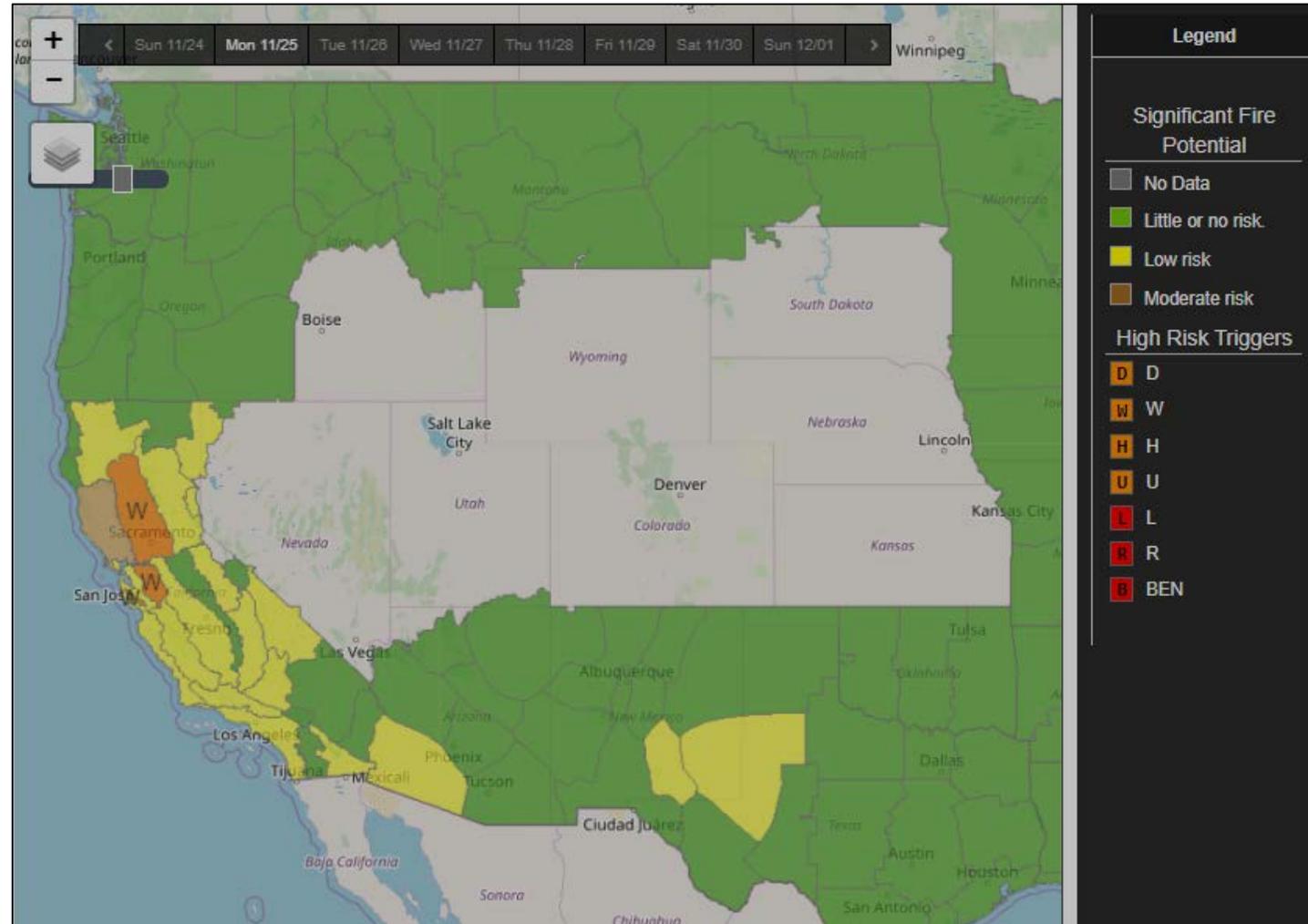# 7-Day National Fire Potential Outlook Project

