Identifying technology capabilities that meet wildfire science and practitioner requirements
Wednesday, July 21 • 11:00am - 1:30pm

More info & slides on Sched Session Page: https://sched.co/jMOK

Attendance & Check in
Add your Name / pronouns / email / affiliation / physical location

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Agenda
- **Welcome**
  - Invite attendees to share their name/email/affiliation/location (**Attendance & Check in**)
- **Community Participation Guidelines Reminder**
  - By participating in this session, you agree to adhere to the ESIP Community Participation Guidelines
  - Expected behaviors and responsibilities for an individual, group, or organization when involved with ESIP activities: (1) Be respectful; (2) Be direct but professional; (3) Be inclusive; (4) Understand different perspectives; (5) Appreciate and accommodate our similarities and differences; (6) Lead by example.
  - To report an issue: https://www.integritycounts.ca/org/esip
- **Goals of this Session**
  - Restating and generalizing from the session title: Map end user requirements to potential technology solutions ("Consumption chain")

- **Schedule**

- [11 am] [Welcome and Introduction](#)
- [Sli.do poll: Which of the following wildfire experiences apply to you?](#)
- [11:10 am] Wildfire problem statement, requirements, and some focus on planning by polygon
    - Everett Hinkley, US Forest Service, Geospatial Management Office National Remote Sensing Program Manager
        - *[Wildfire Mapping--Leveraging AI/ML for needed improvements: Faster delivery, improved consistency, reduced subjectivity](#)*
    - Dave Zader, Wildland Fire Administrator for The City of Boulder, CO Fire Department (retired); Wildlife Fire Policy Committee member for the International Association of Fire Chiefs
        - *[Wildfire management and planning by polygon, a tool for improved decision-making and resources usage](#)*
    - Pier Buttigieg, Helmholtz Metadata Collaboration
        - *Representing and aligning knowledge about wildfires - the need and challenge of semantic harmonization*
- [12:05 pm] [Sli.do poll: Rank the following values-at-risk that are important to *YOUR* community: from most important (rank #1) to least important (rank #6)](#)
- [12:10 pm] Breakouts Part 1
    - Breakout group #1: Knowledge representation for wildfire planning and execution (Focus on Polygons)
    - Breakout group #2: Technological solutions for wildfire planning and execution
- Short break / transition (10 min)
- [~12:45 pm] Breakouts Part 2
    - Breakout group #1: Knowledge representation for wildfire planning and execution (Focus on Values-at-Risk)
    - Breakout group #2: Technological solutions for wildfire planning and execution
- [1:10 pm] Report out from breakout groups
- [1:20 pm] Wrap up
- [1:30 pm] Workshop ends

Resources for this session (link supplementary docs or presentations here)
- [Poster providing a big-picture schematic of how this session relates to data-science topics like AI/ML, semantic technology, graph database technology, etc.](#)
    - See presentation 39 in Research Showcase (https://bit.ly/3eESU11)

Slido poll results

Which of the following wildfire experiences apply to you?

Evacuated from home

3%

Lost a home to wildfire

0%

Seen wildfire

53%

Seen smoke from wildfire

81%

Smelled smoke from wildfire

72%

Seen sky affected by wildfire

78%

Fought a fire

9%

Have not personally experienced any of the above

16%

Rank the following values-at-risk that are important to *YOUR* community: from most important (rank #1) to least important (rank #5)

1. Civil infrastructure

   4.07

2. Biological resource

   3.79

3. Cultural resource

   2.62

4. Native American allotments

   2.59

5. Viewshed

   1.93

Session Knowledge Capture

Table 1: Fire management needs and "interesting" concepts (please enter any questions you have for the stakeholders into the Zoom chat window)

