and monitoring fuel treatment interactions with wildfires across boundaries in accordance with the provisions in IIJA. The SWERI institutes were established to advance adaptive ecosystem management (P.L. 108-317). To do so, it is crucial to make information about management activities accessible and useful, to both managers and their partners, to facilitate learning and improvement.

The initial scope of work proposed for ReSHAPE identified three major audiences for the TWIG Viewer: 1) congressional representatives, 2) data

managers, and 3) federal agency employees. To ensure that TWIG and the TWIG Viewer meet the needs of end users, ReSHAPE established multiple program areas to implement work, including CONNECT, the social science program area. CONNECT is working to advance understanding and practice of collaborative, collective decision-making and action-taking, using geospatial data and decision-support products in the arena of wildland fire management. This report is the first in a series of efforts by the CONNECT team to evaluate the usability of the TWIG Viewer with identified audiences.

## About TWIG

The organization and features of the TWIG Viewer are subject to change as the tool evolves based on user feedback. Future versions may differ from what this report describes. The TWIG viewer at the time of data collection was structured around 8 different tabs: “*Layer List*,” “*Fuel Treatments*,” “*Wildfires*,” “*Representative Summary*,” “*Area Summary*,” “*Daily Wildfire Progressions*,” “*Print*,” and “*Share*.”

### Layer List

The *Layer List* tab allows users to select which layers are visible in the map, view each layer’s symbology (color-coding), and upload custom layers (Figure 1).

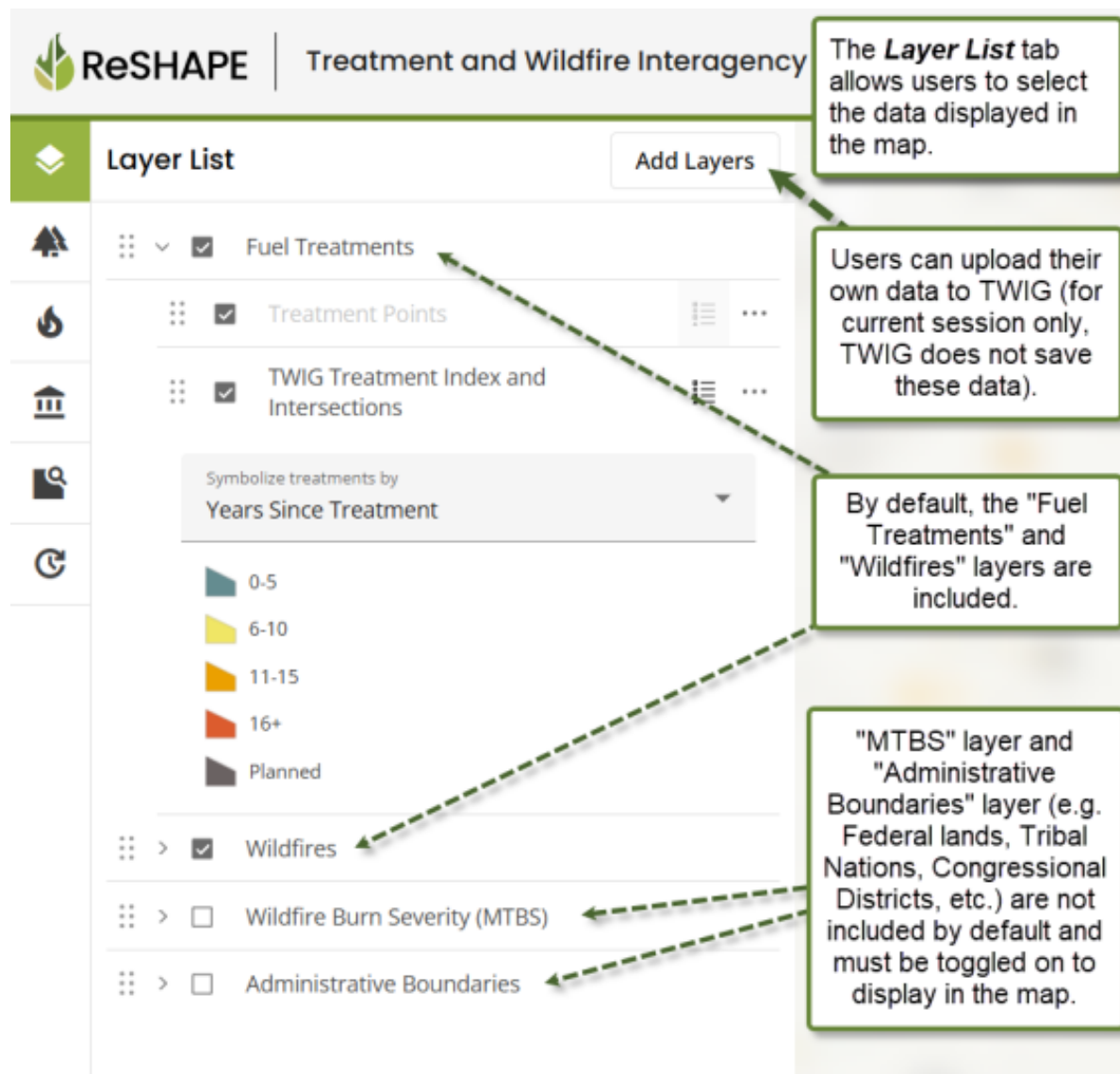


Figure 1. View of the Layer List tab.