12/4/2019 Update
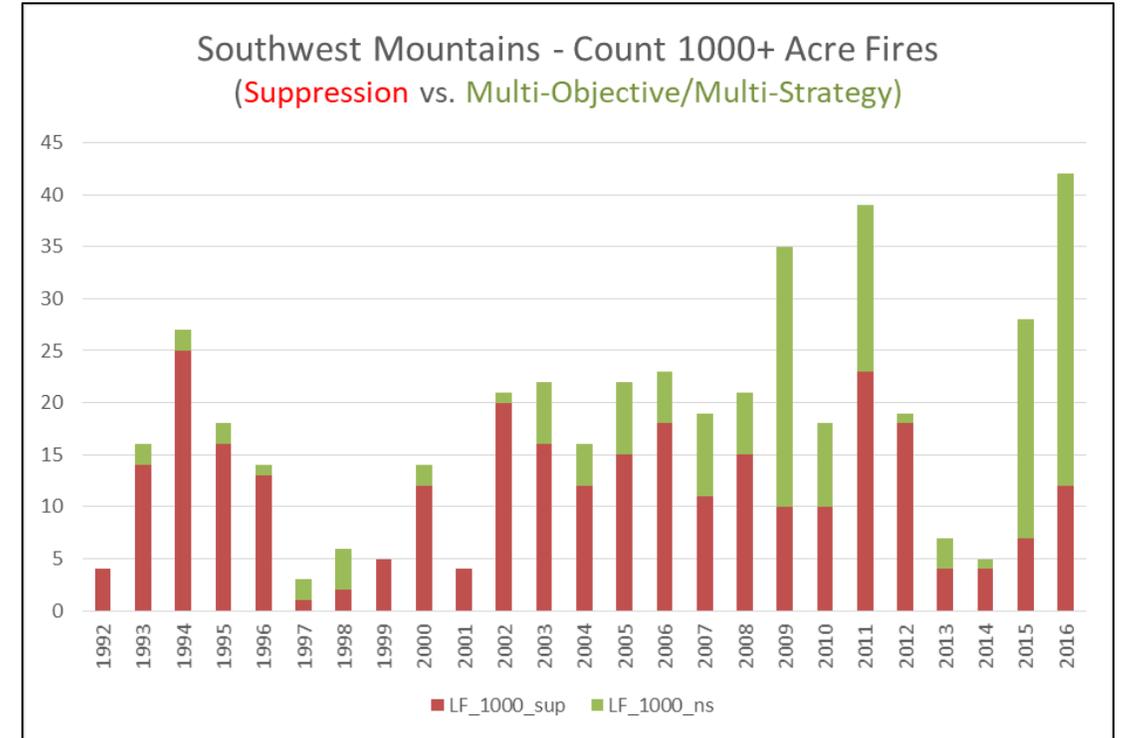
What do we know about the current 7-Day?

- When was the original product developed & how?

- What does it portray?

- How many different input data streams do we have?

- How is the product managed & up kept?

- Is it consistently available?

- How does it relate to the business of the National Coordination System?

Green = 1-3%, **Yellow = 5-7%**, **Brown = 12-15%** , **Orange/Red = 20%+**

What's changed since the 7-Day was developed?

- Fire management & its need for intelligence

- Advancements in science, data, & technology

  - Evolving science & application of fire potential & fire danger rating

  - Fire environment & fire business data abound

  - Spatial analysis & automation are routine

Southwest Mountains - Count 1000+ Acre Fires
(Suppression vs. Multi-Objective/Multi-Strategy)

■ LF_1000_sup   ■ LF_1000_ns

Article

Severe Fire Danger Index: A Forecastable Metric to Inform Firefighter and Community Wildfire Risk Management

CSIRO PUBLISHING

International Journal of Wildland Fire **2015**, 24, 900–910
http://dx.doi.org/10.1071/WF14152

Relationships between fire danger and the daily number and daily growth of active incidents burning in the northern Rocky Mountains, USA

US National Fire Danger Rating System (NFDRS2016)

