



**Hawaiian
Electric**

Operational Strategies and PSPS Enhancements Working Group Meeting

August 21, 2024

Agenda

- Recap of last meeting
- Operational strategies and PSPS Enhancements
 - Group discussion
- Presentation by National Weather Service
- Q&A
- Next Steps





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Recap of Last Meeting



Recap of Last Working Group Meeting

Purpose

- Review and seek feedback on mitigation strategies and prioritization considerations.

Summary

- Reviewed wildfire mitigation process
- Reviewed types of ignitions risks on the grid
- Discussed types of mitigations under consideration to reduce ignition risks, such as, undergrounding, covered conductor, pole replacements
- Mitigation prioritization will consider risk reduction, feasibility, and cost effectiveness
- Sought feedback on qualitative and quantitative factors to consider in prioritization

WG Webpage - Meeting
Materials and Notes Available:

<https://www.hawaiianelectric.com/safety-and-outages/wildfire-safety/wildfire-safety-working-group-documents>

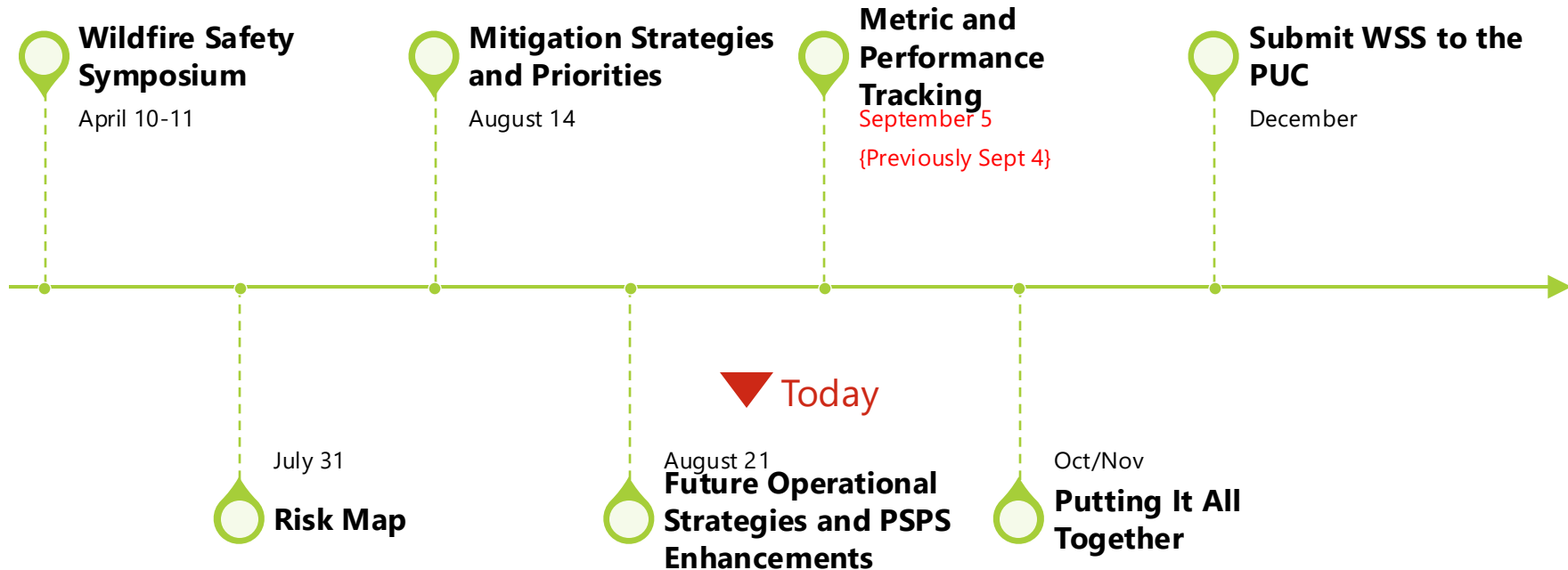


Reminders

- Provide feedback on mitigation and prioritization options from the last meeting
- Email marc.asano@hawaiianelectric.com if you would like to participate in the deep dive of the risk model



Proposed Timeline for WFS WG



Today's Objectives



Review and solicit feedback on operational strategies and mitigation plans



Seek feedback on strategies, challenges, opportunities and additional considerations





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Operational Strategies and PSPS Enhancements



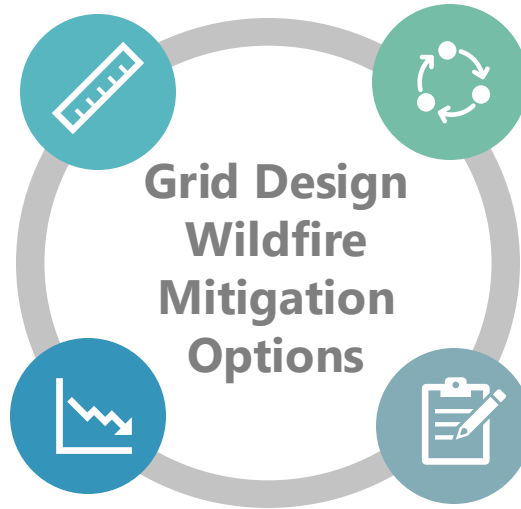
Overview of Utility Wildfire Mitigations

Mitigation Measures

Mitigations are intended to directly address ignition drivers through grid hardening and operational improvements.

Consequence Based Risk Models

Scope and implementation of mitigations are prioritized starting with areas that are estimated to have the highest risks based on fire spread modeling.



Operational Strategies

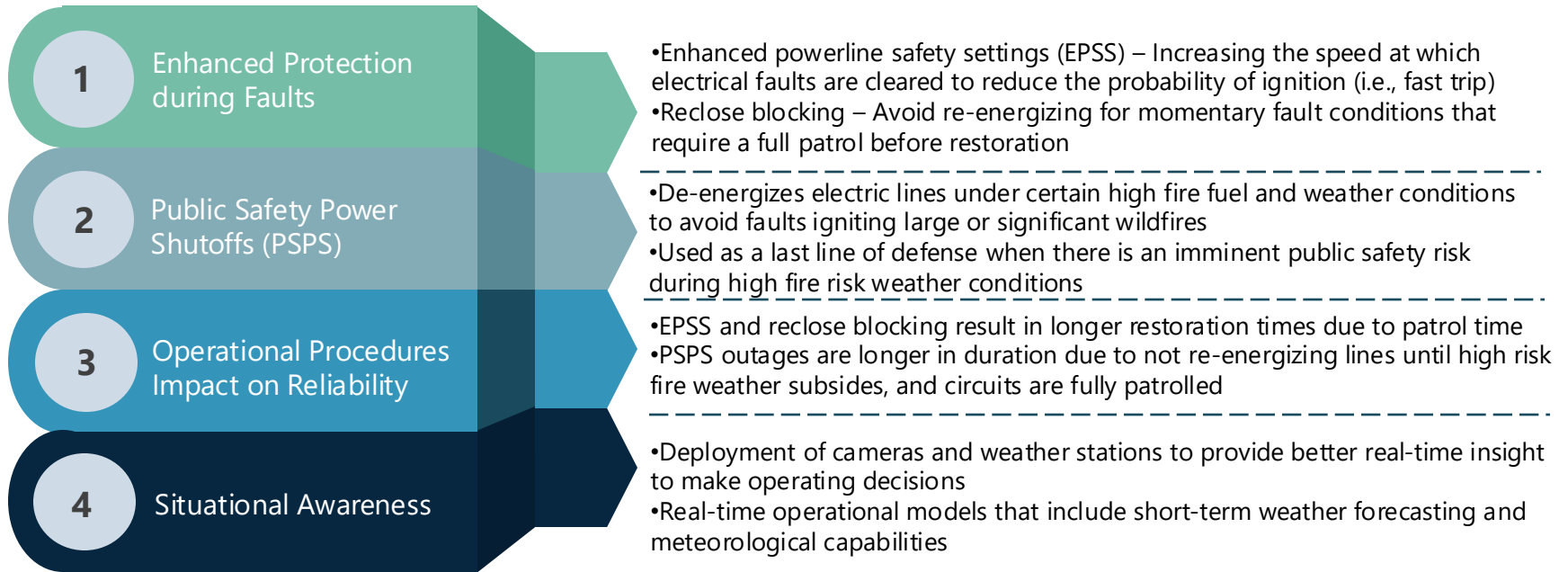
Operational enhancements including fast tripping and PSPS will be a significant tool until longer term mitigations are deployed.

Situational Awareness

Continuously monitoring and understanding fire behavior and environment to make informed decisions that ensure the safety of personnel and resources.



Operational Strategies and Situational Awareness

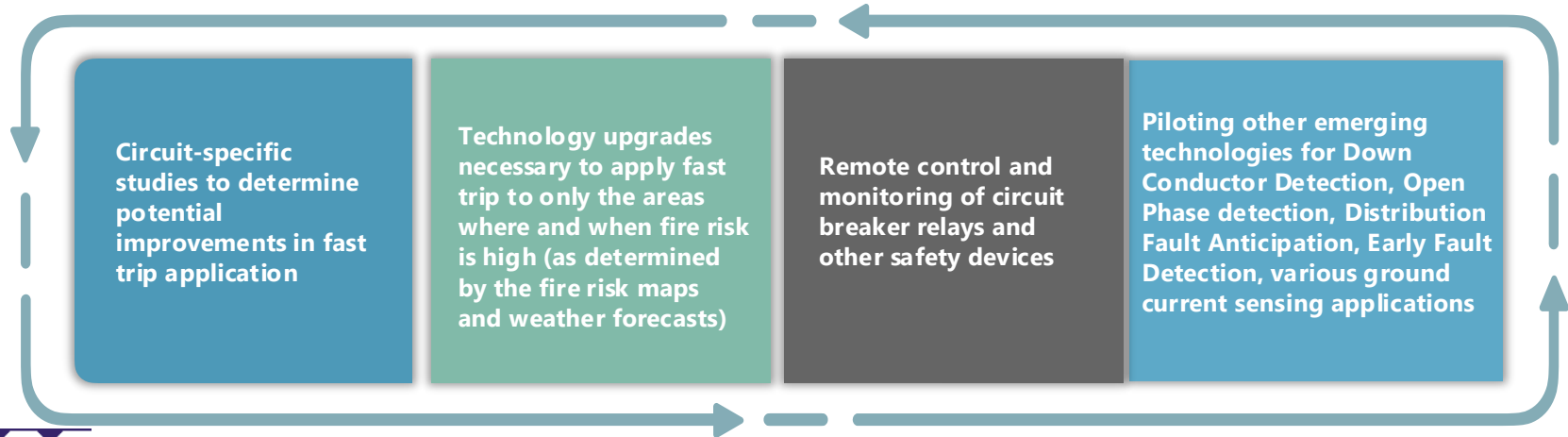


Enhanced Protection During Grid Disturbances

Protection evolving from protecting utility assets and public safety to focusing on wildfire risks. Additional considerations to optimize settings are reliability and restoration, complementing reliability strategies, and on-going changes to the grid.

- Current state:
 - Implemented Fast Trip phase and ground overcurrent reaches with a minimal delay (near instantaneous when a disturbance is detected).
 - Remotely controllable reclosers have been installed to sectionalize PSPS areas from non-PSPS areas of circuits
- Near-Term deployments:
 - In PSPS areas - Install fire safe fuses; re-evaluation of fuse sizing on feeder laterals and sub-laterals
 - Remote toggle of Fast Trip feeder settings


Potential Future Enhancements Under Consideration:



PSPS – Short-term Capabilities for 2024




The PSPS program for 2024 has been developed and implemented as of July 1st



PSPS outages will likely occur on specific circuits identified as highest risk when the following thresholds are met

- Indication of high fire weather threat conditions from the NWS or other sources that include red flag warnings from the NWS and associated wind advisories, or high wind warnings will trigger a PSPS event
- Weather stations are being deployed to provide near real time local weather and wind speeds that will support decision-making



The incident management teams have been trained to monitor conditions and facilitate efficient decision-making on where lines will be de-energized

- Multiple workshops including stakeholders across Maui, Oahu, and Hawai'i have been conducted in preparation for fire season
- Additional spotters have been trained in preparation for PSPS







Segmentation

- Where possible, equipment has been added to reduce the scope of PSPS by better isolating the fire risk areas from populated areas



What happens before, during and after Public Safety Power Shutoff

	PSPS Alert	Happening	Restoration begins	Restoration complete
WHEN:	<p>24–48 hours before a possible PSPS</p> 	<p>During a PSPS</p> 	<p>When it's safe</p> 	<p>PSPS is over</p> 
WHAT:	<p>Weather data, including statements from the National Weather Service, indicate conditions for heightened wildfire risk, and we are considering a PSPS. We'll do our best to provide advance notice, but if conditions are suddenly hazardous we may have to shut off your power with little or no notice. Activate your emergency plan, keep your home survival kit handy and pay attention to notifications from Hawaiian Electric and its emergency partners.</p>	<p>Power is shut off only in high wildfire risk areas for the safety of the community. We'll do everything we can to provide regular updates across multiple media platforms during the event.</p>	<p>Once the fire weather threat has ended, crews will begin patrolling, looking for downed lines and other hazardous conditions. Crews will restore power once it's safe, which may take hours or even days depending on the location and extent of damage.</p>	<p>The immediate threat has passed and power has been restored. But we'll continue to monitor conditions so we can keep our customers and communities safe.</p>
HOW YOU MAY HEAR FROM US:	<p>Email, Text, Hawaiian Electric Mobile App, Public Safety Notification, Social Media, Hawaiian Electric Website, News Media (TV, radio, websites)</p>			