## Fuel Treatments

The *Fuel Treatments* tab can run queries for fuel treatments. Of note in the search parameters is the ability to include data from the FACTS Common Attributes table (FACTS CA). By default, the TWIG Viewer includes data from the FACTS Hazardous Fuel Treatment table (FACTS HFT), which is a subset of FACTS CA filtered by funding source and activity. While FACTS HFT includes activities explicitly designed to reduce intensity and severity of wildfire, many activities logged in FACTS CA may have substantively changed fuel quantity and arrangement, and thus are included

(Call et al. In review). For this reason, the development team decided to give users the option to query FACTS CA as well (Figure 2).

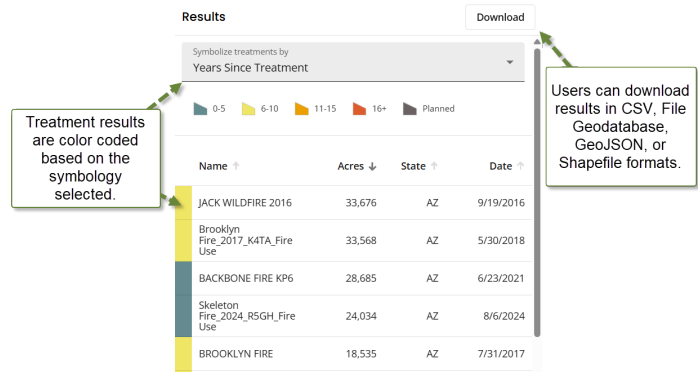
When the user clicks “Apply,” the TWIG Viewer returns a list of all fuel treatments that meet the input requirements. These data can be downloaded to the user’s local machine in a variety of common formats (i.e., CSV, File Geodatabase, GeoJSON, or Shapefile). Results display the name, size (in acres), state, and date of an entry. Additionally, fuel treatments are color-coded based on the option selected in the “Symbolize treatments by” field above the list of treatments (Figure 3).

The screenshot shows the 'Fuel Treatments' search interface. It features a sidebar with icons for various search criteria: Funding Source, Treatment Types, Treatment Name, and Treatment Year. The main area contains input fields for 'Funding Source', 'Treatment Types', and 'Treatment Name'. Below these are two range sliders: 'Treatment Year' (ranging from 1984 to 2025) and 'Treatment Acres' (ranging from 0 to 326,965). There are three checkboxes: 'Include planned treatments', 'Include treatments from FACTS Common Attributes', and 'Filter results by current map extent'. At the bottom, there are 'Clear' and 'Apply' buttons. Three callout boxes provide additional information: 1) 'The Fuel Treatments tab allows users to search for fuel treatments based on the following search parameters: - Funding source (e.g. Hazardous Fuels, BIL) - Type - Name - Year - Size (acres)'. 2) 'Systems of record contain entries for planned treatments that have not yet occurred. Clicking here will include these in the search query.' (pointing to the 'Include planned treatments' checkbox). 3) 'For those familiar with FACTS, users may include treatment data from the Common Attributes table, in addition to Hazardous Fuels.' (pointing to the 'Include treatments from FACTS Common Attributes' checkbox). 4) 'By default, queries search the entire federal dataset. Users can choose to limit their query to only what is currently visible in the map viewer.' (pointing to the 'Filter results by current map extent' checkbox).

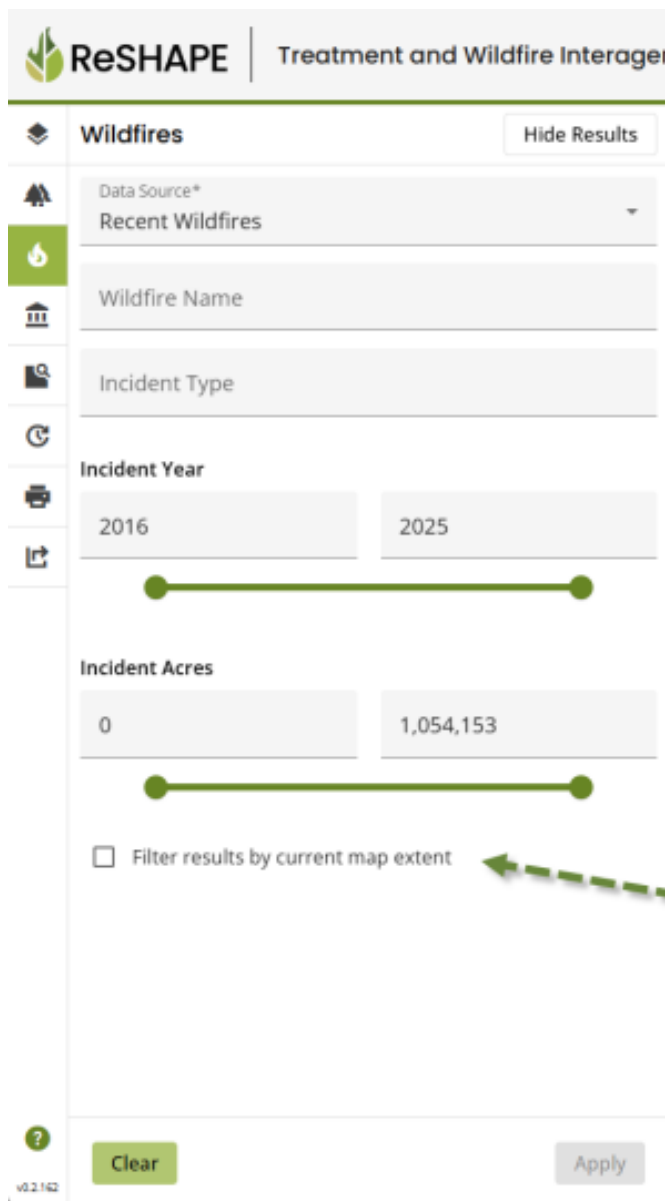
Figure 2. Search parameters for the Fuel Treatments tab of the TWIG Viewer.