(a) Count of New Fire Reports, #
(b) Eventual Area Burned, ac
(c) Active Fire Pixel Counts, #
(d) Summed FRP, MW
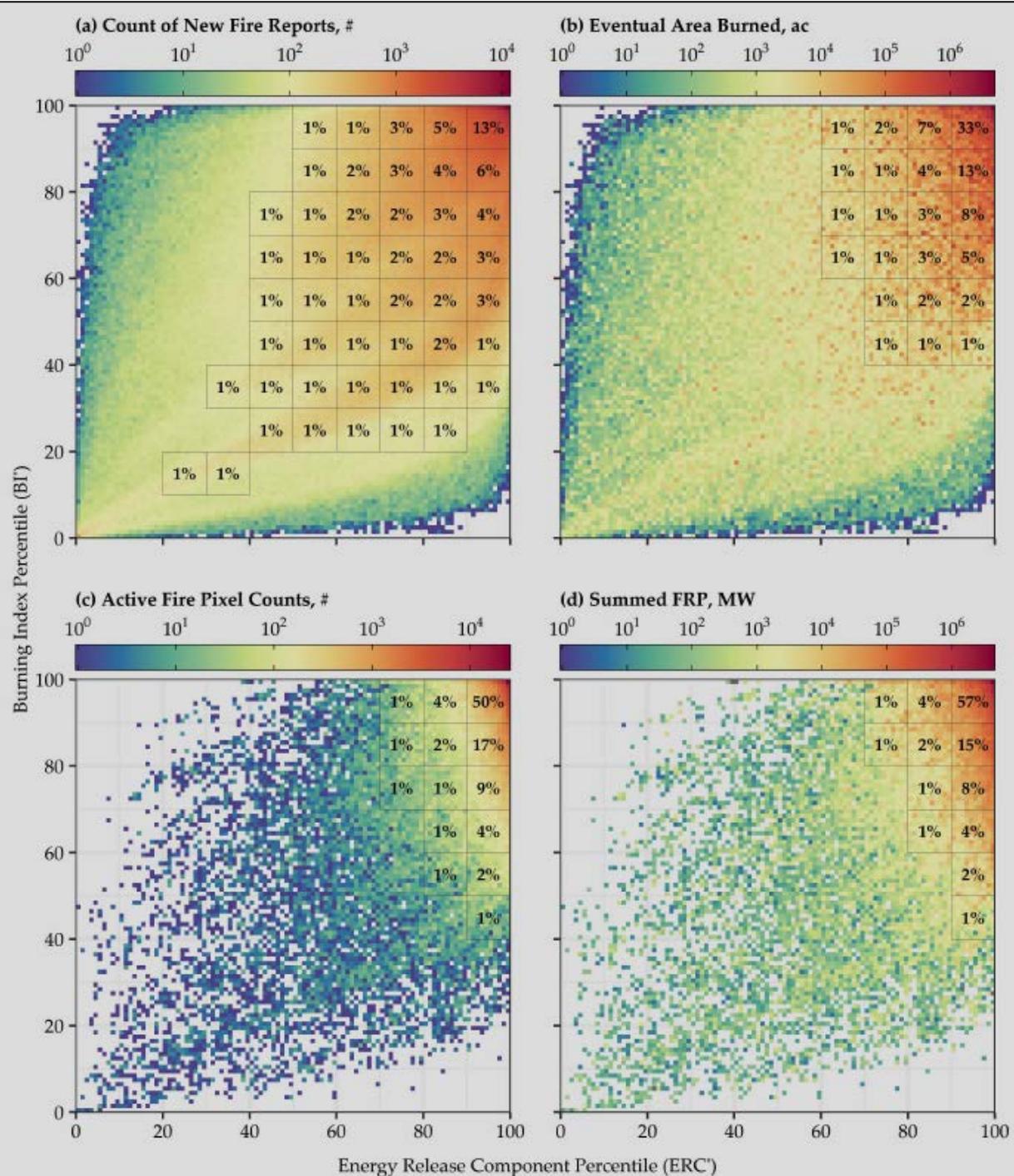
Advances in science, data, & technology...