Inputs and Criteria for Considering a PSPS

- Fire weather data (NWS Red Flag Warning, Fire Weather Watch, High Wind Warning with low humidity, field observations and data) triggers Hawaiian Electric Incident Management Team to stand up to evaluate conditions to determine whether to call a PSPS
- **3 primary criteria for declaring PSPS (*keeping in mind that every situation is unique*)**

Persistent drought conditions

Wind gusts 45 mph and higher

Relative humidity below 45%

Important to know

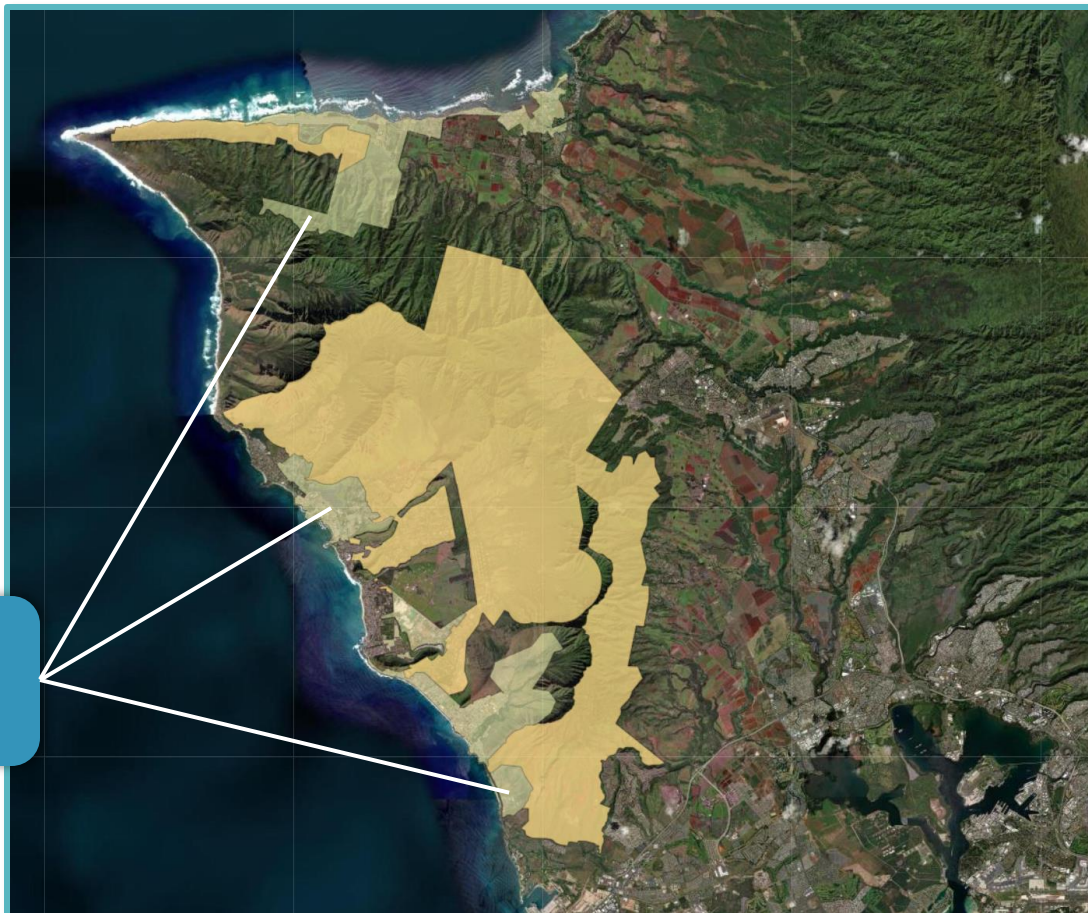
- ◆ NWS Red Flag Warning DOES NOT automatically trigger PSPS
- ◆ Red Flag Warnings have been issued in only 4 of the past 10 years
- ◆ Wind gusts above 45 mph are rare in most areas in summer months



Reducing PSPS Impacts

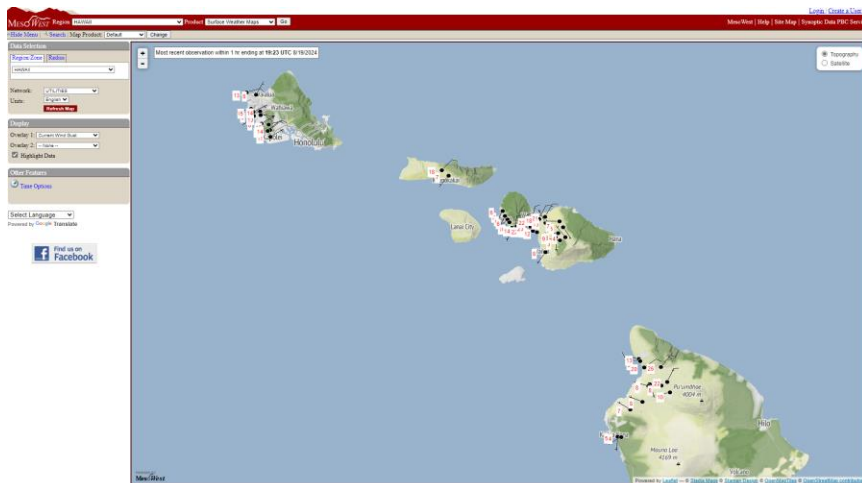
Through segmentation of circuits, there are certain situations where adding a reclosing device can reduce number of customers affected by a PSPS de-energization

Outage area avoided with segmentation (lighter shade)



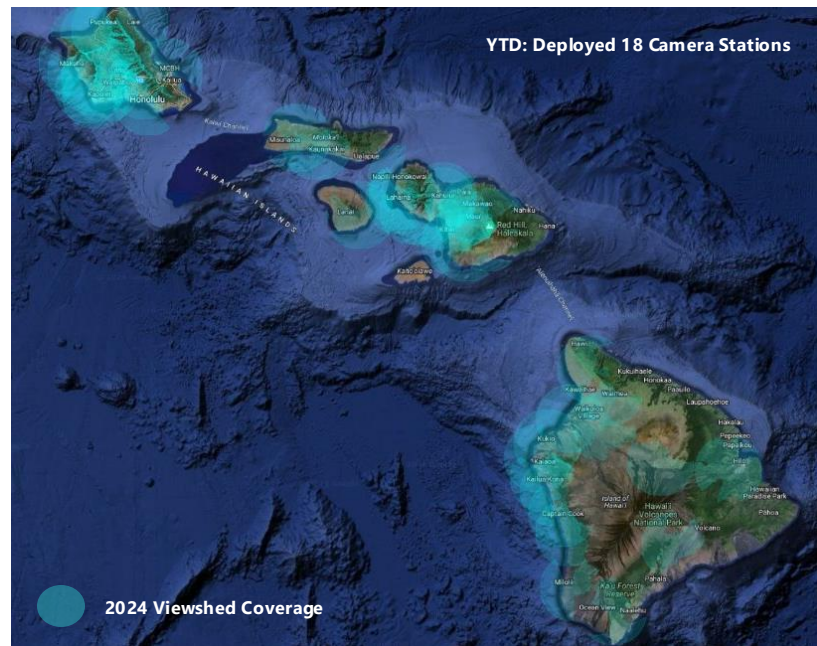
2024 Situational Awareness

52 PSPS Weather Stations

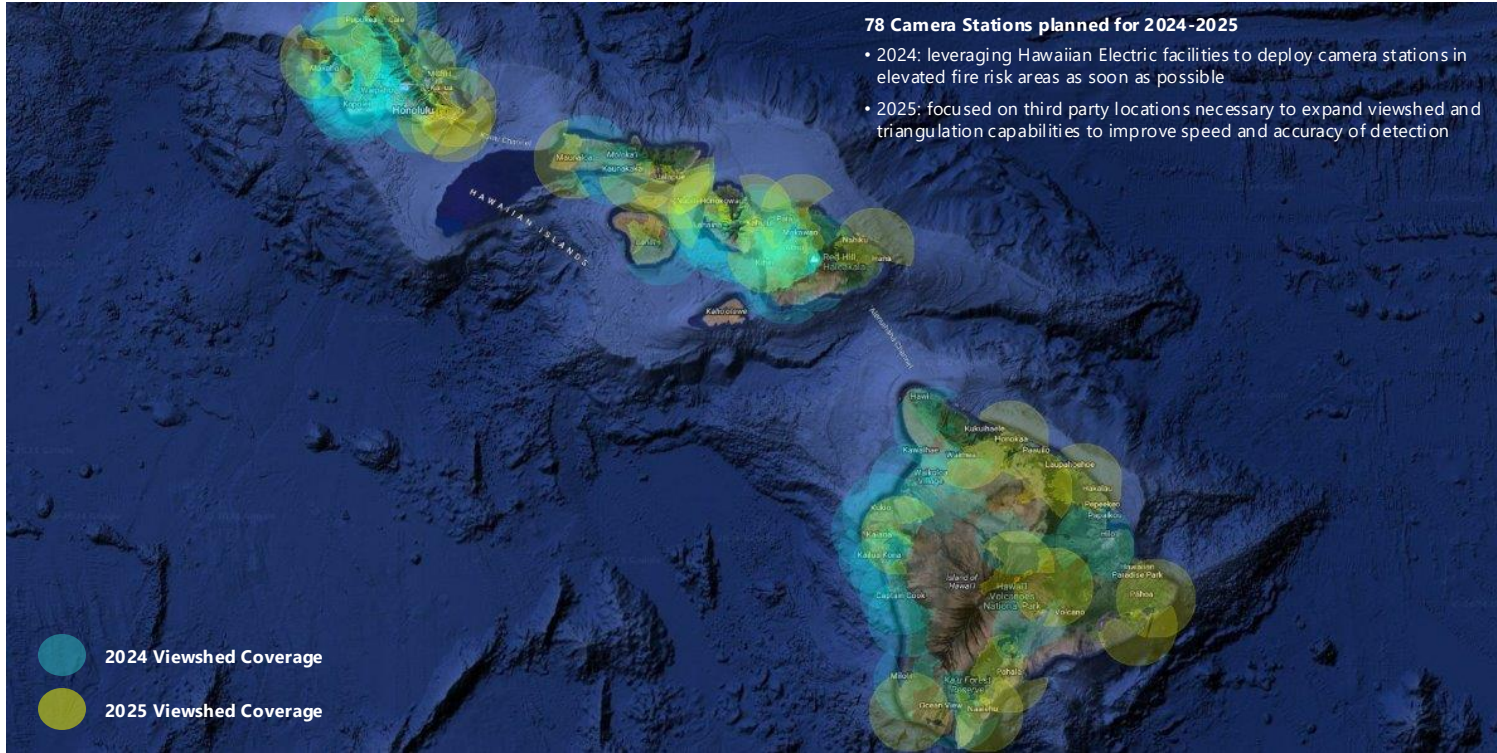


- Weather stations provide wind speed, wind direction, relative humidity, and temperature data every 10 minutes.
- Locations for weather stations are specific to PSPS risk areas.

40+ Video Camera Stations w/AI



2025 Video Camera Stations w/AI





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National Weather Service Presentation



NWS Honolulu Fire Weather Program

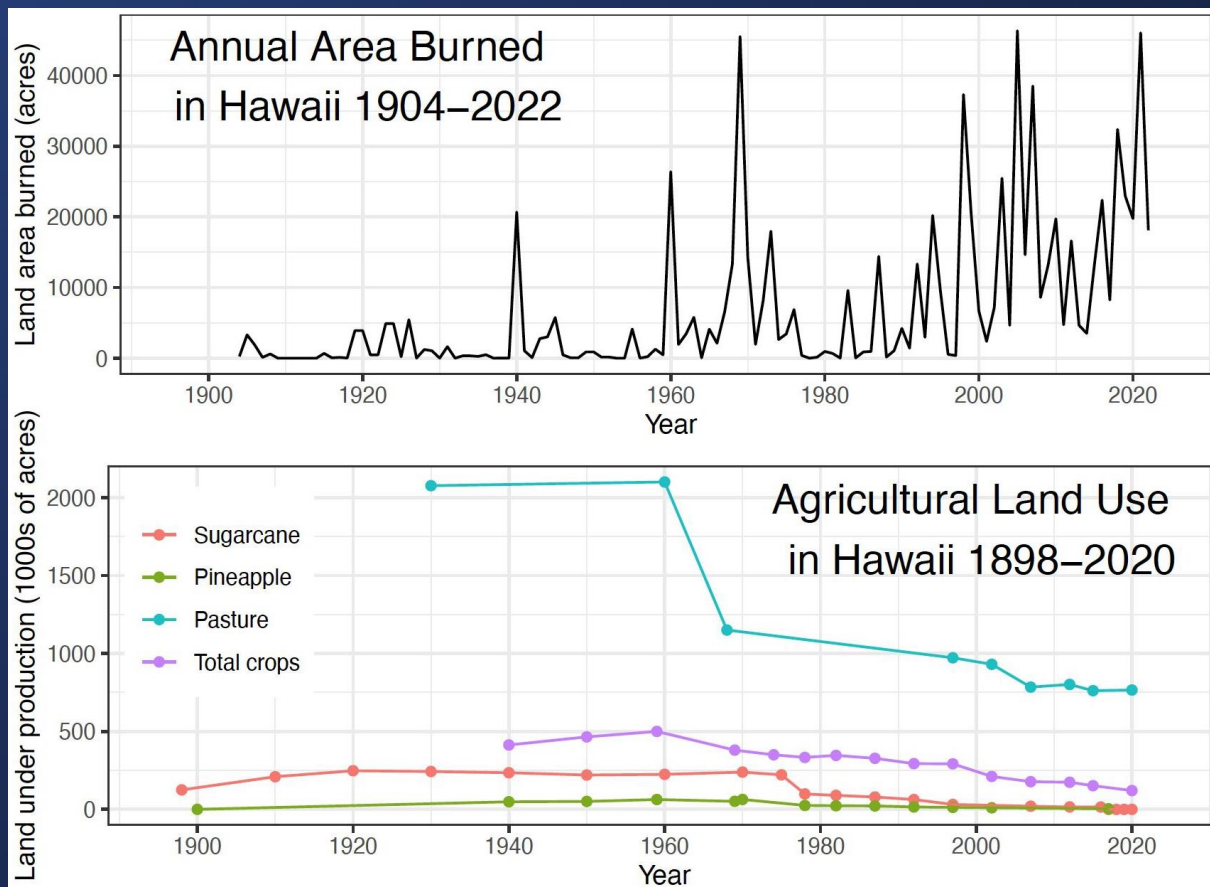
Photo courtesy Civil Air Patrol



Derek Wroe
National Weather Service
August 21, 2024



Wildfire in Hawaii



Fourfold increase in large fires coincides with dramatic declines in agriculture (Gollin and Trauernicht, 2018; Trauernicht, 2015)