# Wildfires

The *Wildfires* tab can run queries for wildfires. When the user clicks “Apply,” the TWIG Viewer returns a list of all wildfires that meet the input requirements. As with fuel treatments, these data can be downloaded to the user’s local machine in a variety of common formats. Results display the name, size (in acres), state, and date of an entry (Figure 4). Results list incidents’ name, acreage, year, and state, in descending order based on acreage (Figure 5).



**Figure 3.** Sample results from a query to the Fuel Treatments tab of the TWIG Viewer.



The *Wildfires* tab allows users to search for wildfires based on the following search parameters:

- Data source (Recent, Historical, and Current)
- Name
- Type
- Year
- Size (acres)

By default, queries search the entire federal dataset. Users can choose to limit their query to only what is currently visible in the map viewer.

**Figure 4.** Search parameters for the Wildfires tab of the TWIG Viewer.

# Representative Summary

The *Representative Summary* tab allows users to query all fuel treatments and wildfires that have been completed within a specific US congressional district. Users can filter by state before selecting a single congressional district, or search and select directly by congressional district code and representative (Figure 6).

# Area Summary

The *Area Summary* tab allows the user to choose an area of interest, generating a summary of fuel treatment and wildfire data. This area can be either a custom area drawn by the user (such as a rectangle or polygon) or a selected feature from a geo-spatial layer (like a national park or forest boundary). The generated summary provides similar data to the Representative Summary tab described above.

# Daily Fire Progressions

Incident Name	Acres	Year	State
Smokehouse Creek	1,054,153	2024	TX
DIXIE	963,309	2021	CA
DOE	589,368	2020	CA
PARK	429,603	2024	CA
Bootleg	413,717	2021	OR
SCU LIGHTNING COMPLEX	396,624	2020	CA

Users can download results in CSV, File Geodatabase, GeoJSON, or Shapefile formats.

Figure 5. Sample results from a query to the Wildfires tab of the TWIG Viewer.

The *Daily Fire Progressions* tab shows the daily fire perimeter progressions for every incident collated by WFIGS current perimeters (data collection began July 30, 2024). Users can use the time slider to track daily fire perimeter changes and download the dataset in a variety of common formats (same as those described in Fuel Treatments and Wildfires). Users can also add any layers from the ‘Add Layers’ button, or the pre-identified layers: Fuel Treatments and MTBS Layers.

**District metadata, including Federal Information Processing System (FIPS) codes.**

Arizona (AZ) Congressional district 0407 is currently represented by Democrat Raúl M. Grijalva.

District ID:	0407
State Name:	Arizona
State FIPS:	04
District FIPS:	07
Political Party:	Democrat
Representative Name:	Raúl M. Grijalva
Area in Square Miles:	15,422.75
Acres:	9,870,560

**The results tab contains fuel treatments and wildfires that intersect the congressional district.**

Category	Action	Download
Treatments	Open to view treatments	Download
Current Wildfires	No current wildfires found	
Historical Wildfires	Open to view historical wildfires	Download
Recent Wildfires	Open to view recent wildfires	Download

**Treatment, wildfire, and funding metrics including charts delineating treatment types and funding sources (scrolls beyond view of the page).**

**Total Area Metrics**

Total Treatment Area Overlap (2000-2025):	121,245 acres
Total Wildfire Area Overlap (2000-2023):	451,599 acres
Total Funding Amount (2000-2025):	\$2,562,209

**Treatment Type by Area (2000-2025)**

**Link to printing tool to create reports and / or maps.**

**Congressional district geographic extent highlighted in blue.**

Figure 6. Sample results from a query in the Representative Summary tab of the TWIG Viewer.

## Print and Share

The **Print** tab allows users to create quick maps to share as needed. For the ‘Layout’ option, users can add a title, select a file format (e.g., PDF, JPG, TIFF), and can select from a variety of templates that the website provides (e.g., 8.5x11 Portrait, 24x36 Landscape). Advanced options include setting the scale, dots per inch (DPI), and including a legend and/or north arrow. The tool generates a printable map for download. There is also a ‘Map only’ option that does not include the full layout where users can name their file, specify the height and width they prefer, and advanced options include setting the scale, DPI, and whether they want to include the attribution.

Finally, the **Share** tab provides the URL of the user’s current map view and selections that users can share with others.

## TWIG Viewer Limitations

There are several limitations to the TWIG Viewer that are noted on the [ReSHAPE website](#), most significant of which is data quality within federal systems of record. These errors include, but are not limited to:

- Inaccurate tabular data due to manual, disjointed methods of data input (by individual and agency)
- Duplication (e.g., when a single activity is recorded multiple times in a single database)
- Inaccurate or incomplete geospatial data compared to underlying tabular data (Knight et al. 2022)
- Missing records of known management actions (Withnall et al. 2024)
- Unknown or inaccurate funding codes and quantities

TWIG is designed to accurately represent those systems of record, so though there are several known errors with entries in these datasets, none of these data are removed or corrected. Instead, the developers included an “Errors” attribute to identify the records that may contain them. Due to the nature of these errors, these data and the TWIG

viewer are not intended for any use cases that require real-time or precise data (e.g., emergency or incident management or small-scale mapping to the level of individual projects or stands).

## Evaluating the TWIG Viewer

We (the CONNECT team) conducted a preliminary study to evaluate the TWIG Viewer beginning in fall 2024. The goals of this study were to:

- 1) Understand and identify potential audiences for the TWIG Viewer.
- 2) Understand and identify potential use cases.
- 3) Better understand what tools managers and professionals are currently using.
- 4) Provide feedback to the TWIG development team to improve the tool use and effectiveness while still in development.