Row ID	Stakeholders (Hinkley, Zader)	Stakeholder Needs looking for solutions or Concepts requiring further discussion	Needs / Concepts / something else
T1.01	Hinkley	GPS coordinates of heat detections, displayed as GIS- ready polygons, lines, or points, to map areas of new fire growths or spot fires since last image.	Need
T1.02	Hinkley	Improve performance of fire predictive models to aid in wildlife behavior forecasting. Using historical fire behavior to inform forecasting models. Prediction of behavior for the 6, 12, 24 hours.	Need
T1.03	Zader	Polygons - defined by whether they are accessible by 4x4 vehicles and can serve as firebreaks. Don't we need to capture the attributes of the polygon edges? E.g., an attribute (i.e. property) could contain the values "walkable only / 4x4 drivable / what else?"	Concept
T1.04	Zader	Automated identification of ridgelines from images so that ridgelines can be incorporated as fire breaks.	Need
T1.05		Generate candidate evacuation route. <This is an example inserted into Table 1 before the start of the workshop to provide ideas on what we're looking for.>	Need
T1.06	Hinkley	Fires evolve, and the currency of the data evolves accordingly. Is there also a latency concern?	Concept
T1.07	Hinkley	Intense heat	Concept
T1.08	Hinkley	Scattered heat	Concept

T1.09	Hinkley	Isolated heat resources	Concept
T1.10	Hinkley	Selected FireGuard processes need to be automated using AI/ML, e.g. Firefly Product that is updated every 15 minutes	Need
T1.11	Hinkley	Improving interoperability of sensor systems (sensor fusion and deconfliction of false alarms). Having multiple sensor systems "looking" at the same scene to fuse data into a comprehensive Common Operating Picture (COP).	Need
T1.12	Zader	Common Operating Picture	Concept
T1.13	Zader	Linear features	Concept
T1.14	Zader	Tactical opportunities - any linear feature that bisects or injects into a polygon (T1.03)	Concept
T1.15	Zader	Planning units: are these truly equivalent to polygons as defined in T1.03?	Concept
T1.16	Zader	Areas	Concept
T1.17	Zader	Zones	Concept
T1.18	Zader	Smallest drivable perimeter	Concept
T1.19	Zader	Use algo and data to ID edges of inorganic soils that can be used to fight fire from	Need
T1.20	Zader	Use algo and data to ID where drainages are	Need
T1.21	Zader	Use algo and data to ID where water sources are	Need
T1.22	Zader	Determine number of resources that are at-risk within a polygon	Need
T1.23	Zader	Vulnerable population	Concept
T1.24	Zader	Fuels	Concept
T1.25	Zader	Fire history	Concept

T1.26	Zader	Evacuation	Concept
T1.27	Zader	Defensible features	Concept
T1.28	Zader	Automate processes to delineate linear features into polygons	Need
T1.29	Everett	Persistent heat sources. There is a "constant emitter" database. E.g. solar farms. Smoke stacks, thermal emitters, power generation stations, etc. Things that may be mistaken for a fire.	Concept
T1.30	Everett	Use thermal products to evaluate stand change.	Need
T1.31	Breakout Group 2	Calibrate BARC map estimates by using a multitude of data sources, including in-situ ground-truth of burn severity by BAER team after fire containment.	Possible Need
T1.32	Everett	Daily time slices of the burn map.	Need

TECHNOLOGICAL SOLUTIONS (Breakout group #2 notes capture table)

Table 2: Solutions sketch

Priority (column 2) ranking of five most important needs provided by Everett Hinkley: 1=Most important.
Note that T2.02 (ranked #5) was an exemplar that traces to T1.05 which itself was an exemplar.