Early Fire Weather in Hawaii

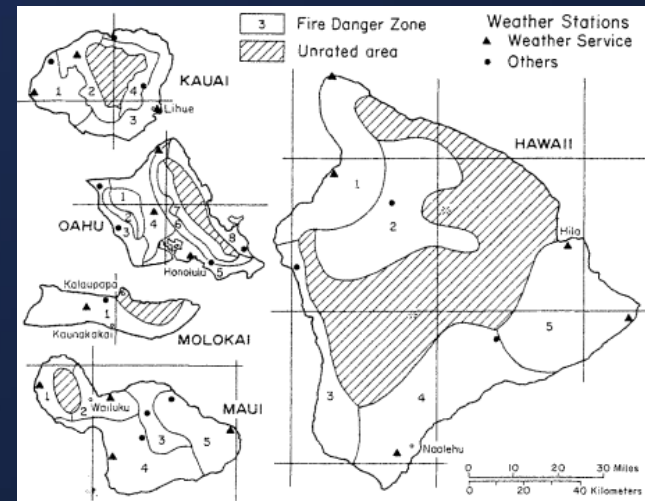
Burgan et al (1974) indicated a significant fire problem in Hawaii

The Hawaii Fire Danger Rating System (1974) (HFDRS 1974) was created

A Fire Danger Rating System for Hawaii

ROBERT E. BURGAN, FRANCIS M. FUJIOKA,
and GEORGE H. HIRATA

Extremes in rainfall on the Hawaiian Islands make it difficult to judge forest fire danger conditions. The use of an automatic data collection and computer processing system helps to monitor the problem.





Early Fire Weather in Hawaii

HFDRS 1974 involved sending observations to the National Weather Service (NWS) in Honolulu to create various fire danger indices

HFDRS 1974 fell into disuse after a few years due to difficulty in maintenance

FOR HAWAII CIVIL DEFENSE
HAWAII FIRE DANGER INDEXES FOR 00Z 29 JAN 74

STATION	T	RH	FF	PPP	FFM	IC	SC	ERC	OI	BI	FLI
KOKEE (161)	57	93	2	0	23.4	0	1	0	0	0	0
BARK SANDS (162)	78	57	6	.04	8.2	37	7	9	37	2	1
LIHUE (165)	78	65	8	.31	31.0	0	0	0	0	0	0
WAIALEE (169)	77	69	4	0	9.9	28	3	8	28	1	0
WHEELER (170)	78	54	8	.07	7.8	39	7	10	39	3	1
HONOLULU (182)	75	64	8	0	31.0	0	0	0	0	0	0

FOR HAWAII CIVIL DEFENSE
FORECAST FOR HAWAII FIRE DANGER INDEXES
(EFFECTIVE 24 HOURS FROM 00Z 29 JAN 74)

STATION	T	RH	FF	PPP	FFM	IC	SC	ERC	OI	BI	FLI
KOKEE (161)	60	82	5	0	11.5	19	5	7	19	2	0
LIHUE (165)	78	65	10	0	9.2	31	9	9	31	3	1
WAIALEE (169)	77	73	10	0	10.2	26	8	8	26	2	1
HONOLULU (182)	77	65	10	0	9.2	31	11	9	31	3	1
MOLOKAI AP (186)	78	69	10	0	12.8	14	7	6	14	2	0

Figure 3. Printouts of current and predicted fire danger indexes list dry bulb temperature (T), relative humidity (RH), wind speed (FF), 24-hour rainfall amount (PPP), fine fuel moisture (FFM), ignition component (IC), spread component (SC), energy release component (ERC), fire occurrence index (OI), burning index (BI) and fire load index (FLI).

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ROBERT E. BURGAN, FRANCIS M. FUJIOKA, and GEORGE H. HIRATA

Extremes in rainfall on the Hawaiian Islands make it difficult to judge forest fire danger conditions. The use of an automatic data collection and computer processing system helps to monitor the problem.



Development of Current Red Flag System

By mid 2000s NWS Honolulu was tasked to create a Red Flag Warning program

The slide background features a dark blue sky with a lightning bolt and a tower structure. The NOAA and National Weather Service logos are positioned in the top left and right corners respectively.

Red Flag Program

- Purpose:
 1. A combination of dry fuels and weather conditions supports extreme fire danger and/or extreme fire behavior.
 2. Alert land managers for the potential of widespread ignitions or control problems with existing fires, both of which could pose threat to life and property.
- NWS cannot keep Red Flag event confidential

Development of Current Red Flag System

Dolling et al (2005) found a strong statistical relationship between KBDI and fire activity, both in the number of fires and total acres burned

Dolling et al (2005) found that the driest leeward stations on each island can serve as reference stations to diagnose fire activity

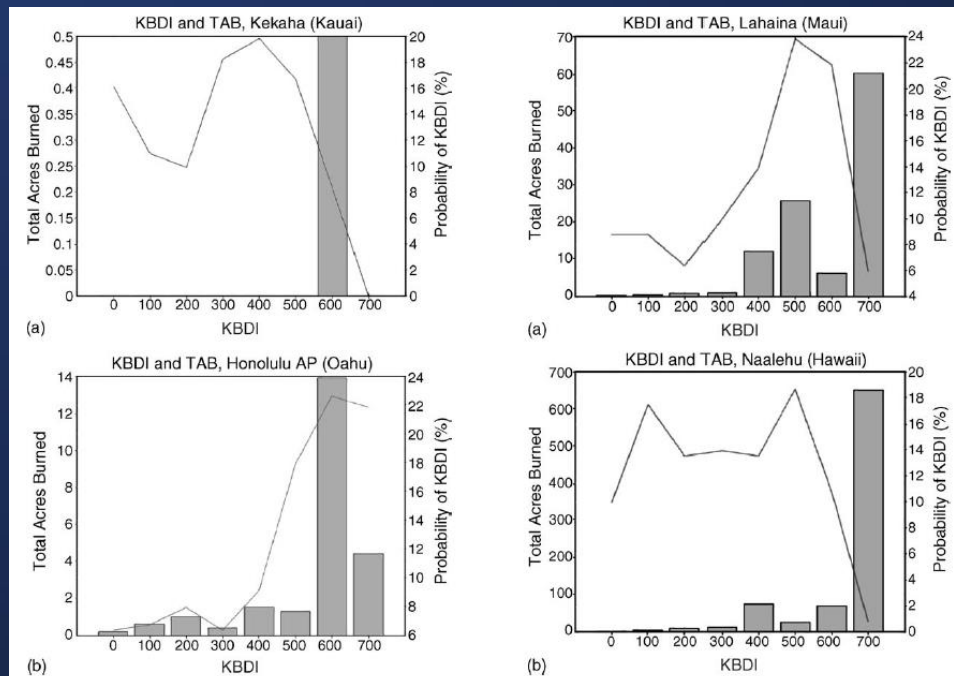


Fig. 8. Bar graph of total acres burned (TAB) and intervals of KBDI. Bars represent the median value of TAB for each interval of KBDI. Also shown is the probability distribution (KBDI) for each interval (solid line): (a) Kekaha, Kauai (1981–1996) and (b) Honolulu Airport, Oahu (1976–1996).

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Development of Current Red Flag System

The Hawaii RAWS network was sparse in the mid 2000s

Of the stations Dolling et al (2005) considered (Kekaha, PHNL, Lahaina, Naalehu), only the Honolulu International Airport (PHNL) could provide reliable real time data

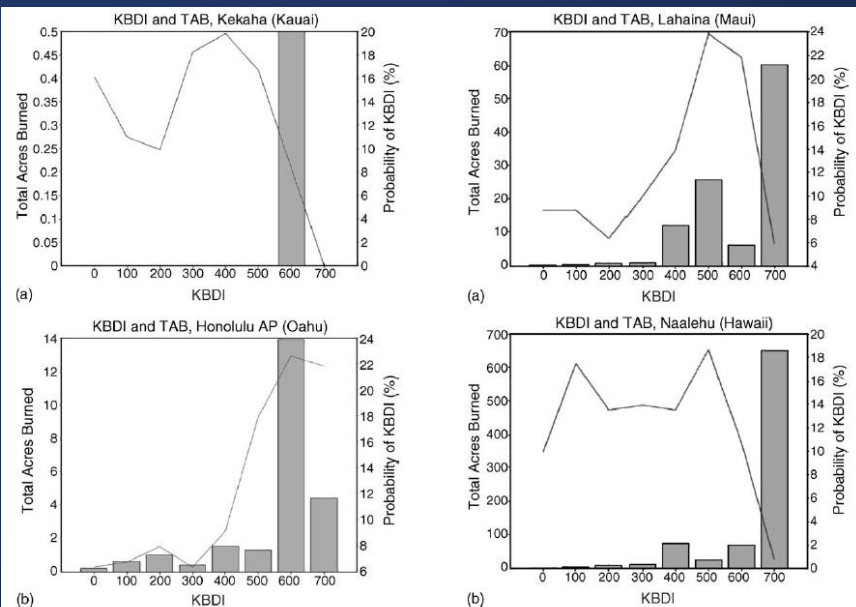


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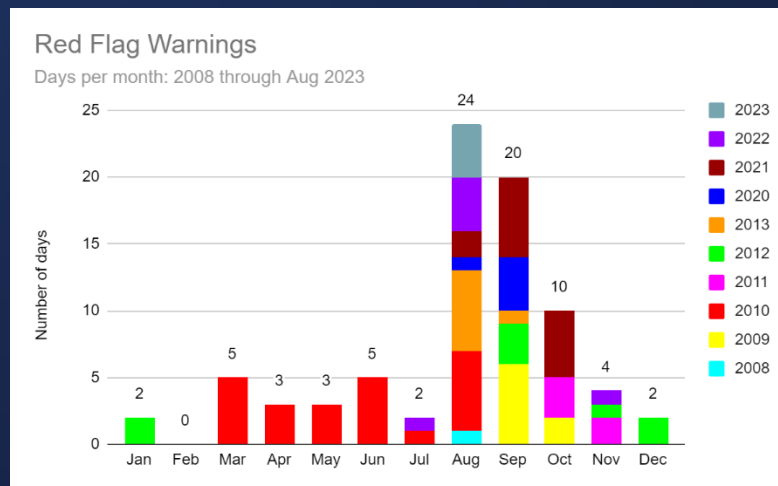
Current Red Flag System

In 2008, the Fire Weather Watch & Red Flag Warning system was implemented with little change to this day

In keeping with land managers requested that “Red Flag days” be rare (less than 10 per year), expect about 5 days per year

All three of the following criteria are met during any part of a day for 2 or more hours at the Honolulu International Airport (PHNL):

- Keetch-Byram Drought Index (KBDI) \geq 600**
- Minimum RH \leq 45 % (2 hours or more)**
- Wind \geq 20 mph (\geq 17 kt) (2 hours or more)**





Current Red Flag System Weaknesses

Use of PHNL to diagnose statewide weather is a major weakness

RAWS network has expanded considerably (need history)