We assessed the user interface, utility, and applicability of the TWIG Viewer to its current and potential audiences that may use fuel treatment and wildfire data for their work.



Use of TWIG during a field trip, Durango, Colorado, June 2025. Photo credit Aidan Franko.

# Methods

## Sampling

We had several conversations with key TWIG team members individually and in group settings to clarify assumptions and the expected utility of the TWIG Viewer, as well as the type of feedback that would be useful for tool development. The information needs of the TWIG team informed the sampling strategy. We sampled a variety of users with different levels of GIS expertise representing different organization types (e.g., NGO, state agency, federal agency). We also sampled across states to ensure diverse geographical perspectives and identified five western states (Arizona, California, Colorado, Idaho, and Utah) to sample in. We used a combination of purposive and snowball sampling to ensure representation across user types and geographic areas (n = 37, Tables 1–3). All participants had low familiarity with the tool, meaning they had either never looked at the TWIG Viewer or had only superficially explored it prior to the interview.

We asked each participant:

- What tools they currently use in their work and the pros and cons of those tools.
- To share their screen and explore the TWIG Viewer while thinking aloud and sharing any comments, suggestions, likes and dislikes, etc.
- How or if they could envision using the TWIG Viewer and for what purpose in their work.

**Table 1.** Interviews by source

Interview Source	Count
State agency personnel	8
Local practitioners	14
Federal agency personnel	15
<b>Total</b>	<b>37</b>

**Table 2.** Number of participants by professional affiliation

Professional Affiliation	Count
Private industry	1
Local government	2
National forestry related nonprofit organizations	4
Local fire and forest health collaboratives/nonprofit organizations	7
State and federal agencies	23

**Table 3.** Number of participants by geographic area

Geographic Area	Count
California	1
Arizona	7
Utah	8
Idaho	9
Colorado	12

## Analysis

We conducted semi-structured interviews lasting 30–90 minutes in person or via video teleconferencing software (Zoom and Microsoft Teams) depending on the respondent’s preference and location. Interviews were recorded with permission, including screen recording as respondents explored the TWIG Viewer. Interviews were transcribed using Alice AI and coded for key themes using Dedoose qualitative coding software. We met regularly during analysis to discuss and modify themes and synthesize results. Quotes from anonymized participants are used throughout the report to illus-

ustrate the identified themes and the number following indicates the different participants (e.g., (1) is a different participant from (3)). This project was reviewed and approved by the Institutional Review Boards at Northern Arizona University, Colorado State University, and New Mexico Highlands University.

We categorized results around four major feedback themes received about the TWIG Viewer:

- Data Accessibility and Sharing
- Communication and Prioritization
- Document Preparation
- Monitoring and Effectiveness

In the following sections, we discuss compliments and criticisms of the TWIG Viewer, including quotes from participants to provide context and highlight various perspectives.

## Findings

### Data Accessibility and Sharing

*“It really needs to start [being] broader tools that are for everyone.” (6)*

What Users Liked	What Users Critiqued
<p><b>The TWIG Viewer makes datasets accessible that previously required login credentials, GIS expertise, or both.</b> As one respondent stated, <i>“querying data out of FACTS is a nightmare”</i> (32), and the TWIG Viewer offers a way to access this data without having to go directly to cumbersome systems of record.</p>	<p>Multiple participants brought up <b>data quality and control issues in the underlying data sources</b> such as input inconsistencies and duplications of fuel treatment and wildfire information that reduce the power of the dataset to inform decision-making and monitoring. Though outside the purview of the TWIG team to change, it nonetheless presented a barrier for participants.</p>
<p><b>Accessibility was not limited to those outside of federal agencies.</b> Even participants from within federal agencies have issues accessing these data. For those that lacked GIS expertise, acquiring data often meant submitting a request to a GIS specialist, which took significant time and would delay their ability to use data in their own workflow.</p>	<p>Participants also criticized <b>the data not available via TWIG like state and private land data.</b> At the time of this report, TWIG compiles only federal fuel treatment data, and many participants identified state and private data as crucial to compiling a complete catalog of fuel treatments, a necessary step toward understanding those treatments’ effectiveness. <i>“If we did have some kind of more locally relevant non-US Forest Service or non-BLM data, that’d be huge.”</i> (6)</p>
<p><b>Importing additional geospatial data</b> as layers into the TWIG Viewer and exporting data to their preferred tool of choice (e.g., incorporating burn severity data from MTBS, or exporting federal data to a state-based tool to combine datasets).</p>	<p><b>“The overabundance of tools is almost the problem ... I think folks are feeling very overwhelmed with the amount of information out there ... is it actually leading to better decisions or reducing our workload or streamlining things?”</b> (25)</p>

## Communication and Prioritization

*Sometimes they don't want to just take it from [me]. They want to see something on a map, and me showing them on a map saying, "See? Nothing's been done in this big donut or this hole right here. This is where we need to focus our money and our treatments." I think it helps us tell our story.*

(17)