- Testing combining ERC and BI (SFDI)
- High-resolution, spatial analysis
- 40-year gridded climatology
- "Traditional" fire occurrence data & MODIS detections
- Plenty to learn about & take advantage of!
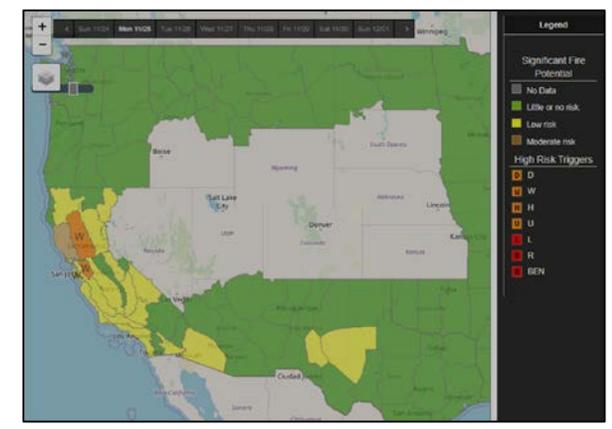
7-Day Product: A case for change

- Current product is no longer the state of the science & it's become non-standard.

- Our original plan for the 7-Day to be managed actively & consistently in-house isn't sustainable.

- Knowledge, resources & capability are available to us by way of evolved science, data and technology.

- A "refreshed" product using sound & consistent methodology will be easier to manage & <u>improve</u>.

Shifting 7-Day project emphasis...

- Ongoing 7-Day FPO project a multi-year effort to update and modernize the 7-Day Significant Fire Potential product.

- PSOG decision made to pursue a shorter-term, incremental approach.

This revised approach is being referred to as the 7-Day NTS (Near-term Solution)

7-Day NTS principles…

- Project support from RD&A, based on following the "Path Forward".

- Customer-driven, science-based approach.

- A perpetual learning loop.

- Focus on developing decision support to deliver actionable intelligence.

Wildland Fire Decision Support Product/Service Development Workflow

Customer Engagement (Needs Assessment)
- Who will be making decisions?
- What kinds of decisions will be made?
- Over what spatial and temporal scales are decisions being made?
- What is being used to support these kinds of decisions now?
- Are there existing requirements or processes that guide any of the above?
- Are there identifiable strengths and weaknesses with the current means used to support decisions?
- What kind of new or improved decision support capability is desired, and why?

Product/Service Prototype
- Utilizing sound scientific processes & information gathered from customer engagement, develop an appropriate decision support product/service prototype for evaluation.
- Conduct an opertional test of this prototype, providing opportunity for structured customer and subject matter expert feedback.
- Integrate customer & SME feedback into prototype optimization.
- Publish the product/service methodology and prototype evaluation process in a peer-reviewed journal.

Scientific Peer Review
- Conduct a scientific peer review of the product/service development means & methods, as well as the prototype outcome.
- Seek confirmation of sound scientific process, use of best available science and overall scientific integrity.
- Adapt product/service development as necessary, based on feedback

Product/Service Implemention
- Implement decision support product/service operationally.
- Monitor (verify):
  - Product/service performance
  - Customer application effectiveness
- Periodically revisit this **entire process** to stay apace of changing customer decision support needs & the best available science.

7-Day National Fire Potential Outlook Product NTS

- **Business Need:**
  - A consistent, scientifically sound, automated national fire potential product that is available year round to inform the business of the National Coordination System on behalf of Predictive Services.

- **Project Goal:**
  - Develop, test and deliver a methodology for meeting the business need (in roughly a year and for $100k) – **CONUS only initially**

- **Project Features:**
  - <u>Research Track</u> – Analysis and development of methodology.
  - <u>Operational "Bridge" Track</u> – Prototype products for evaluation, an archive methodology, and data and systems requirements for an operational platform.
  - Fire activity used as a basis for "where and when resources are needed".
  - Uses defined PSAs.
  - Operational evaluation, validation & feedback.
  - Peer reviewed publication.