Row ID	Priority (top 5)	Need / concept from Table 1	Background	Technology / algorithm / approach required to fulfill that need / concept	Data science keywords
T2.01		T1.04 | Automated identification of ridgelines from images so that ridgelines can be	Within an area that is bounded by a polygon (i.e. can be driven on by 4x4 emergency vehicles), ridgelines may be used to plan	● Satellite / UAS imagery classification of landscape into bare-earth, vegetation, and other	● Image classification. ● Feature

		incorporated as fire breaks.	out firebreaks, depending on how flat the ridgelines are and the amount of vegetation surrounding the ridgeline.	classes. ● Assign attributes to identified ridgelines. Ridgelines that are "flat", with extensive bare-earth with little surrounding vegetation, are assigned different attributes than sharp ridgelines that have vegetation close to the ridge.	extraction.
T2.02	5	T1.05 | Generate candidate evacuation routes.	If you need to escape from a wildfire situation, the nearest road is not always the best way out because the road may be blocked, or the fire may have jumped the road (with fires on both sides of the road) rendering the road unsafe.	● Determine contours of landscape from digital elevation models (DEM). ● Create a network map (i.e. a graph) that connects potential evacuation routes, with each edge of the route assigned some metric of traversal ease. ● Apply operational research / graph data science methods to determine a ranked list of evacuation options (updated in real-time).	● Graph data science. ● Operations research.
T2.03	1	T1.01 | GPS coordinates of heat detections, displayed as GIS- ready polygons, lines, or points, to map areas of new fire growths or spot fires since last	An analyst might draw a polygon around an area of intense tightly packed fires, and another polygon around a group of smaller fires.	<sketch of technology / algorithmic approach>	

		image.			
T2.04	3	T1.02 | Improve performance of fire predictive models to aid in wildlife behavior forecasting. Using historical fire behavior to inform forecasting models. Prediction of behavior for the 6, 12, 24 hours.		<sketch of technology / algorithmic approach>	
T2.05	2	T1.10 | Selected FireGuard processes need to be automated using AI/ML, e.g. Firefly Product that is updated every 15 minutes		<sketch of technology / algorithmic approach>	
T2.06	4	T1.11 | Improving interoperability of sensor systems (sensor fusion and deconfliction of false alarms). Having multiple sensor systems "looking" at the same scene to fuse data into a comprehensive Common Operating Picture (COP).	RAWS stations do not have imaging sensors. Fusing land cover and persistent heat source in a COP. Persistence and growth: if the fire pixels are growing, there is a chance that these things are fires and not persistent sources.	Mobile multispectral solutions, combinations of lidar, radar, that produce lots of streaming data that needs to have data products. Processing at the edges. Sensor fusion and product development. Ready-to-go robust mobile sensor systems. Streaming data acquisition. Data processing, either at the	● Edge computing ● Computer Vision ● Segmentation, mapping, classification ● Distributed software frameworks

				edge or at some computer. Containerize the processing.	
T2.07		T1.19 | Use algo and data to ID edges of inorganic soils that can be used to fight fire from		\<sketch of technology / algorithmic approach>	
T2.08		T1.21 | Use algo and data to ID where water sources are		\<sketch of technology / algorithmic approach>	
T2.09		T1.20 | Use algo and data to ID where drainages are		\<sketch of technology / algorithmic approach>	
T2.10		T1.22 | Determine number of resources that are at-risk within a polygon		\<sketch of technology / algorithmic approach>	
T2.11		T1.28 | Automate processes to delineate linear features into polygons		\<sketch of technology / algorithmic approach>	
T2.12		T1.31 | Calibrate BARC map estimates by using a multitude of data sources, including in-situ ground-truth of burn severity by BAER team after fire containment.			

Additional observations:

Observation ID	Description
Ob.01	Kristina Fauss notes that taskable multi-sensor packages that can be relocated to targets of opportunities could be used to gather data.
Ob.02	Prescribed fires: these taskable multi-sensor packages could be set up before the fires are lit to take a snapshot of critical ecosystem variables before the event. And then redeploy those multi-sensor packages after the fire to re-assess the change in those ecosystem variables.
Ob.03	Regardless of whether these are taskable (mobile, redeployable) multi-sensor packages or not, there is a case to be made for measuring selected variables (e.g. soil moisture, plant evapotranspiration, etc) along certain environmental gradients that are hypothesized to affect fire behavior.