What Users Liked	What Users Critiqued
<p>Participants praised the <b>user-friendly interface in comparison to other GIS tools</b>, the functionality to quickly filter recent and historical fuel treatment and wildfire data and the automated data and visualizations via Area Summary, Representative Summary, and Print tools within the TWIG Viewer.</p>	<p>Interviewees also identified a variety of user interface design elements that needed clarity or improvement (e.g., limited fuel treatment symbology, like color-coding fuel treatments on the map by agency, in addition to age). These suggestions are detailed in "Feedback to Developers" below.</p>
<p>The TWIG Viewer could help <i>"tell stories in a common basis nationwide"</i> (7) by <b>establishing a known history of completed work</b>. Providing fuel treatment histories and their corresponding funding information can help build the shared understanding needed to reduce miscommunication and improve collaboration in land management.</p>	<p>Known <b>data quality and control issues with the underlying data sources</b> limit the TWIG Viewer's ability to facilitate communication.</p>
<p><b>Coordinating contiguous fuel treatments across the landscape</b> was considered more impactful for restoration and risk reduction, otherwise work becomes patchy and disconnected, reducing its effectiveness. Respondents believed the TWIG Viewer could <b>help groups in collaborative settings to articulate their priorities</b> and more effectively identify areas of overlap for mutual gain. <i>"The thing I hear the most in these partnerships is they want to coordinate ... make it more efficient and get better response by doing similar stuff on the other side of the line."</i> (12)</p>	<p>Participants described <b>confusing database schemas</b> (i.e., the set of classes / names used for columns of the database), including lack of clear definitions for terms (e.g., date fields, funding codes, and fuel treatment types like "fire use") and lack of a consistent interagency schema when trying to aggregate data.</p>
	<p>Participants critiqued the <b>absence of data on National Environmental Policy Act (NEPA) planning assessments</b>, as such products are often a prerequisite to landscape-level fuel treatment, especially if leveraging wildfire or prescribed fire.</p>

## Document Preparation

*If we are confident and can visualize that a partner has prioritized treatment in their given area of management or ownership, that's huge ... it's really easy for us to shift gears or direct funding and resources if it's conveyed to us by a partner that they've gone through some process of prioritization, whatever it is, and can show us: "Here's where we want to work."*

(22)

### What Users Liked

Respondents believed the information and functionality within the TWIG Viewer could help **build documents or products used in pre-treatment planning and post-treatment reporting.** These products spanned spatial and temporal scales:

- Grant applications
- CWPPs
- Potential Operational Delineation (POD) networks
- Reporting (e.g., accomplishment maps, fuel treatment contracts, etc.)

### What Users Critiqued

**Lack of state or private data** limit the TWIG Viewer's ability to inform some documents.



Rx Pile Burn in Mendocino, CA. Photo credit Susan Knight-Ashley

## Monitoring and Effectiveness

**“What does effective mean? And how can I tell this story? How can I share with others to build social license for this kind of work?” (2)**

What Users Liked	What Users Critiqued
<p><b>Automation in the TWIG Viewer would reduce the overhead of tracking progress.</b> Its scripting that pulls daily from systems of record could be especially helpful to collaborative groups. <i>“[A local collaborative] used to house a similar localized program that showed [treatments], but it just had shapefile; It wasn’t as interactive as this ... it just got to where nobody would talk to each other and share shapefiles very well, and so the map just kind of fell apart” (17).</i></p>	<p><b>More functionality for analyzing data,</b> to go from the “raw form” of the data and “tease out the intricacies of it” (13). As the TWIG team’s commissioned tasks are to “compile and display” fuel treatment information, any manipulation of the data for the purpose of monitoring or analysis is unlikely to be developed.</p>
<p>Access to information that is useful to start investigating effectiveness, like the MTBS layer and Wildfire Progressions tool. Overlaying fire progressions and footprints with fuel treatments gave participants <b>validation of the work done to protect landscapes.</b> <i>Naturally you want to know how wildfires interacted with any of the treatments ... when you can see them basically boxed in by treatments, it’s really exciting. Because in many ways it validates the work that we’re all doing. (7)</i></p>	<p>N/A</p>

## Tools Currently Used

In addition to potential use cases for the TWIG Viewer, we also asked participants to name the tools they currently use and their strengths and weaknesses. They mentioned 21 unique tools used across our 37 interviews, ranging from publicly available platforms like the Risk Management Assistance (RMA) Dashboard, to agency-specific tools like the Forestry Information Tracking System used exclusively by the Arizona Department of Forestry and Fire Management.

Common strengths in the tools mentioned were:

- User-friendly interfaces.
- Collating multiple data sources into one repository or access point.

- Functionality or data that facilitated collaboration with partners.

Common weaknesses were:

- Missing one or more federal, state, or local datasets.
- Inaccuracies between tools and on-the-ground conditions.
- Lack of trust in data input quality.

The full list of tools mentioned by users, along with any strengths and weaknesses mentioned, is in Appendix A.

# Feedback to Developers

As of the writing of this report, the TWIG Viewer remains in active development. Though some of the feedback described in Findings remain outside of the control of the TWIG developers (e.g., data quality issues with federal systems of record), some were insightful critiques of the tool and how the user experience could be improved. We distilled the feedback gathered through interviews with potential users into a set of viable feature requests for the development team to consider implementing. Table 4 shows a subset of the requests made by users, and their current implementation status.

**Table 4.** *The subset of TWIG Viewer feedback provided to the development team for future implementation, as well as its current implementation status.*

Feature Request	Implementation Status (as of 2025)
Include “agency” as another option for fuel treatment symbology (i.e., how polygons are color-coded)	Completed
Include user-uploaded layers as selectable layers for the Area Summary tab	Completed
Allow multiple selections for fuel treatment type and other filterable fields (i.e., can select both “thinning” and “mastication” instead of one or the other)	Planned
Offer optional “buffer” filter for fuel treatment intersection (i.e., have the option to select not just intersecting fuel treatments, but any fuel treatment within a certain, adjustable distance)	TBD
Add state as a filterable attribute of fuel treatments and wildfires	TBD
Provide an export option to the Representative Summary report, including figures	Completed
Adjust figure and symbology color palette for colorblindness	TBD
Identify in-progress fuel treatments in addition to completed and planned fuel treatments	TBD

# Conclusion

## *The TWIG Viewer addresses a need set by IJA provision*

At its core, the TWIG Viewer makes important content available that was previously hard to reach. Participants both inside and outside federal agencies expressed disappointment in the effort necessary to query and use data from federal systems of record like the Forest Activity Tracking System (FACTS), the National Fire Plan Operations and Reporting System (NFPORS), and the Interior Fuels and Post-fire Reporting System (IF-PRS). As a publicly available, user-friendly access point for federal fuel treatment and wildfire data, the TWIG Viewer provides a notable improvement from the status quo, which could help build transparency, accountability, and efficiency for organizations that monitor or evaluate fuel treatments and wildfires. It allows individuals to access and download unmanipulated data and incorporate it into preferred analyses and assessment strategies, achieving a primary objective of the IJA provision.