7-Day National Fire Potential Outlook Product NTS Development Flow
Research Track

Assemble: → **Define:** → **Analyze:** → **Develop:**

Base Data:
- PSA shapefiles
- Fire occurrence
- Gridded NFDRS Climatology
- Select gridded wx

PSA Fire Business:
Summarize historical fire occurrence by PSA.
- FPA FOD for ignitions
- VIIRS/MODIS for active burning/fire growth

PSA Fire Environment:
Summarize historical gridded NFDRS and meteorological data by PSA

PSA Fire Business Analysis:
Develop statistical relationships between historical fire business and environmental conditions.
- NFDRS parameters only
- Best NFDRS predictors and select meteorological parameters (i.e. lightning, stability, wind, etc.)

PSA-level Equations Depicting Risk/Probability for:
- Ignition days
- Active burning/growth days
- Ignition and/or active burning/growth days

PSA Equations + Operational Weather Forecasts =
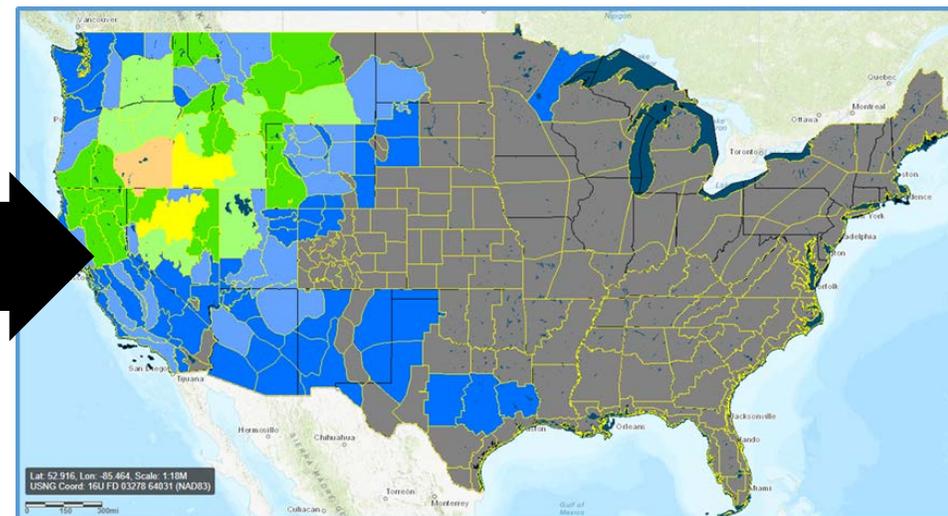
7-Day National Fire Potential Outlook Product NTS Development Flow
Operational "Bridge" Track

Identify:

Prototype & Evaluate:

Develop:

Meteorological Datasets:
Viable, operational forecast data available daily on a national scale to "feed" the fire potential model.

Fire Potential Products:
Prototype PSA-based national maps of predicted risk/probability for:
- Ignition days
- Active burning/growth days
- Ignition and/or active burning/growth days

Operational System Requirements:
Guidance/specifications for an operational system to host, produce, archive & validate the new product(s)

Validation & Archive:
- Create validation product that overlays metrics of NCS fire business on products
- Establish process for archiving all products (and data?)