2007

2023





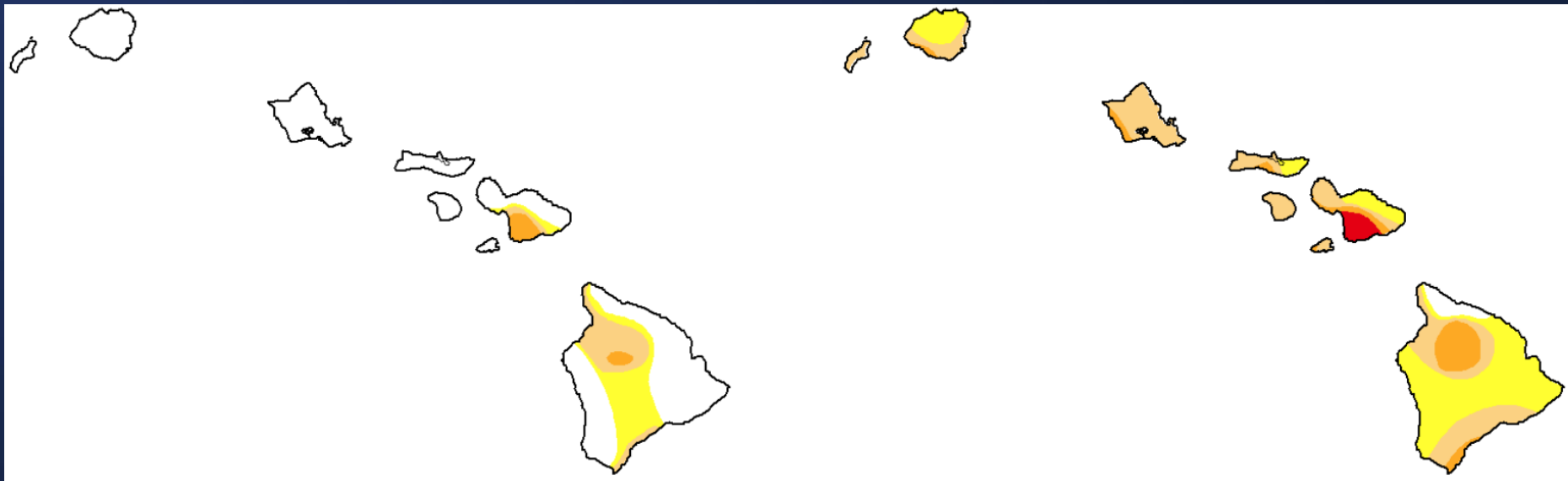
Current Red Flag System Weaknesses

Use of PHNL to diagnose statewide fuels is a major weakness

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May 14, 2024

Aug 6, 2024





Wildfire "Season" in Hawaii

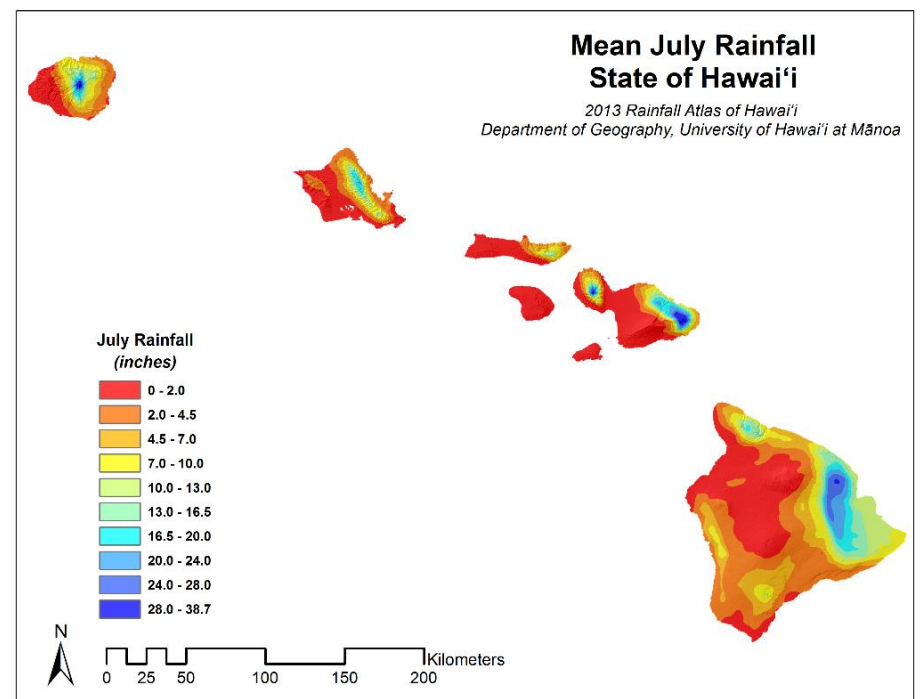
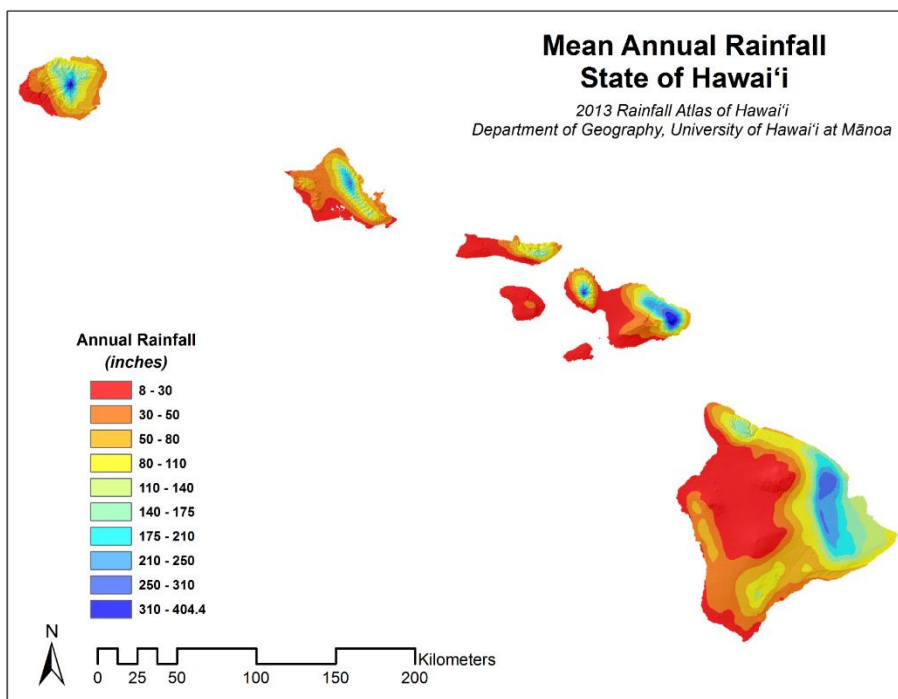
Summer climate:
Driest
Hottest
Steadiest wind





Wildfire "Season" in Hawaii

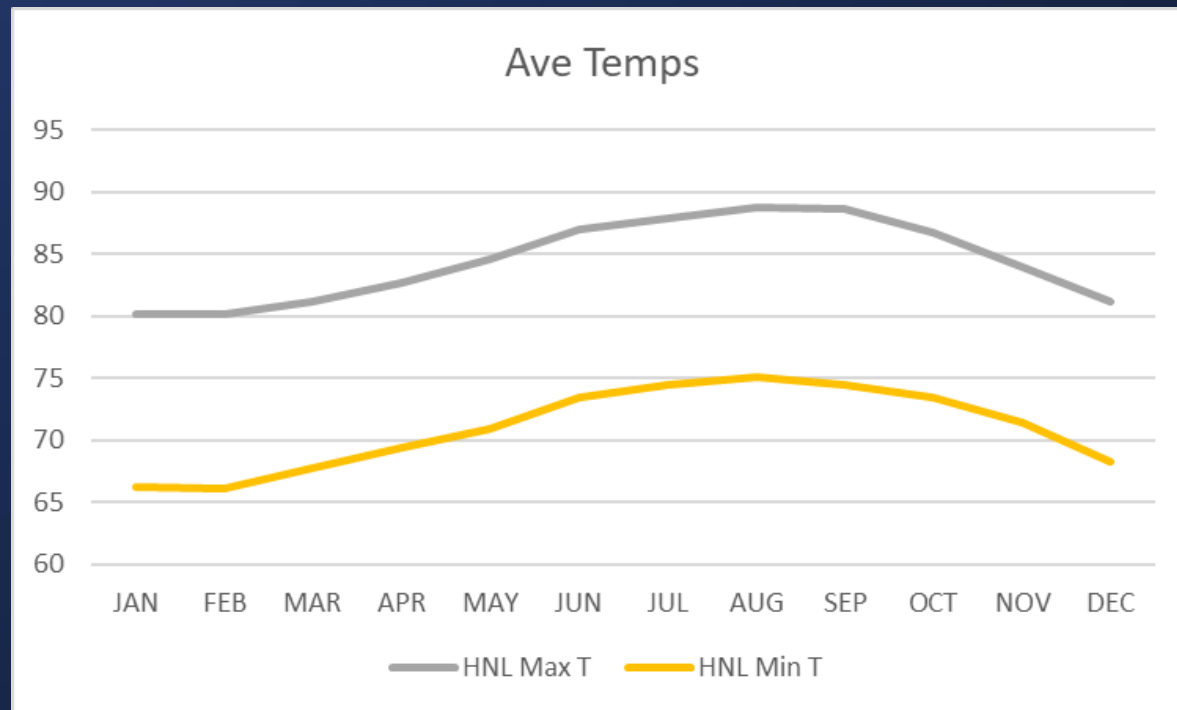
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Driest
Hottest
Steadiest wind





Wildfire "Season" in Hawaii

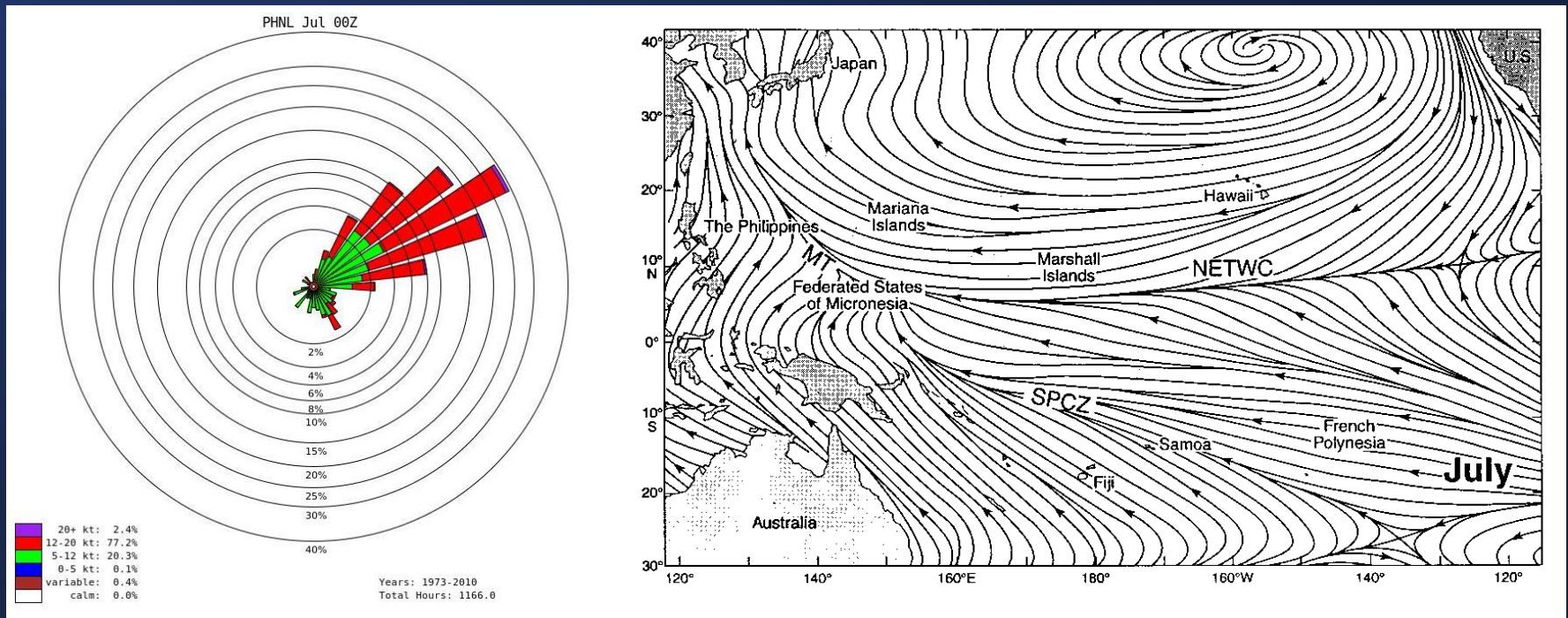
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Driest
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Steadiest wind





Wildfire "Season" in Hawaii

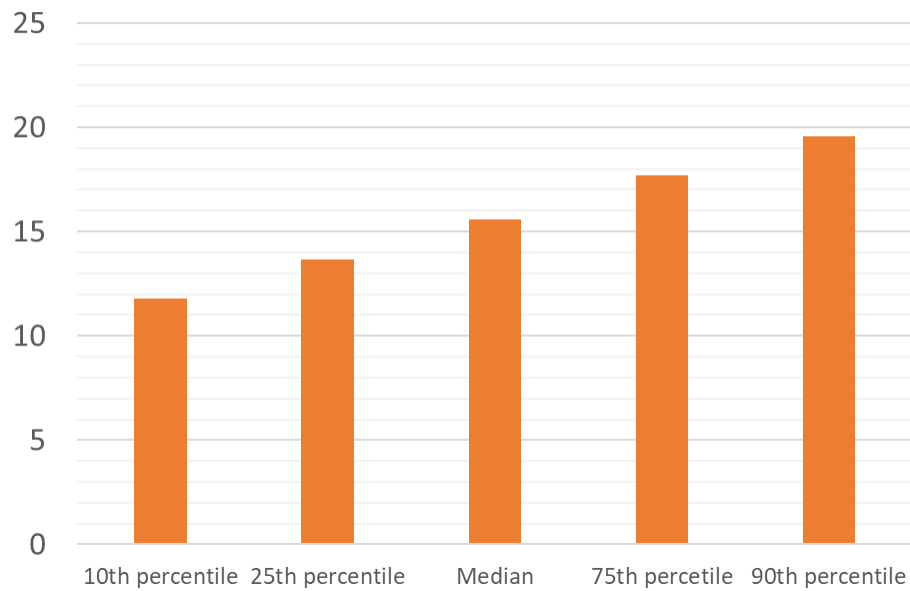
Summer climate:
 Driest
 Hottest
Steadiest wind