There are a few notable limitations for the TWIG Viewer and this evaluation of it. First, data quality issues will limit its applicability. Our data indicate that federal systems of record have known issues of inconsistent data quality. While the TWIG Viewer can shine a spotlight on this need by noting these confirmed and potential inaccuracies, it cannot directly address these issues, that responsibility lies with the federal agencies and the workforce that inputs and maintains these data. For this reason, it cannot serve needs for real-time or high-fidelity data. Second, the TWIG Viewer only compiles federal data as of the writing of this report. The absence of state and private landowner data also limits its applicability. Participants both implicitly and explicitly indicated that these data represent a significant piece of the fuel treatment history puzzle. Third, our evaluation captured mostly anticipated use cases. The TWIG Viewer is a relatively recent addition to the decision support

landscape, and as such, it has yet to develop a consistent user base, so participants largely envisioned how they would use it. For the many decision support tools in fire and fuels management (O'Mara et al. 2024), potential use and actual use can differ significantly (Rapp et al. 2020; Schultz et al. 2021; Fillmore and Paveglio 2023). While the feedback provided by potential users has informed and will continue to inform development, the TWIG Viewer's effectiveness in decision support cannot be fully evaluated until potential users turn into active users.

With those limitations in mind, the TWIG Viewer is still in active development. Multiple identified bugs, gaps in functionality, and reasonable feature requests have already been implemented, while others are in progress at the writing of this report. For example, ReSHAPE recently reached a formal agreement with the National Association of State Foresters (NASF) to build the means to collate state data. These ongoing efforts demonstrate the iterative and responsive feedback with users critical to driving adoption and efficacy for any decision support tool (Stoltz et al. 2023).



Post-wildfire, 2023. Photo credit New Mexico Forest and Water Restoration Institute.



Prescribed burn, Flagstaff, AZ, November 2024.  
Photo credit Cole Brant.

## Audiences and Use Cases

The initial scope of work proposed by SWERI identified three major audiences for the TWIG Viewer: 1) congressional representatives, 2) data managers, and 3) federal agency employees. Our results corroborate those groups and align with that scope. We have adapted those groups into the following:

- **Elected officials.** Elected officials and their staff at various levels of government have a vested interest in the work to restore landscapes and reduce wildfire risk. Congress controls many of the funding sources necessary to implement projects and requires agencies to measure and report on their performance. The TWIG Viewer's automated, off-the-shelf products produced in the Area Summary and Representative Summary tabs improve visibility and accessibility of data, showing where and how the money is spent, and serving the needs of county, state, and federal officials.
- **Researchers.** One participant described how their team had to go through the same arduous

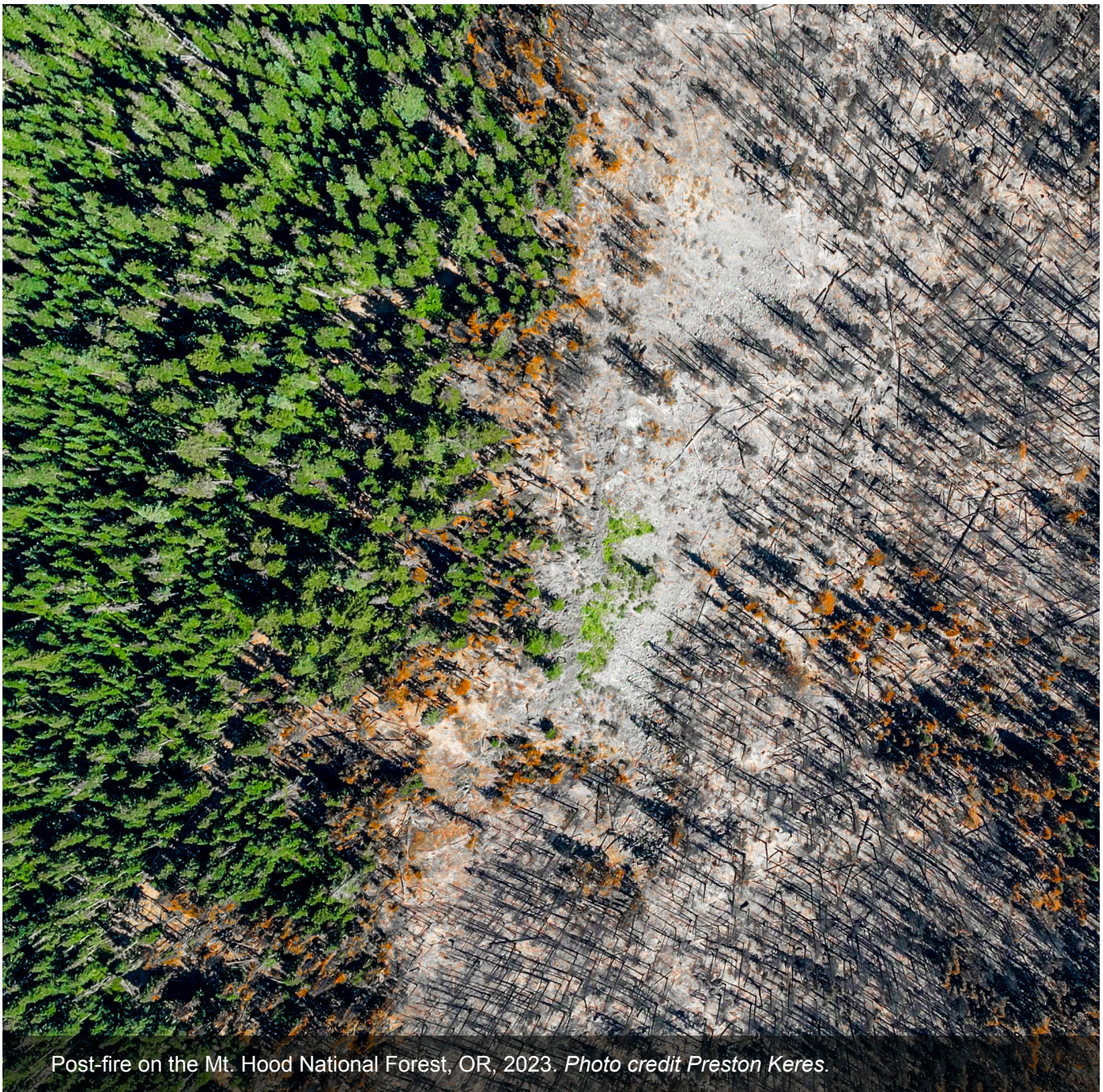
process of wrangling and cleaning the data from federal systems of record into a usable dataset capable of analyzing the biophysical effects when fuel treatments and wildfires interact. The TWIG Viewer's focus on creating clean, downloadable datasets of these intersections could improve our understanding of not just the readily quantifiable, first-order effects of fuel treatments such as reduced burn severity, but also the extent to which fuel treatments protect and enhance cultural values and ecosystem services. Additionally, the availability of financial data could help answer nascent research questions about the economics of fuel treatments. These users are more likely to use the TWIG Viewer as an access point only, bringing the collated data into their tool(s) of choice to analyze.