Before session close:
- **Capture 3 Takeaways & Shared insights**

  - We strongly encourage domain experts and knowledge representation experts to work together in joint sessions to derive a shared conceptualization of the problem domain that can eventually be translated into machine-readable representations to foster improved data and information interoperability.
  - There is a need to better integrate fire behavior model data, values-at-risk data, and sensor data that can be represented and visualized in a Common Operating Picture.
  - There is a need to better estimate burn severity by fusing data from various sources (in-situ, remote, model) to facilitate after-burn mitigation of possible cascading effects.

- **Closing circle**
  - Email notification of cluster events:
    - Sign up for emails at the [Agriculture and Climate Cluster's wiki page](#)
    - Sign up for emails at the [Semantic Harmonization Cluster's wiki page](#)

5 ways to stay involved with ESIP
- Join the conversations on our [ESIPFed Slack Channel](#) and say hello on #ag-climate and #semantic-harmonization.
- Keep up with the latest from in and around ESIP by signing up for the [ESIP Monday Update](#) or the mailing list of this group.
- Share your feedback, questions, and suggestions with our Twitter community [@esipfed](#) and [#esipfed.](#)
- Hop on an [ESIP Telecon](#) that interests you - no need to RSVP!
- At this meeting, check out the Research Showcase Poster and Demo Gallery.

Feedback
Please take a moment to share your thoughts on this session in Sched by going to the Sched session page linked at the top of this document.

Zoom chat in "plenary" session, before breakout

From Brian Wee to Everyone: 11:14 AM
https://app.sli.do/event/hhsqstfp/embed/polls/f3e50e3e-6b85-4b85-aeae-5bf6b9a3c155
From Ramapriyan to Everyone: 11:17 AM
Results of poll may be affected by self-selection to attend this session.
From Me to wteng: (Direct Message) 11:20 AM
we are about 9 mins behind
From wteng to Me: (Direct Message) 11:22 AM
We could shorten the Q&A by ~2 min.
From Garybc to Everyone: 11:31 AM
Note semantic harmonization of the data nd ML/AI support one another since ML, like people,
requires good data to work with..
From ruth.duerr3@gmail.com to Everyone: 11:31 AM
Can e get a copy of those slides - you went through them very quickly!!!
From Teddy Gelabert to Everyone: 11:31 AM
Yes, please, copy of the slides! ^^^
From Brian Wee to Everyone: 11:32 AM
yes! we will post the slides immediately after the session, probably sooner, in the next 20 mins
if possible... check back in the sched page for the link to all slides
From ScottyStrachan to Everyone: 11:35 AM
Great presentation Everett - that comprehensive picture seems more achievable than ever
before
From Everett Hinkley to Everyone: 11:35 AM
Thank you Scotty!
From Brian Wee to Everyone: 11:40 AM
if you look at the session notes, Everett's presentation has been hyperlinked to the bullet point
corresponding to his talk
i.e. google doc session notes
From Brian Wee to Everyone: 11:47 AM
Dave Zader's PPT has also been hyperlinked in the Google Doc session notes
From Melissa Cragin to Me: (Direct Message) 11:51 AM
Hi Brian, looks like you attached your slides, rather than Everett's (maybe)?
From Me to Melissa Cragin: (Direct Message) 11:51 AM
whoops... let me check.. thanks for pointing that out... and hi Melissa!
From David Neufeld to Everyone: 11:51 AM
Is OpenStreetMap a potential source for linear features?
From Brian Wee to Everyone: 11:52 AM
sorry everyone: I attached the wrong PDF to Everett's talk... back in a bit (thanks Melissa
Cragin!)
From Dave Jones dave@stormcenter.com to Everyone: 11:53 AM
Here is a video I posted for the poster session tonight about real-time data sharing in a
collaborative environment. This might be a good way to access disparate data and share them
in a collaborative common operating picture. https://youtu.be/b5E0N0P51IM
From Everett Hinkley to Everyone: 11:54 AM

Thanks Dave!