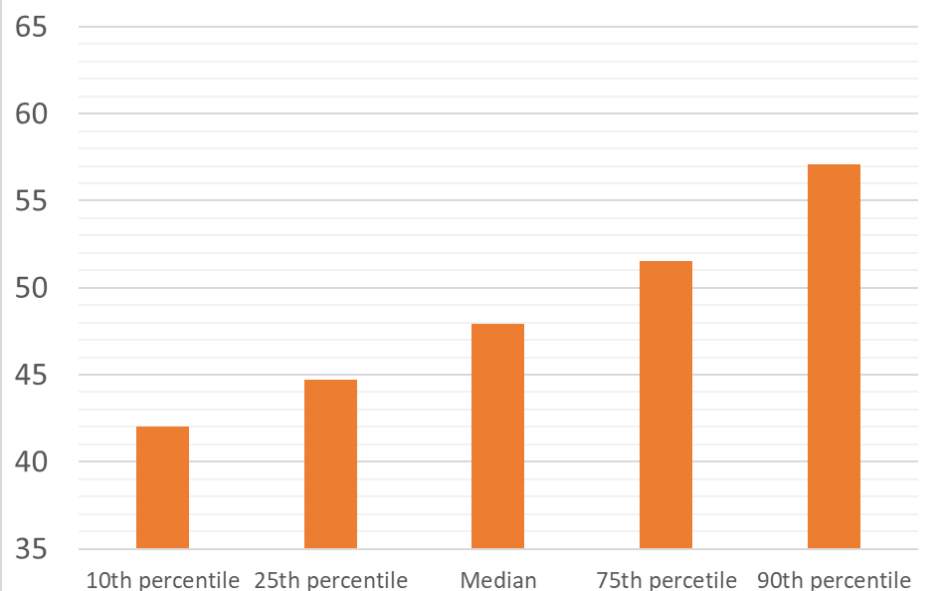


Fire Weather Forecast Problem in Hawaii

Jun-Sep Daily Maximum Wind (kt) Percentiles 2001-2020



Jun-Sep Daily Minimum RH Percentiles 2001-2020

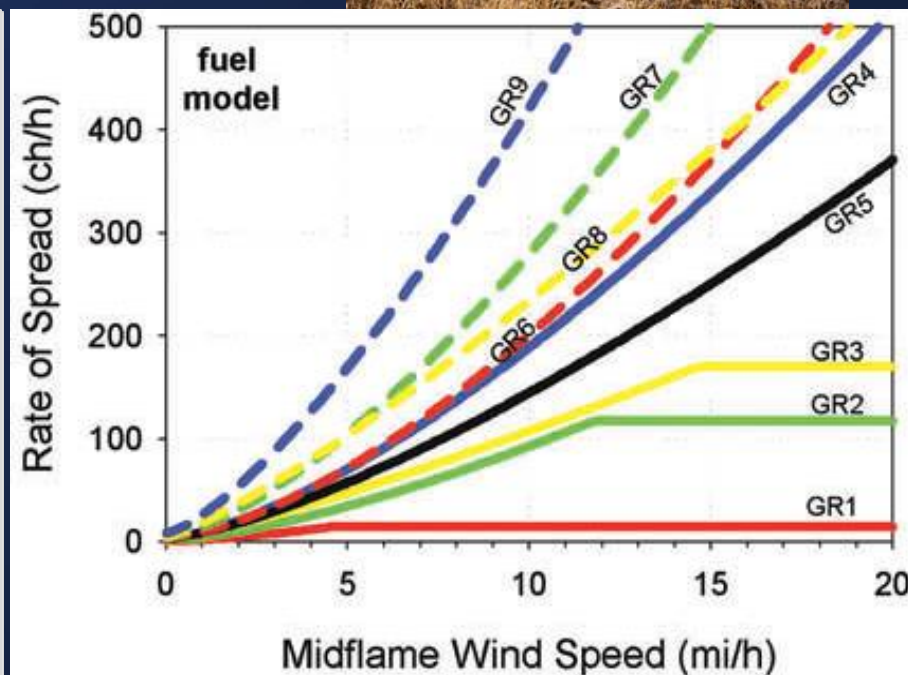
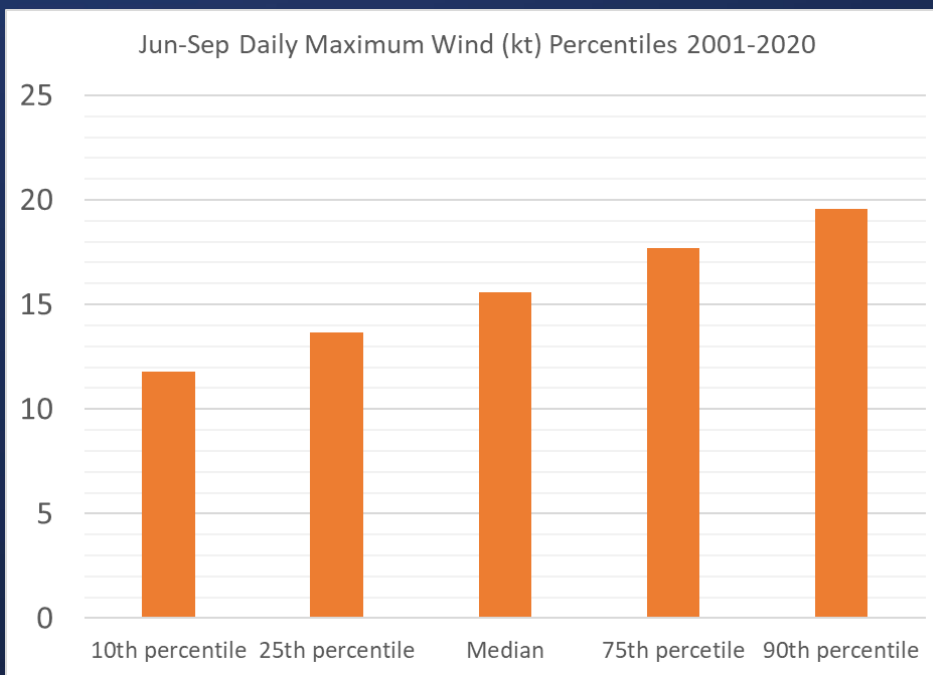


Fire weather forecast challenge: small deviations from typical summer weather can produce critical fire weather conditions



Fire Weather Forecast Problem

A median summer PHNL wind on a fire in GR4 could result in a rate of spread of nearly 5 mi/h



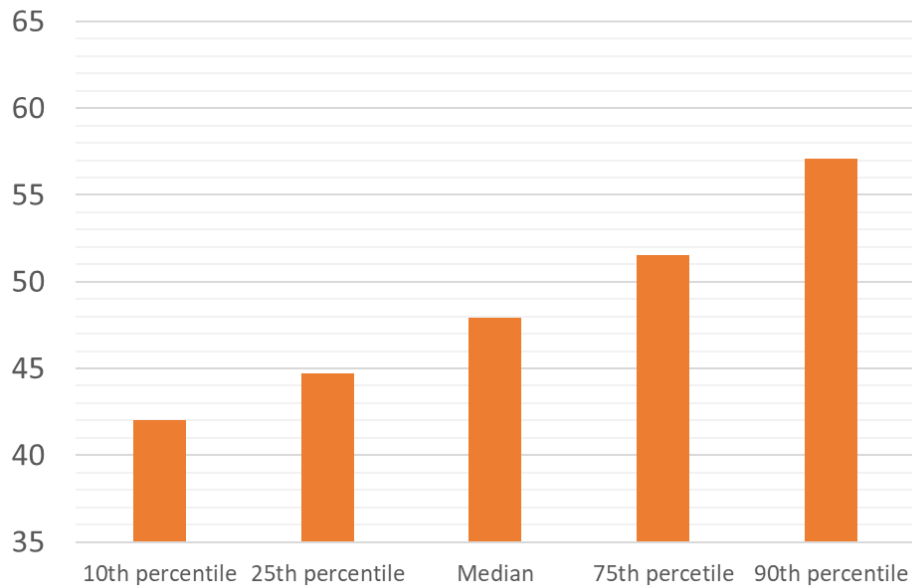


Fire Weather Forecast Problem

A median summer PHNL RH (48%) is not much higher than a “critical” PHNL RH (45%)

Near the reliability threshold of the sensor

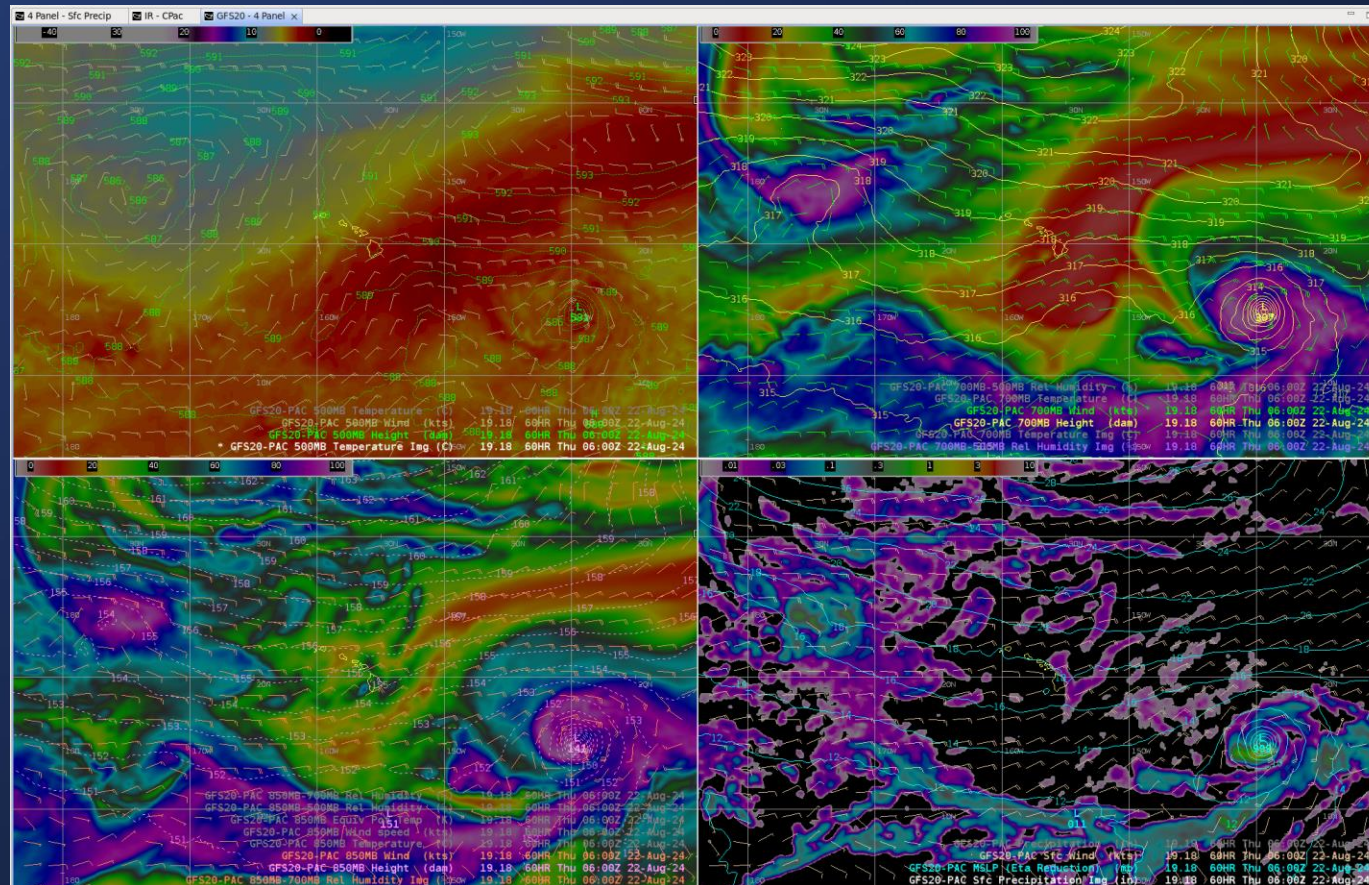
Jun-Sep Daily Minimum RH Percentiles 2001-2020





Fire Weather Forecast Challenge

Numerical models are the main predictive tool





Fire Weather Forecast Challenge

Model Output Statistics are used for detail

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FOPA20 PHNL 191800
PHNL  GFS MOS GUIDANCE  8/19/2024  1800 UTC
DT /AUG 20                /AUG 21                /AUG 22
HR   00 03 06 09 12 15 18 21 00 03 06 09 12 15 18 21 00 03 06 12 18
N/X          76          88          77          89          76
TMP   86 84 80 79 78 77 80 86 87 85 80 79 78 77 80 86 88 85 80 77 80
DPT   68 67 68 68 68 67 67 66 66 65 65 66 66 66 66 64 63 64 65 66 65
CLD   SC BK SC SC SC SC SC SC SC SC SC CL SC SC SC SC FW SC SC SC SC
WDR   06 06 06 06 05 04 06 07 06 06 06 06 06 06 06 06 06 06 06 06 06
WSP   15 15 11 08 06 06 09 13 14 14 10 08 09 09 11 15 17 16 13 12 12
P06           2     3     5     4     1     4     3     4     2  6  6
P12           5     7     4     7     15
Q06           0     0     0     0     0     0     0     0     0  0  0
Q12           0     0     0     0     0     0     0     0     0  0  0
CIG   8  8  8  8  6  6  8  8  8  8  8  8  8  8  8  8  8  8  8  8  8
VIS   7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7
OBV   N  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N