- **Managers and their partners.** Federal and non-federal managers, practitioners, and collaborative partners participate in the planning, implementation, and evaluation of fuel treatments. Those outside of the federal agencies now have an access point for federal data that previously sat behind a login and a firewall. Even those within agencies noted that collating federal data was typically arduous and time consuming, whereas the TWIG Viewer quickly and easily collected data from systems of record. Beyond the agency context, collaboratives working on projects like Community Wildfire Protection Plans (CWPPs) could leverage the TWIG Viewer to build applications for funding.

One use case resonated with most of our participants across each of these groups: the TWIG Viewer can help build a shared understanding of land management history and progress. Making the data accessible, visualizing them in maps, and providing means to summarize them can improve transparency in a world of land management mired in accounting inaccuracies (US Department of Agriculture OIG 2016; Knight et al. 2022). Additionally, the TWIG Viewer can help future planning. With a shared understanding of history, we can identify what work has been done, and where we ought to go next.

## ***Future Directions***

Based on the feedback we received, future directions for the TWIG Viewer should focus on driving the tool's adoption and building a consistent user base. With a wider and longer history of use, an additional study could capture actual uses, both to compare against anticipated uses from this report and to assess the quality of the TWIG Viewer more accurately as a decision support tool for the planning, prioritization, implementation, and communication of fuel treatments. To accomplish this goal, outreach should focus on workshops and webinars with a variety of audiences that could benefit from the tool. Ultimately, the success of the TWIG Viewer will continue to depend on the iterative nature of its outreach and development. By consistently incorporating user feedback, it will continue to facilitate investigation and communication about how fuel treatments and wildfires interact, how their interaction improves the resilience of landscapes, and how to efficiently protect communities against wildfire risk.



Post-fire on the Mt. Hood National Forest, OR, 2023. *Photo credit Preston Keres.*

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# Appendix A: Tools Used by Participants

Table 5. List of tools currently used by interviewees and any strengths or weaknesses mentioned.

Tool	Strengths	Weaknesses
<a href="#">ArcGIS Pro</a>	Not mentioned	Difficulty in aggregating desired layers/features
<a href="#">Arizona Wildfire Risk Assessment Portal</a> (AZWRAP)	Not mentioned	Inaccurate
<a href="#">Climate and Economic Justice Screening Tool</a> (note: this tool is not currently available)	Not mentioned	Difficult to understand the outputs
<a href="#">Colorado State Forest Tracker</a>	<ul style="list-style-type: none"> <li>Multiple data sources (e.g., federal, state, private, county lands), including local treatment data</li> <li>Used by many organizations, becoming a central repository</li> <li>Easy, intuitive user-interface</li> </ul>	<ul style="list-style-type: none"> <li>Not comprehensive dataset from all partners, potential loss in transfer from physical to digital storage</li> <li>Inconsistent data coding compared to federal systems of record</li> <li>Inconsistent functionality with KMZ or shapefile formats</li> </ul>
<a href="#">Colorado Wildfire Risk Assessment</a> (COWRA)	<ul style="list-style-type: none"> <li>Compiles data from many different partners</li> <li>Can be used live for wildfire incidents (did not specify how)</li> <li>Can keep iterating and adding new, relevant data</li> </ul>	Trusts this data because was part of putting it together
<a href="#">Community Wildfire Protection Plans</a>	Facilitates collaboration, not just quantitative results	Not mentioned
<a href="#">Forest Service Activity Tracking System</a> (FACTS)	Not mentioned	<ul style="list-style-type: none"> <li>Complexity; difficult to export and otherwise interact with features</li> <li>Federal data only (missing state, private, tribal data)</li> <li>Data quality control (e.g., errors, duplicates, poor geographic accuracy)</li> <li>Requires user credentials / login to access</li> </ul>
<a href="#">Forestry Information Tracking System</a> (FITS)	<ul style="list-style-type: none"> <li>Can build reports with information on fuels treatments in specific areas and times</li> <li>Can know exactly what they are accomplishing each year very quickly</li> </ul>	Specific to AZ Department of Forestry and Fire Management; requires credentials / login and only has their data
<a href="#">Fuel Treatment Effectiveness Monitoring</a> (FTEM)	Not mentioned	<ul style="list-style-type: none"> <li>Could be more thorough</li> <li>Not the best place to try to keep track of stories and images of treatment effects</li> </ul>