From Ben Galewsky NCSA to Everyone: 11:54 AM

Love that idea of fire pre-planning maptime!

http://maptime.io/lessons-resources/

From Qian Huang - ESIP Fellow to Me: (Direct Message) 11:54 AM

And the PDF to Dave's talk seems wrong either

From Susan Shingledecker - ESIP to Everyone: 11:54 AM

That may be my favorite quote so far - " I was tired of getting my #$% kicked by fire - we need better data in visual formats with mapping and geospatial tools." This work is SO vital!

From Me to Qian Huang - ESIP Fellow: (Direct Message) 11:56 AM

thanks! now fixed!

From Qian Huang - ESIP Fellow to Me: (Direct Message) 11:56 AM

Looks good

From Dave Jones dave@stormcenter.com to Everyone: 11:57 AM

+1 Susan

From Brian Wee to Everyone: 11:57 AM

Both Dave and Everett's slides are now hyperlinked to the notes... this time with the correct URLs! thanks Melissa Cragin and Qian Huang for pointing out my boo-boo

From JensenSun to Everyone: 11:57 AM

+1 Susan

From Kai Blumberg to Everyone: 12:08 PM

*correction were still finishing up that SWEET envoy mapping work because it's difficult and time consuming

From Brian Wee to Everyone: 12:12 PM

link to sli.do poll about what is important to you with regards to "values-at-risk" in the event of a wildfire (or other disasters):

https://app.sli.do/event/hhsqstfp/embed/polls/92a422bb-92c4-41a9-85f6-3dd597c3f7b1

From David Neufeld to Everyone: 12:13 PM

Perhaps add watershed to the options?

From ruth.duerr3@gmail.com to Everyone: 12:14 PM

I'd make that item 2 if you did

From Dave Zader to Everyone: 12:15 PM

Great point

From Kristina Fauss to Everyone: 12:15 PM

Should this be relating to us as an individual, or as we perceive our communities to rank these?

From ScottyStrachan to Everyone: 12:16 PM

"Natural resources" including water, timber, recreation, air quality, etc are of most concern to my community. Not represented in the poll.

From Kristina Fauss to Everyone: 12:18 PM

Viewshed is ranked highly here in Santa Barbara

Zoom chat for breakout group #1: Knowledge representation for wildfire planning and execution

From Kai Blumberg to Everyone: 12:24 PM

When ready will you share the link to the cmap diagram so we can help?

From Kai Blumberg to Everyone: 12:38 PM

Zader units

From Garybc to Everyone: 12:39 PM

Zader units are good..unless we are on a first name basis

From Kai Blumberg to Everyone: 12:40 PM

firebreaks: stream dry river bed, ridline

From brandon w to Everyone: 12:40 PM

if we use Zader polygons we could call them ZaPs

From Kai Blumberg to Everyone: 12:45 PM

13 standard rule fire categories use to get spread rate prediction

Perhaps soil types as well?

Organic soils deep organic soils with more moisture, vs mineral soils without moisture (better for fire breaks)

1 hour fules 10 hour fules unto 100,000 hours

From JensenSun to Everyone: 12:45 PM

fireworks

From Kai Blumberg to Everyone: 12:46 PM

1 hour fuel dries in an hour and becomes flammable again in an hour

Solar radiation

From Martha Apple to Everyone: 12:46 PM

Ignition source

From Kai Blumberg to Everyone: 01:04 PM

Locations of fire hydrants, streams exist

Creating polygons (smaller possible drivable surface) from road network data not yet automated

State highways, driveways

Materials used, e.g., repellent sprays

Spotting rollout

Fire causes transient campers and lightning

Downed power lines

Wind events causing downed power lines

Open areas without rocks

Snags partially burned tress or other hazards

Water source?