Work Breakdown Structure – Nearing Completion

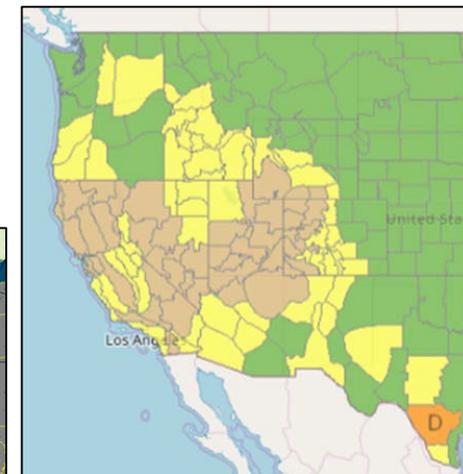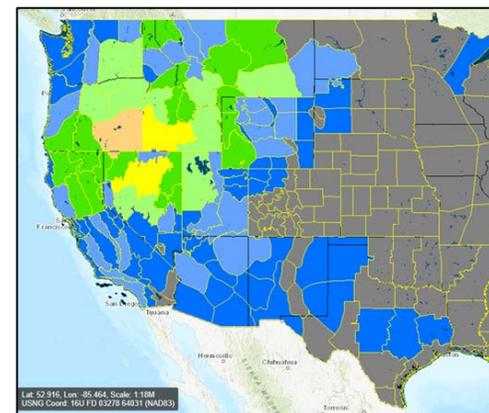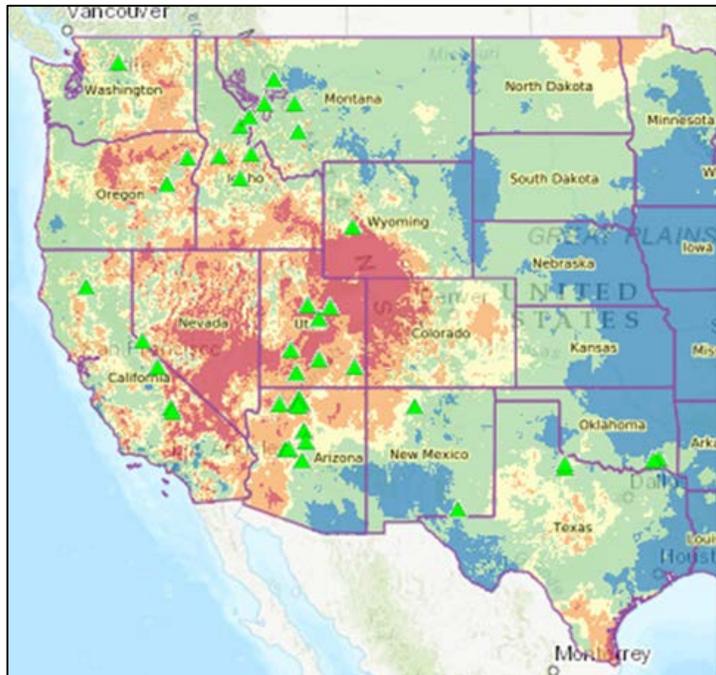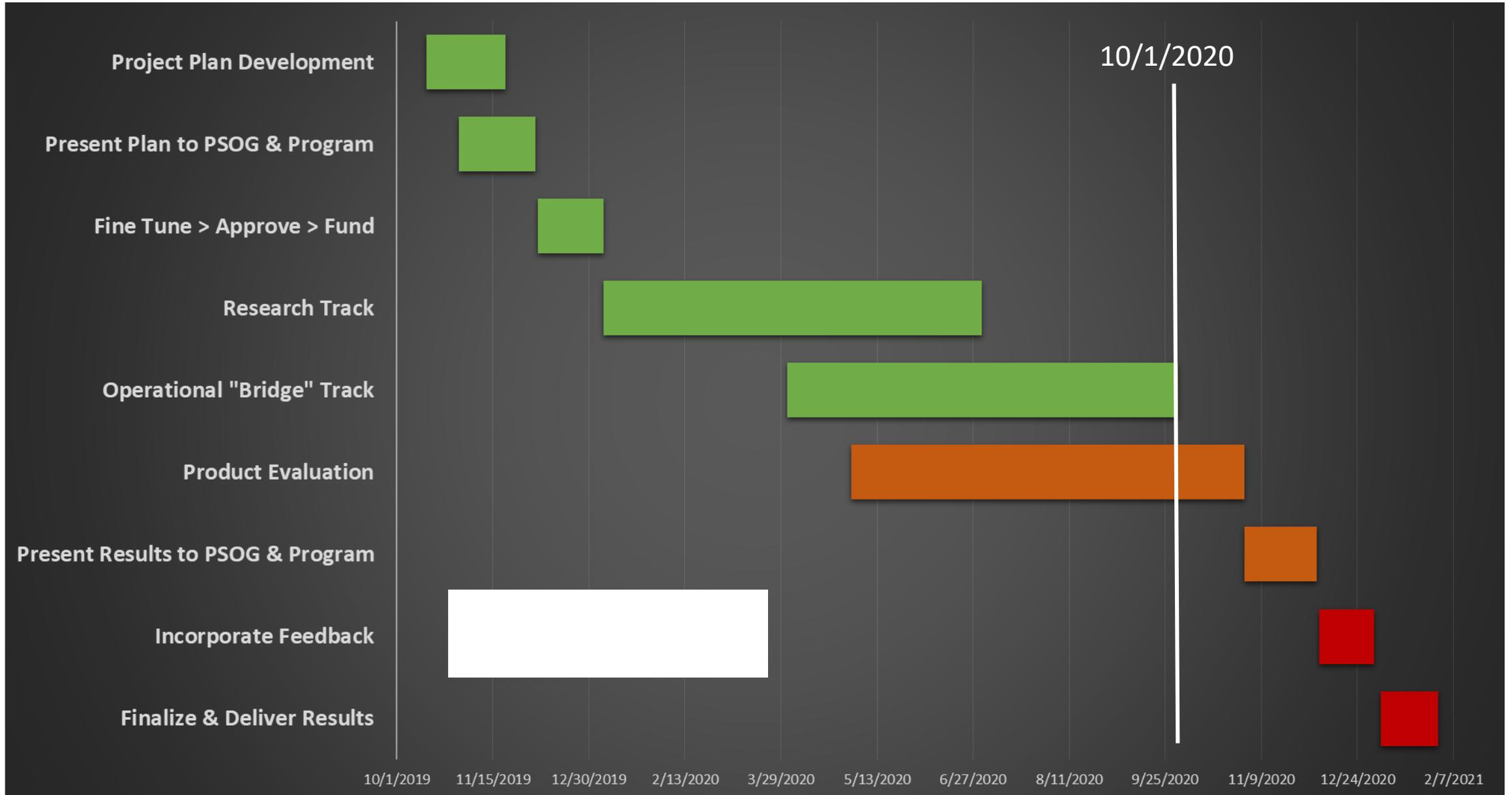| Task No.	Task	Description	Task Owner	Dependency	Resources Needed	Task Status	Cost	Start Date	Estimated Completion	Finish Date	Notes
1	**Planning Phase**										
1.1	Develop project plan		C.Maxwell	Consultation with research assets/SMEs	RMRS researcher(s)	In Progress	N/A	10/15/2019	37 days	11/21/2019	
1.2	Present plan for feedback		C.Maxwell	Draft project plan & presentation	Stakeholder meeting agenda time	Assigned	N/A	10/30/2019	36 days	12/5/2019	Stakeholders include PSOG, FMB, PS
1.3	Finalize plan		C.Maxwell	Stakeholder feedback & revised project plan	Consult with Matt Jolly & PSOG	Unassigned	N/A	12/6/2019	31 days	1/6/2020	
1.4	Fund Project		PSOG	Approved project plan & funding source	RDA/Tim Sexton	Unassigned	N/A	1/6/2020	5 days	1/10/2020	$100k already offered for project by RDA
2	**Research Track**										
2.1	Assemble base data		RMRS	Available spatial data representing PSAs and historical fire occurrence/activity, fire danger & weather/climate for the CONUS	PS geospatial portal, FPA FOD, VIIRS/MODIS, RMRS gridded NFDRS climatology, other spatial weather/climate data resources	Unassigned	$5,000	1/6/2020	30 days	2/7/2020	
2.2	Define PSA fire business & fire environment		RMRS	Task 2.1 completed; capability to spatially analyze/summarize fire business & fire environment conditions by PSA	RMRS researcher(s)	Unassigned	$10,000	2/10/2020	31 days	3/13/2020	Need to define PSA fire business paradigm for ignition days, active/growth days, and composite…as well as a process for expressing daily PSA fire environment conditions as singular values (i.e. spatial summarization process)
2.3	Conduct PSA Fire Business Analysis		RMRS	Task 2.2 completed for at least one Geographic Area; capability to conduct a robust statistical analysis to determine relationship between the fire environment and fire business	RMRS researcher(s)	Unassigned	$20,000	3/16/2020	107	7/1/2020	Test NFDRS predictors first, then combine with select meteorological elements to include lightning occurrence, stability, windy/dry index, VPD, etc.
2.4	Develop PSA fire business equations		RMRS	Task 2.3 completed for at least one Geographic Area; capability to express the probability of daily PSA fire business as a function of the best environmental predictors	RMRS researcher(s)	Unassigned	$15,000	5/1/2020	61	7/1/2020	
3	**Operational "Bridge" Track**										