Tool	Strengths	Weaknesses
<a href="#">Interagency Fuel Treatment Decision Support System (IFTDSS)</a>	<ul style="list-style-type: none"> <li>Useful for fuels effectiveness monitoring</li> <li>An authoritative database, so more buy-in (e.g., USDA Forest Service encourages its use)</li> <li>Helps only have a few different fire behavior models that are used</li> <li>User friendly               <ul style="list-style-type: none"> <li>Past fuel treatment layers are already in there, so editing is easy</li> <li>Easy to upload own shape-files</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Some vegetation classifications (e.g., agricultural lands) did not match up well with what is on the ground</li> <li>Shows LANDFIRE vegetation types, but it cannot summarize them.</li> <li>Have to anticipate real world conditions and it is difficult</li> </ul>
<a href="#">Land Tender</a> by Vibrant Planet	<ul style="list-style-type: none"> <li>Facilitates collaboration</li> <li>Accesses trusted, publicly available datasets</li> <li>Uses a “robust wildfire analysis system”</li> <li>Creates a shared operational risk assessment language across different agencies</li> <li>Accessible for everyone, especially users without other tools or platforms available</li> <li>Helps determine project scope and associated costs</li> <li>3rd party product / services creates level playing field for collaborators</li> <li>Vibrant Planet provides helpful walkthroughs</li> </ul>	<ul style="list-style-type: none"> <li>Does not show outcomes or effectiveness</li> <li>Complexity; takes time to learn to use and understand the many dynamic variables involved</li> <li>Manual; a lack of automation in platform tasks / functionality</li> <li>Access; platform is not free and requires credentials / login</li> </ul>
<a href="#">National Fire Plan Operations and Reporting System (NFPORS)</a> / <a href="#">Interior Fuels and Post-fire Reporting System (IFPRS)</a>	Not mentioned	<ul style="list-style-type: none"> <li>Complexity</li> <li>Manual; lack of automated collection/cleaning of data</li> <li>Access; platform requires credentials/login</li> </ul>
<a href="#">Potential Operational Delinquencies (PODs)</a>	Helps frame conversations with land management collaborators	<ul style="list-style-type: none"> <li>Significant effort to develop and ground truth</li> <li>Lack of verification of their use (what happens after development?)</li> </ul>
<a href="#">PODs Dashboard for the Northern Colorado Fireshed</a>	<ul style="list-style-type: none"> <li>Helpful to get conversations started</li> <li>Helps to develop a grant proposal with many different partners</li> <li>Gives treatment cost estimates (per acre)</li> <li>Easy user-interface</li> <li>Includes important variables / metrics (e.g., treatment costs, expected net value change, land ownership, etc.)</li> </ul>	Not mentioned

Tool	Strengths	Weaknesses
<a href="#">Risk Assessment Decision Support</a> (RADS) by Colorado Forest Restoration Institute	<ul style="list-style-type: none"> <li>Facilitates working with stakeholders to find out what their valued resources and assets</li> <li>Facilitates collaboration to produce a better product</li> </ul>	Not mentioned
<a href="#">Risk Management Assistance</a> (RMA) Dashboard	<ul style="list-style-type: none"> <li>Automated process considered “not subjective”</li> <li>Integration with other processes like ISAP, PODs, etc.</li> <li>User-friendly interface</li> <li>Access; publicly available, easy to share</li> <li>Helpful analytics</li> </ul>	<ul style="list-style-type: none"> <li>Not always helpful at the national level</li> <li>Specific to the USDA Forest Service</li> <li>Other agencies are more cautious handing over data</li> </ul>
<a href="#">Risk Monitor</a>	Not Mentioned	<ul style="list-style-type: none"> <li>Difficult to incorporate partner information (e.g., data sharing)</li> <li>Not fine enough scale or detail to inform project area prioritization</li> </ul>
<a href="#">Timber Information Manager</a> (TIM)	Tracks volume reporting for timber	<ul style="list-style-type: none"> <li>Does not track acres</li> <li>Manual effort to match up with FACTS</li> <li>Does not track all contracts/agreements</li> </ul>
<a href="#">Watershed Investment Tool</a> created for Peaks to People Water Fund	<ul style="list-style-type: none"> <li>Provides data on potential outcomes of treatment and allows side by side comparisons</li> <li>Measures apples to apples when prioritizing projects that have the greatest potential return</li> </ul>	<ul style="list-style-type: none"> <li>Costs money</li> <li>Multi-step process that must involve third party to run analysis</li> </ul>
<a href="#">Four Forest Restoration Initiative</a> (4FRI) Dashboard	<ul style="list-style-type: none"> <li>Integrated with FACTS</li> <li>Can facilitate quality control of FACTS</li> <li>User-friendly interface</li> <li>Facilitates collaboration</li> <li>Can view multiple districts or forests to see project areas and associated information</li> </ul>	<ul style="list-style-type: none"> <li>Manual; no automation</li> <li>Difficult to maintain</li> <li>Monitoring data not stored in the dashboard</li> </ul>