From Andrea Poersch to Everyone: 01:05 PM

thank you very much for the interesting, intensive and very impressive exchange

From Kai Blumberg to Everyone: 01:10 PM

Local values, farmer's grass is their livelihood

From Garybc to Everyone: 01:11 PM

Among the resources used to help planning are maps with various levels with info about values at risk etc, . Polygons are represented on these. as containers of these features. The model should include this fact.

Besides vulnerable populations there are other types of vulnerability to represent.

From Ramapriyan to Everyone: 01:18 PM

Very impressive work - Pier!!

From Dave Jones dave@stormcenter.com to Everyone: 01:19 PM

This is fantastic. I assume that you could build in 'cascading' impacts to a decision making process?

From Pier Luigi Buttigieg (Helmholtz Metadata Collaboration) to Everyone: 01:19 PM

Team effort - magic happens when domain experts and knowledge representation folks are locked in the same room

From Pier Luigi Buttigieg (Helmholtz Metadata Collaboration) to Everyone: 01:20 PM

@Dave - yes, we can use something called "causal algebra" to help map cascades. Usually, on the semantic layer, this is a common skeleton to add data and information products to in a knowledge graph or similar

From Kai Blumberg to Everyone: 01:20 PM

Thanks Dave perhaps we the sem harms cluster can reach out to you

To get some more out of your experience and finish this exercise

Harvest your knowledge and expertise

From Pier Luigi Buttigieg (Helmholtz Metadata Collaboration) to Everyone: 01:23 PM

Harvest and give back a KR resource - don't worry, we don't just harvest brains

I really like the common operating picture model - very good principle for distributed but interoperable digital tech development

From Dave Zader to Everyone: 01:28 PM

My Email is zaderd@gmail.com

From Dave Jones dave@stormcenter.com to Everyone: 01:30 PM

Disparate trusted data sources can drive decision making in a collaborative common operating environment. We are focusing on Operational Readiness Levels for data that can accelerate trust in data by non-technical experts.

..in the Disaster Lifecycle Cluster for ESIP

Great session everyone. Sorry I have a 1:30pm call. I will catch up with you Brian and Bill. Dave

Thanks for joining Everett!!

From Martha Apple to Everyone: 01:32 PM

Thanks everyone! What an excellent session!

From Pier Luigi Buttigieg (Helmholtz Metadata Collaboration) to Everyone: 01:32 PM

Thanks all!

From Daniel Fuka to Everyone: 01:32 PM

Thnks!

From Mark Schildhauer to Everyone: 01:32 PM

thanks! great session!

From Pier Luigi Buttigieg (Helmholtz Metadata Collaboration) to Everyone: 01:32 PM

Thanks Brian and Bill ! herding cats :)

From Chung-Lin Shie to Everyone: 01:32 PM

Thanks to all for all the "cool" talks and discussions!

Zoom chat for breakout group #2: Technology solutions for wildfire planning and execution

From Tim Bailey to Everyone: 12:33 PM
Hi everyone, my camera and microphone are acting up
This is similar to the phenocam project
From Kristina Fauss to Everyone: 12:35 PM
https://sonomacounty.ca.gov/CAO/Press-Releases/Sonoma-County-invests-in-artificial-intelligen
t-technology/
From ScottyStrachan to Everyone: 12:39 PM
Tim - that is one really good way to try to scale "standardized" contributions on distributed
networks
From Tim Bailey to Everyone: 12:40 PM
The notification issues are significant as well. What triggers should responders get pushed.
From ScottyStrachan to Everyone: 12:42 PM
Kristina - funny full-circle story: I met the Sonoma camera hosts from the pepperwood preserve
as part of ESIP! Hooked them up with our fire cam team and the rest is history!
From Kristina Fauss to Everyone: 12:43 PM
Awesome! I saw them present at the UC Wildfire Research Symposium
From Dave Jones dave@stormcenter.com to Everyone: 12:44 PM
Bootleg Fire