3.1	Identify suitable forecast meteorological datasets		RMRS	Task 2.4 completed for at least two Geographic Areas; capability to identify national scale, operational meteorological forecast datasets to populate inputs for PSA fire business equations	RMRS researcher(s), NOAA/NWS, RDA/RMC, PS Mets	Unassigned	$5,000				NDFD & NDGD are two known options, as well as some work done by the RMC. Might need to get creative to populate 3D meteorological fields (stability, lightning, etc.)
3.2	Prototype fire potential products for evaluation		RMRS	Task 3.1 complete and Task 2.4 completed for at least two Geographic Areas; a system capable of producing and displaying products by applying results of Task 3.1 to results of Task 2.4	RMRS researchers, WFAS, RSAC	Unassigned	$15,000				Prototype products would be PSA-based probabilities of fire business, per Task 2.2…and possibly gridded displays of contributing elements (i.e. SFDI, lightning probability, etc.)
3.3	Prototype a fire business validation product		RMRS	Task 3.2 completed for at least two Geographic Areas; objective metrics of fire business impacts on the National Coordination System	Reliable data sources representing daily fire business impact on NCS, RMRS researchers, PS program, National Coordination System, FMB	Unassigned	$12,500				Data representing fire business impact on NCS could include fire activity, acres, cost, personnel assigned, resources assigned, fire growth/behavior, etc.
3.4	Develop capability for archiving products & data		RMRS	Tasks 3.2 & 3.3 completed for at least two Geographic Areas; subject matter expertise on data/product archival and possibly records management	RMRS, IT/Tech & records management SME's	Unassigned	$7,500				Check on any records management requirements
3.5	Develop operational system requirements for creating, hosting, and archiving products		RMRS	Prior tasks completed for at least four Geographic Areas in the CONUS;	RMRS, IT/Tech SME's, WFIT	Unassigned	$5,000	9/15/2020		10/1/2020	Potential connection to FEMS inititative being worked through FENC
4	**Evaluation Phase**										
4.1	Customer/SME evaluation of fire potential products		PSOG	Task 3.2 completed for at least one Geographic Area; guidelines for evaluation & feedback	PS, PSOG, FMB, NCS personnel	Unassigned	$0				Evaluation can begin as soon as products are available
4.2	Customer/SME evaluation of fire business validation products		PSOG	Task 3.3 completed for at least one Geographic Area; guidelines for evaluation & feedback	PS, PSOG, FMB, NCS personnel	Unassigned	$0				Evaluation can begin as soon as products are available
				Tasks 3.2 & 3.3 completed for all or most Geographic							