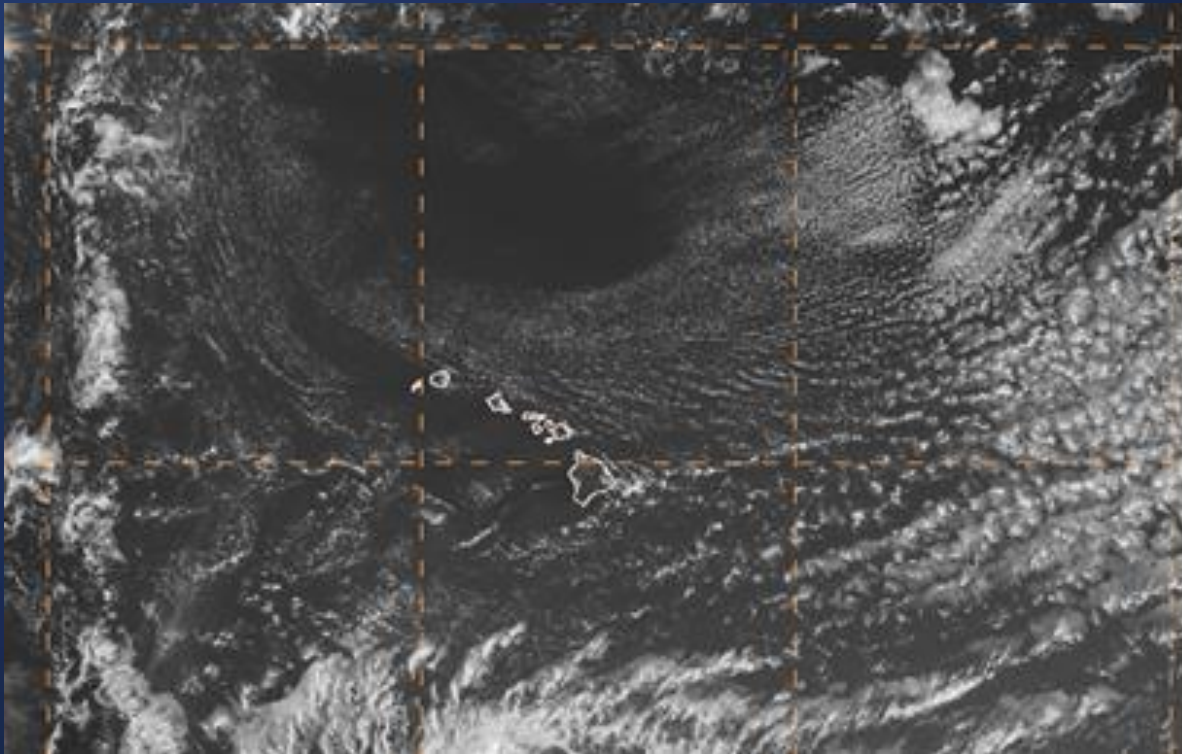
FOUS11 PHNL 200000
PHNL  GFS LAMP GUIDANCE  8/20/2024  0030 UTC
UTC   01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 00 01
TMP   88 87 85 84 82 80 80 80 79 79 79 78 78 78 77 76 77 80 82 84 86 87 87 87 87
DPT   68 68 67 67 67 67 67 67 67 68 68 68 67 68 68 67 67 67 66 66 66 65 65 65 66
WDR   06 06 06 06 06 06 06 06 06 06 06 06 06 06 05 06 06 06 07 06 06 06 06 06 06
WSP   16 16 15 15 12 11 10 09 09 08 07 07 06 07 06 06 06 08 10 13 14 14 14 14 15
WGS   24 23 22 NG NG NG NG NG NG NG NG NG NG NG NG NG NG 20 21 22 22 22 23
PPO   0  1  1  0  0  1  1  1  1  2  2  2  2  2  2  1  2  2  2  2  2  2  2  2  2
PCO   N  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N
P06           1           3           5           4
CLD   BK BK BK BK SC SC SC SC SC SC SC BK BK BK BK SC SC SC SC SC SC SC SC SC
CIG   6  6  6  6  8  8  8  8  8  6  6  6  6  6  6  6  8  8  8  8  8  8  8  8  8
CCG   6  6  6  6  6  6  6  6  6  6  6  6  6  6  6  6  6  6  6  6  6  6  6  6  6
VIS   7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7
CVS   7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7
OBV   N  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N

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Fire Weather Forecast Challenge

Subtle changes in appearance of clouds on satellite imagery can reflect a dry or moist flow





Fire Weather Forecast Challenge

The NWS Station Duty Manual has “rules of thumb”:

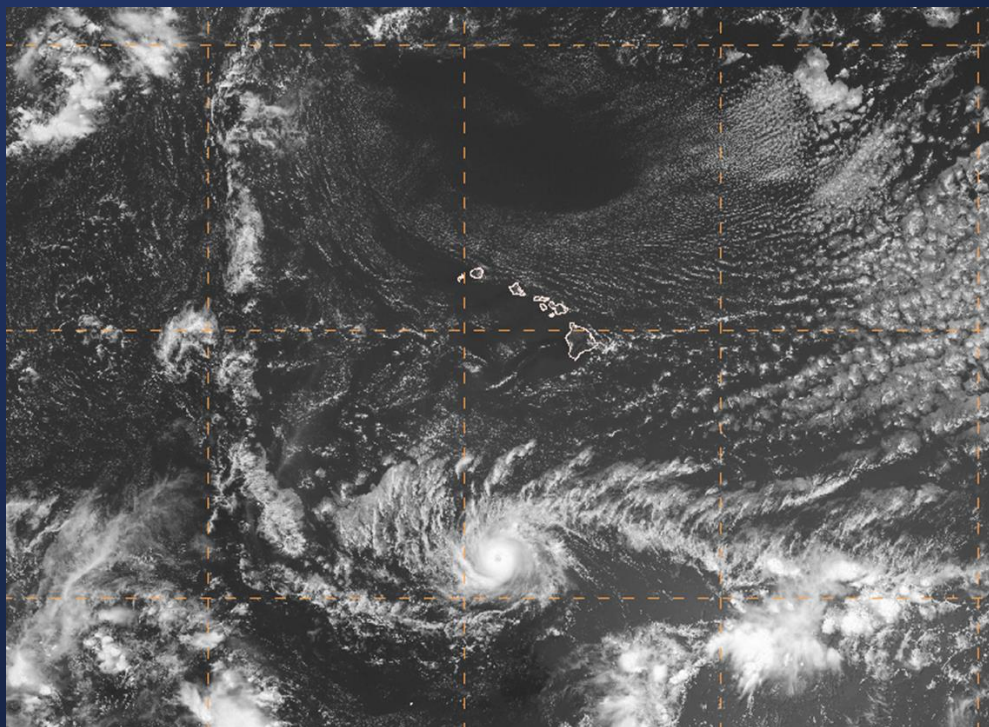
...the strong winds required for a Red Flag event develop when we have a Small Craft Advisory for the typically windy waters and channels around the Big Island and Maui, as well as for additional waters such as the Kaiwi Channel. For RH, the initial rule of thumb is that when the pattern is relatively dry with little or no leeward showers, afternoon RH at PHNL will likely drop to 45 %.



Performance: Aug 8 Wildfires

Hawaii was not directly affected by Dora

Subsidence (sinking motion) and dry air north of Dora were critical ingredients that led to a rare summertime downsloping wind event during the dry season





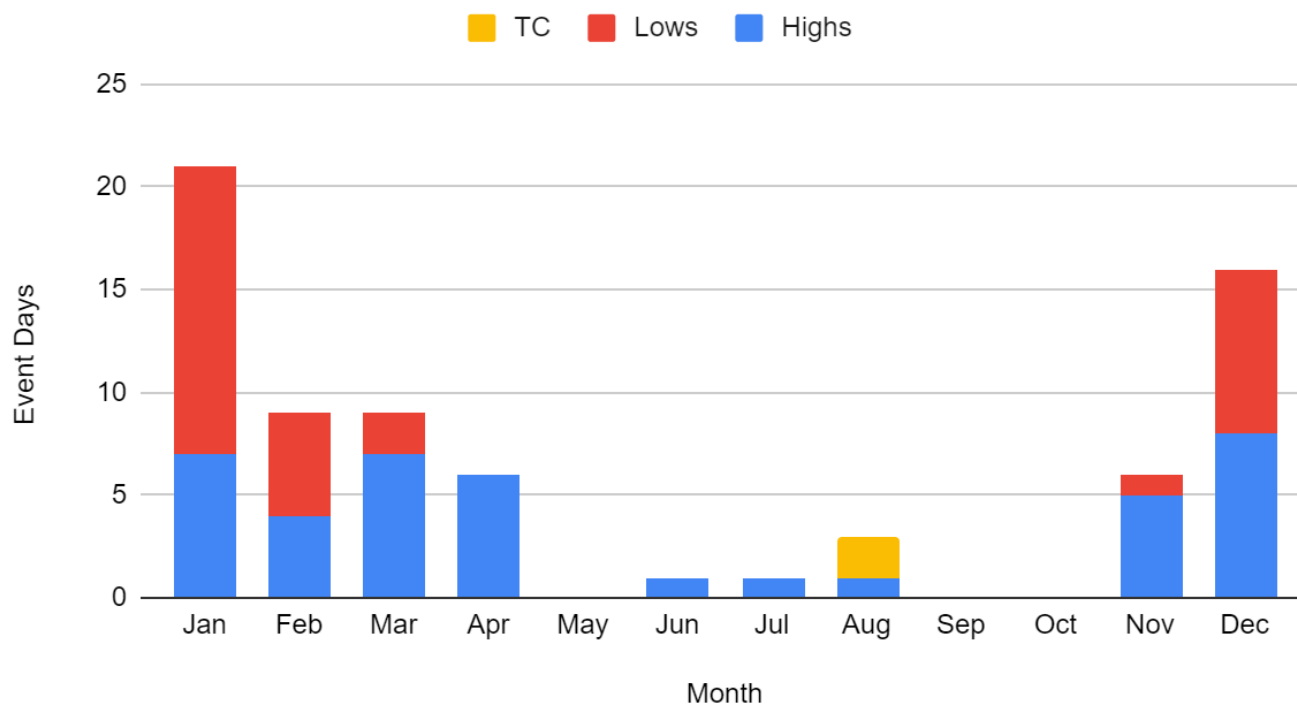
Performance: Aug 8 Wildfires

Summer High Wind Warning events are extremely rare

Criteria: Sustained winds 40 mph or more

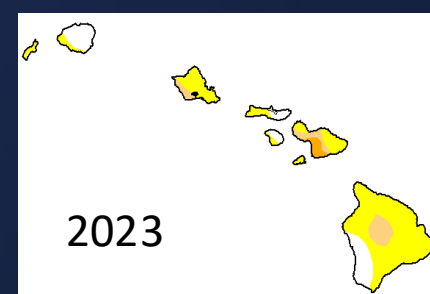
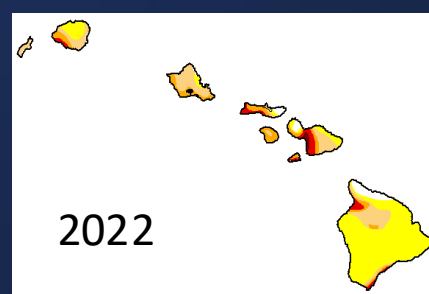
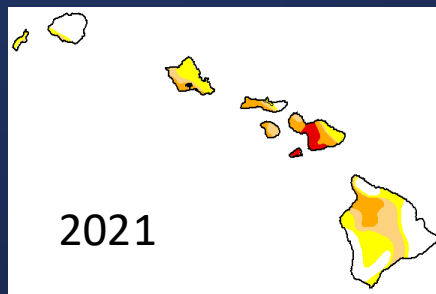
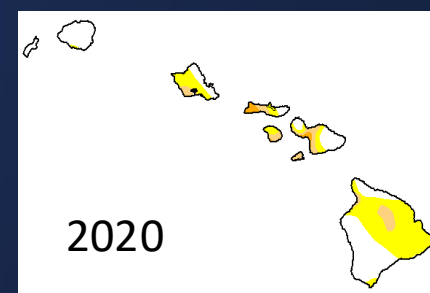
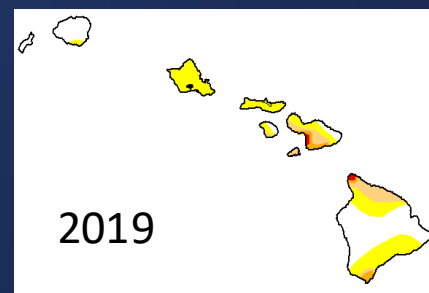
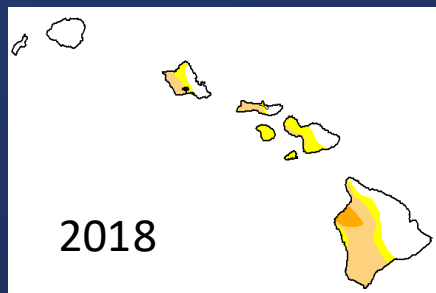
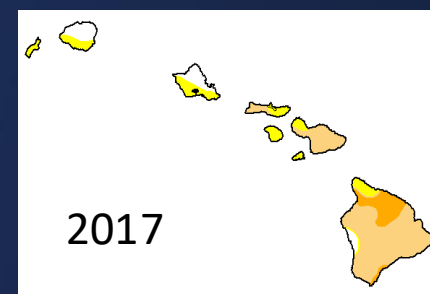
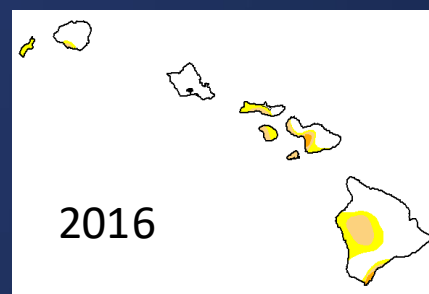
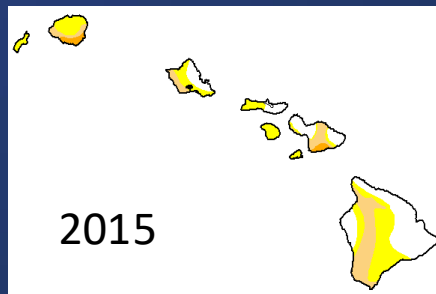
Wind gusts 58 mph or more

Storm Data: High Wind Events since 1996





Performance: Aug 8 Wildfires



Drought category for Maui was not atypical for early August



Performance: Aug 8 Wildfires

NWS Honolulu Area Forecast Discussion Fri, Aug 4 (continued):

.FIRE WEATHER...