Deliverables

- Publication on process and outcome to be submitted for peer review
- Logic for new prediction system, including:
  - <u>Datasets, analyses and methods</u> used to develop datasets, predictive equations and operational products/data.
  - <u>Viable meteorological datasets</u> that can be used as input (plus processes)
  - <u>Archive and validation processes</u> (including any datasets used to represent fire business impacting the NCS)
  - <u>Requirements/guidelines for an operational system</u> to host, produce, archive and validate the new product(s)

A few last things…

- FY2021 project funding in the works to:

  - Address any remaining work from FY2020

  - Extend product capability to include Alaska, and potentially include the Canadian Forest Fire Danger Rating System (CFFDRS) <u>nationwide</u>.

- Charting a course to move deliverables towards a sustainable operational system.

New product implementation…

- **There are no present plans for decommissioning or changing the current operational product.**

- Ideas:
  - A valid, automated "off-season" option?
  - A consistent, national scale perspective that is always available?
  - An eventual shift to a new way of doing business, driven by customer needs and product evaluation?

Role of program personnel...

- **Project**:
  - Assist with development, evaluation and improvement.
  - Ask questions, challenge assumptions.

- **Eventual Operational Outcome**:
  - Less button pushing
  - More communication and interpretation role
  - As SME's with knowledge of the process & products, how might we best inform decisions?

CONCLUSION

12/4/2019 Update