...critical fire weather conditions are looking highly likely early next week. Dry, stable, and breezy to windy trades are expected as deep high pressure to the north moves in tandem with Hurricane Dora, which is forecast to pass south of the islands. Conditions could develop as early as late Monday, but Tuesday has the greatest potential as the Keetch Byram Drought Index (KB DI) is expected to reach the critical 600 mark and models show leeward relative humidity falling below 45 percent. A Fire Weather Watch will be issued sometime this weekend to highlight this threat.

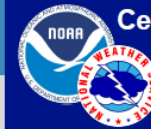


Performance: Aug 8 Wildfires

NWS Honolulu partner video conference slide Fri, Aug 4:

Weather Concerns in Hawaii

Hurricane Dora



Central Pacific Hurricane Center
Honolulu Forecast Office

Honolulu, HI

Friday, August 4, 2023

Strong trade winds:

- Winds increasing Monday, peaking Tuesday
- At least Wind Advisory; possible High Wind Warning
 - *Wind Advisory criteria: sustained winds 30 to 39 mph and/or gusts of 50 to 57 mph*
 - *High Wind Warning criteria: sustained winds ≥ 40 mph and/or gusts ≥ 58 mph*

Fire weather:

- Likely to reach Red Flag Warning criteria on Tuesday, which indicates the potential for extreme fire behavior
 - *[Keetch-Byram Drought Index](#) ≥ 600 ; relative humidity $\leq 45\%$; sustained winds ≥ 20 mph*
- A Fire Weather Watch could be issued as early as Saturday, valid for the day on Tuesday

Surf:

- East-facing shores may reach advisory levels of 10 feet
- Easterly wind swell building Monday; peaking Tuesday; possibly lingering into Wednesday



Performance: Aug 8 Wildfires

NWS Honolulu issues Fire Weather Watch 3:33 AM, Sun, Aug 6:

...FIRE WEATHER WATCH IN EFFECT FROM MONDAY MORNING THROUGH LATE TUESDAY NIGHT FOR LEEWARD AREAS DUE TO STRONG AND GUSTY WINDS WITH LOW HUMIDITY...

The National Weather Service in Honolulu has issued a Fire Weather Watch, which is in effect from Monday morning through late Tuesday night.



Current Red Flag System Performance

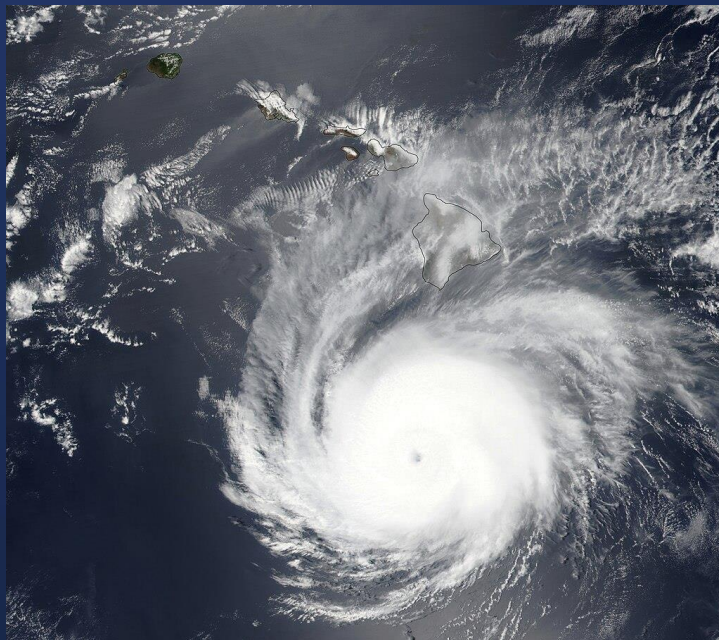
First week of August 2018:

Nearly 9,000 acres burned in Makaha Valley & Waianae Valley

PHNL KBDI was in 560s

PHNL winds greater than 20 mph (gusts over 40 mph Waianae Vly)

PHNL RH near summertime average around 50%





Current Red Flag System Performance

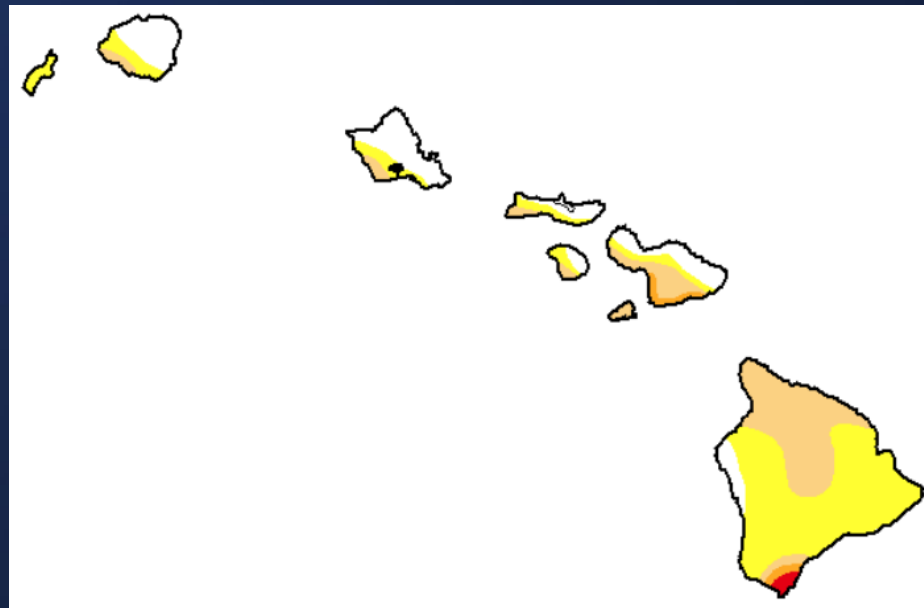
Maui Central Valley July 11-13, 2019:

About 9,000 acres

PHNL KBDI was about 250

Kahului KBDI was about 575 and area was in moderate drought

Winds & RH at Red Flag criteria for one hour on July 11 and were borderline on July 12





Current Red Flag System Performance

Mana Road Fire on Big Island July 30 - Aug 1, 2021:
42,000 acres in Parker Ranch into leeward Kohala
HNL KBDI was 588 on July 30 and went to 598 an Aug 3
Winds forecast to increase as drier air filled in during that period
July 30 was borderline
July 31 had strong enough winds but RH was borderline
Aug 1 & 2 had the winds and RH but HNL KBDI was in low to mid 590s





Future Improvements

The National Fire Data Rating System (NFDRS) will expand to cover Hawaii RAWS stations in September 2024

While this data is beneficial to experienced land managers, historical analyses must then be performed by combining fire weather and fire occurrence data

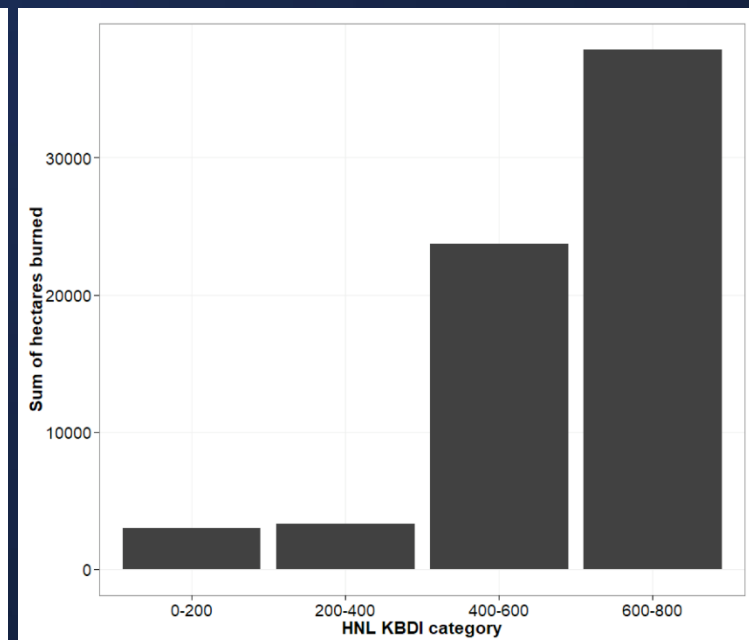
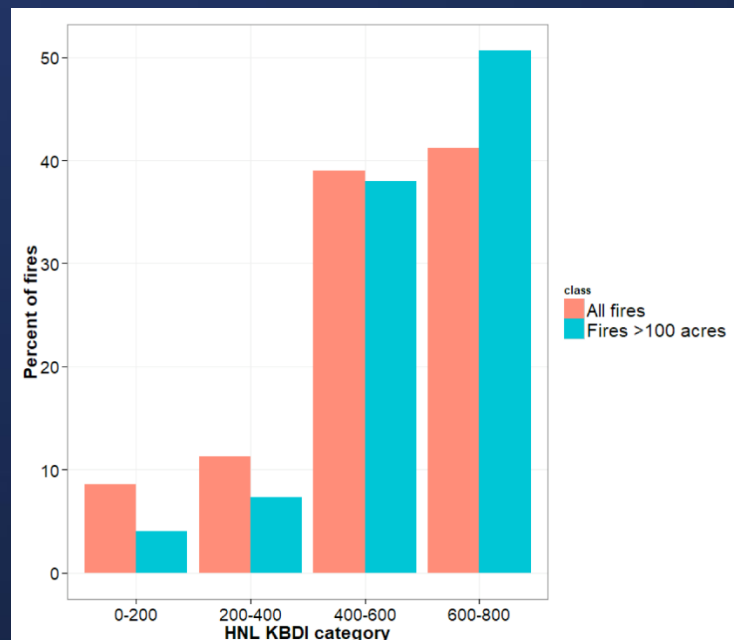
***** Hawaii *****	Elev	Lat	Long	Mdl	Tmp	RH	Wind	PPT	ERC	BI	SC	KBDI	HUN	THOU	TEN	STL	ADJ	IC	(Staffing Specs)
492018 PALEHUA	2400	21.3	158.1	16V	73	92	7	.03	0	0	0	503	20	20	30			0	/ / / /
492019 KUAOKALA	947	21.5	158.2	16V	78	75	17	.00	0	0	0	444	19	19	21			0	/ / / /
495006 MOLOAA DAIRY	338	22.1	159.3	16V	83	69	0	.00	0	0	0	576	30	30	24			1	/ / / /
495007 PUU LUA	3274	22.0	159.6	16V	78	56	2	.00	0	0	0	546	20	20	16			1	/ / / /
495008 WAIMEA HTS	524	21.9	159.6	16V	94	41	10	.00	2	20	28	575	19	18	13			19	/ / / /
495009 PUU OPAE	2068	22.0	159.6	16V	83	49	6	.00	0	0	0	568	19	19	16			1	/ / / /
496009 HILINA PALI #2	2808	19.3	155.2	16Y	85	42	15	.00	62	45	6	745	18	17	15	5	V	28	ERC/ 52/ 58/90/97
496024 KEALAKOMO 2	97	19.2	155.1	16Y	87	61	21	.00	62	51	8	737	18	17	12	5	V	20	/650/718/90/97
496026 PUU WAAWAA	2222	19.7	155.8	16V	79	72	8	.06	0	0	0	305	21	19	20			0	/ / / /
496027 PUU ANAHULU	2725	19.8	155.7	16V	78	69	9	.03	0	0	0	523	18	18	19			0	/ / / /
496028 AHUMOAO	6568	19.8	155.6	16W	68	69	9	.00	8	27	14	537	12	14	14			7	/ / / /90/97
496029 PUU MALI	6658	19.9	155.4	16V	72	47	8	.00	0	3	3	316	10	11	9			3	/ / / /
496030 KOHALA RANCH	1326	20.0	155.8	16V	81	62	8	.00	0	0	0	264	18	17	22			0	/ / / /
496031 KAUPULEHU LAVA FLO	1221	19.8	155.9	16V	85	61	8	.18	0	1	1	784	21	18	19			1	/ / / /
496032 WAIKOLOA	977	19.9	155.7	16V	84	65	11	.01	0	0	0	419	19	17	19			0	/ / / /
496033 KAPAPALA RANCH	1733	19.2	155.4	16V	79	66	6	.00	0	0	0	625	16	17	15			0	/ / / /
498011 MOLOKAI 1	2733	21.1	156.9	16Y	77	68	3	.07	51	22	2	721	20	19	22			4	ERC/ / /90/97
498012 KULA 1	6620	20.6	156.3	16Y	64	84	4	.00	57	23	1	171	13	15	12	3	M	1	/300/600/50/93
499911 OAHU FOREST	1666	21.4	157.9	16W	73	88	8	.05	2	7	3	534	24	23	29	4	M	0	ERC/ 1/ 2/90/97



Future Improvements

Dr. Clay Trauernicht, a University of Hawaii professor who has done extensive wildfire research in Hawaii and the tropics, shared a presentation with unpublished research. Using a 2002-2012 Hawaii fire history (10,000+ events with about 150 more than 100 acres), Trauernicht attached five drought indices to each fire event.

Results suggest that KBDI threshold could be altered:

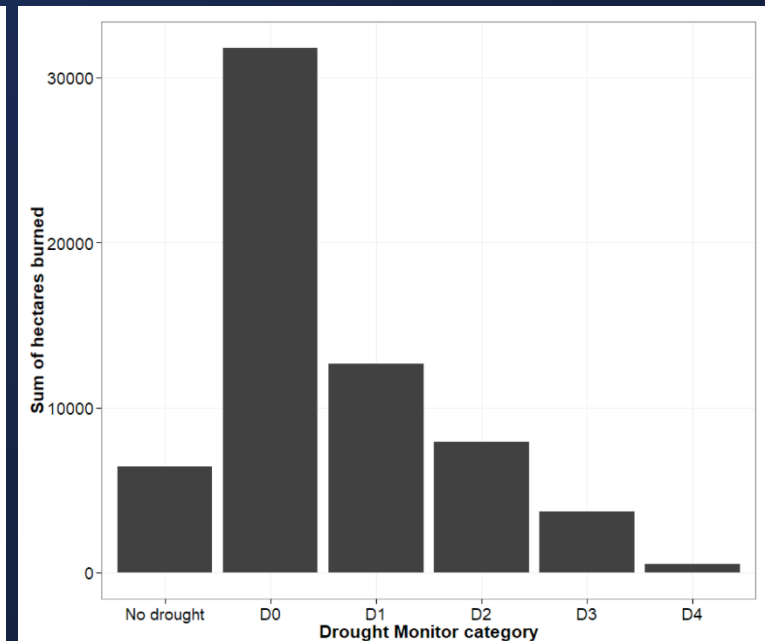
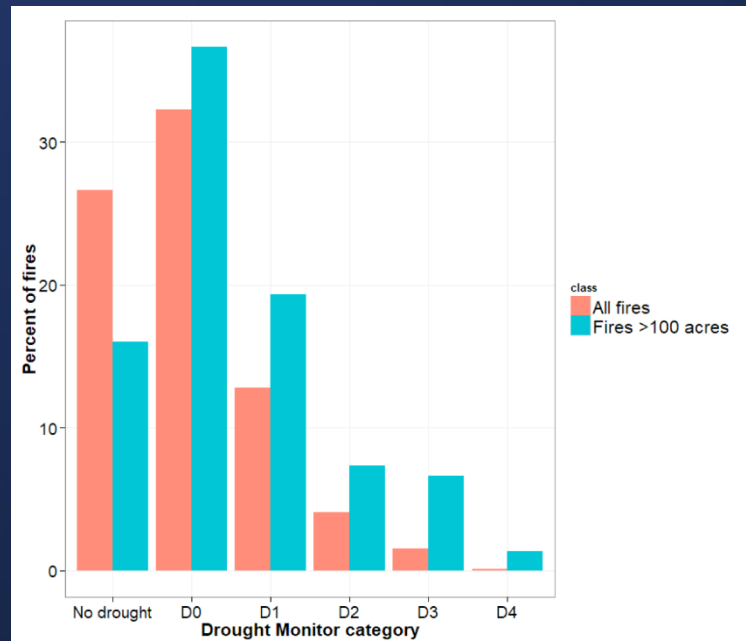




Future Improvements

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Results suggest that the U.S. Drought Monitor could be used:





Future Improvements

For 2024 season: Little significant change is expected
An extreme wind event may lead to warnings with KBDI below 600

After 2024 season: Change to island by island warning likely
Altering the fuels criterion ($KBDI \geq 600$) possible
Look into NFDRS indices

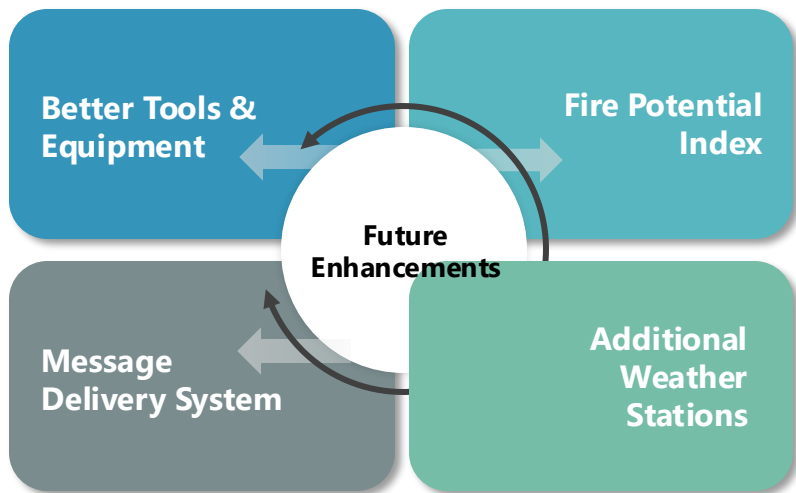
Others: No current plan to adopt AI, though State of Hawaii is working with U.H. Engineering Dept



Questions?



PSPS Enhancements Beyond 2024



As more grid hardening is deployed, the need for PSPS is expected to be reduced over time

- Grid hardening will increase the wind thresholds that trigger PSPS on overhead electric lines
- *Example* – replacement of bare overhead conductors prone to interference with foreign objects, with covered conductors, or, thresholds for de-energizing may be less stringent as grid is hardened



PSPS Enhancements Beyond 2024

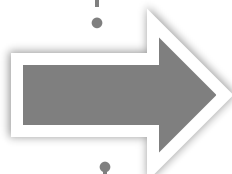
Better Tools & Equipment	Fire Potential Index	Additional Weather Stations	Message Delivery System
<ul style="list-style-type: none">• Through better tools, the capability to forecast fire weather threats at a more granular and localized level will be enabled and improved over time<ul style="list-style-type: none">• Use of better weather forecasting tools that can project dry and high wind conditions days in advance at a circuit level• Additional equipment will be deployed to further enable segmentation and surgical de-energization of power lines	<ul style="list-style-type: none">• A fire potential index (FPI) can be developed that will reflect daily fuel conditions based on the dryness of vegetation and potential for significant fire spread<ul style="list-style-type: none">• FPI indices are widely used by the CA utilities and could trigger more targeted mitigations such as fast tripping (i.e., EPSS) and PSPS at a circuit level at a local level• Together with more accurate weather forecasting, fire threats can be better forecasted in absence of a statewide red flag alert	<ul style="list-style-type: none">• Additional weather stations will be deployed to further expand situational awareness and improve the ability to further reduce the scope of PSPS during events• Weather stations will enhance future tools and forecasting models	<ul style="list-style-type: none">• A new emergency notification system that will be able to send messages to various channels at once via phone, text and emails to customers<ul style="list-style-type: none">• Together with improved forecasting, notifications can be delivered on a more targeted basis



Mitigating the Impact of PSPS Outages on our Customers and Communities

Currently in place:

- Dedicated PSPS 800 line with updates and information pre, during and post event
- Notifications
 - Provide as much advance notification as possible to all impacted stakeholder groups
- Enrollment of medical baseline customers
 - Ensure that customers who depend on power for certain medical needs have updated information to ensure notification are received.



Future plans under consideration:

- Community Resource Centers
 - Pre-designated locations where customers can charge medical and mobile devices, and have access to water, ice, refreshments, etc.
 - Learn more about PSPS and ways to deal with longer outages
- Customer Generator/Battery Programs

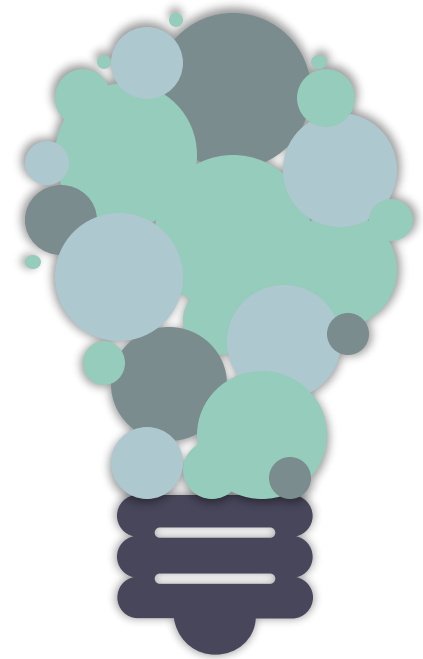


PSPS Enhancements and Mitigating Customer and Community Impacts

Group discussion

What are additional considerations that Hawaiian Electric can take to reduce the impact of PSPS, fast trip and reclose blocking, and the long duration outages that result when implemented?

How can we better coordinate response to ensure the safety of our communities during these events?



Operational Strategies Challenges and Opportunities

CHALLENGES

- Lack of granular weather forecasting at a local level (e.g., 1-2 km)
 - Currently, red flag events are statewide
 - PSPS outages may occur with little notice depending on how fast fire weather threat conditions occur
- Public information and messaging about outages may confuse customers between outages that occur from PSPS vs other types of outages
- Critical facilities that have back up generation may not have been sufficiently maintained to support longer outages
- Securing facilities to enable community resource centers

VS

OPPORTUNITIES

- Ongoing installation of weather stations will help to provide additional situational awareness
- Partnership with the NWS and other institutions to provide additional capabilities to provide more accurate granular weather forecasting
- Partnership with public services such as Aloha United Way 211, food banks, and disaster response agencies like the American Red Cross may help to support residents during more extreme events



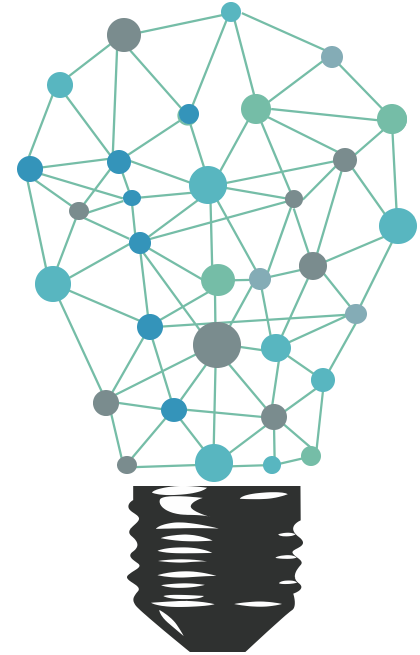
Operational Strategies Challenges and Opportunities

Group discussion

What additional challenges and opportunities may occur that were not listed on the prior slide?

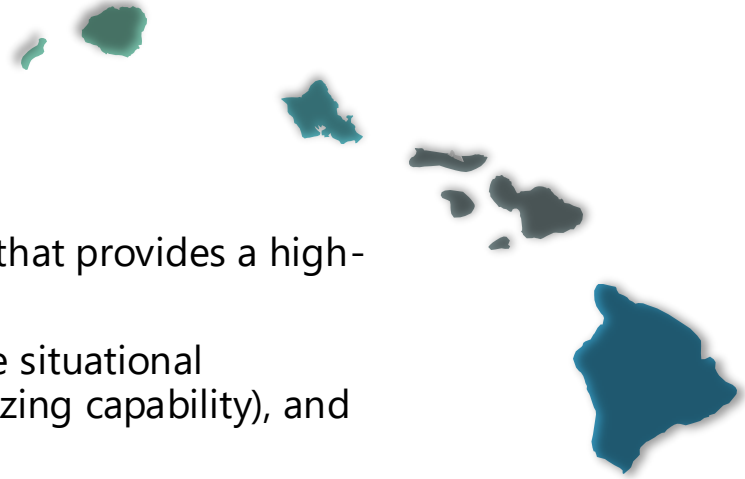
Are there other ways to mitigate the impacts of these types of outages on our customers, communities, and stakeholders?

What new programs and services need to be considered, and what funding opportunities or mechanisms are available for these programs and services?



Key Points

- PSPS is an effective operational mitigation for wildfire that provides a high-level of defense during extreme wildfire risk events.
- The need for PSPS will be reduced over time with more situational awareness, grid technology deployment (i.e., sectionalizing capability), and grid hardening.
- Lessons learned from 2024 implementation will be applied in future PSPS program deployments.
- Further deployment of situational awareness technologies and capabilities are needed to mature PSPS and allow enhanced powerline settings to be more surgical.
- Meteorology and forecasting capabilities need to be developed for wildfire risk in Hawaii.





**Hawaiian
Electric**

Questions



Next Steps



Next Meeting

September 5

Metrics and Performance Tracking

WFS WG Webpage:

<https://www.hawaiianelectric.com/safety-and-outages/wildfire-safety/wildfire-safety-working-group-documents>



Feel free to provide any additional feedback

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