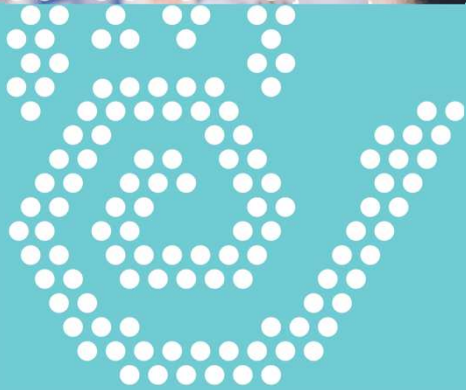


Low Frequency High Consequence

Wildfire



October 6, 2015



Low Frequency High Consequence (LFHC)

Also known as “tail risk” or “black swan event”

Examples of LFHC:

- Meteor strikes
- Nuclear leaks
- Stock market crashes

In some cases, the event type itself is not rare, rather it is the large-scale consequence that is rare

- Meteors hit the earth’s atmosphere very frequently. But devastation from them is exceedingly rare
- The same is true for wildfires. Fires that burn vegetation with absence of control are quite common. But fires that remain uncontrollable for extended periods are more rare.

Wildfire Data

- Data for wildfires is available in many sources
 - CALFIRE
 - GACC (Geographic Area Coordinating Center)
 - Inciweb
 - National Interagency Fire Center
 - SDG&E (for fires associated to electric equipment)
- However much of this data does not include every wildfire, only those reaching a certain threshold (acres, damage, social significance)
- Information for damage is frequently misleading.
 - Statistics that show the number of properties damaged may also include buildings such as sheds, stables, etc.
 - Suppression (fire fighting) costs can sometimes be found, but rare to see total cost of damage including property damage, loss of revenue, etc.

Wildfire Data

- Factors of wildfire:
 - Wildfire spread is largely driven by weather, fuel, topography; as well as availability of fire fighting resources
 - Amount of damage from fire is determined by the presence of valuable assets
- Information regarding spread and damage may not be explicit in most data sources:
 - Wind speeds throughout time and space of fire instance
 - Vegetation class, density, and moisture
 - Value of properties
 - Adherence to fire codes

Wildfire Data – Lessons Learned



- Some very damaging fires did not start during particularly bad weather; however they started just prior to the bad weather.
 - Cedar 2003; before winds truly picked up a man started an intentional fire. Within a few hours the winds strengthened and the fire grew to 200,000 acres in 31 hours
- In very strong wind, fire fighters have limited chance to contain fire
 - Air support is grounded
 - Not only unsafe to fly in those conditions but chemical/water drop in high winds is ineffective; atomizes before hits ground
 - Marginal ability to protect property on flanks of fire
 - Fire moves too fast
 - In 2003 and 2007 fire fighters were nearby before fire grew, but attempts at control were not successful.
 - In 1956, in San Diego 11 fire fighters perished when they were overrun at the front of a fire.
 - Possible to have large fires that do not destroy much property
 - In low winds, with remote areas of dry vegetation

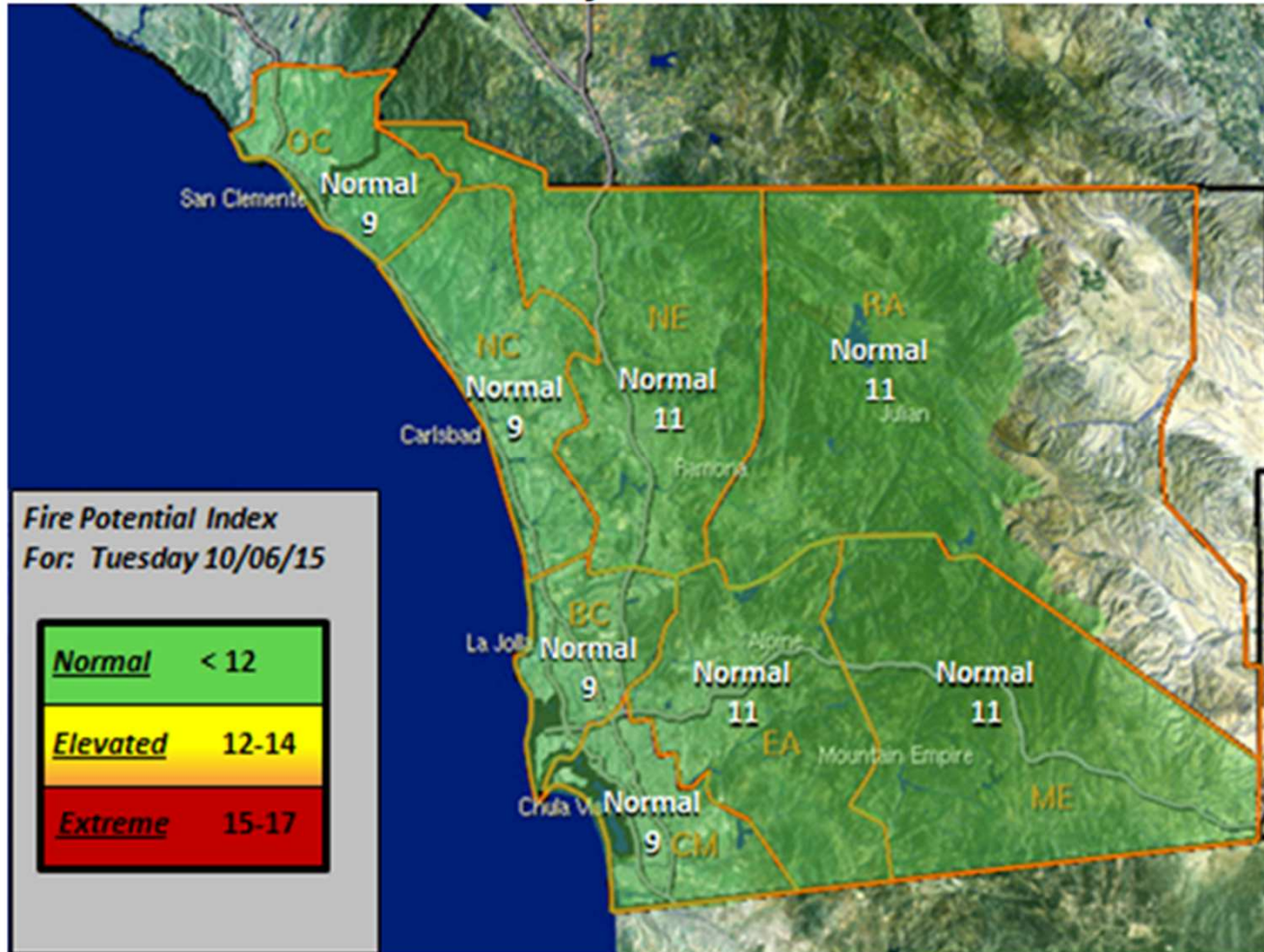
Wildfire Data and SDGE



- SDG&E created the Fire Potential Index (FPI) which attempts to use real-time environmental data to assess the potential for large, damaging fires
- Each day the FPI is calculate for the current day, and for each day of the upcoming week (8 days in total)
- Eight (8) operating districts each have their own FPI index
- The FPI uses a scale from 0-17, and three adjective descriptors:
 - Normal: 0-11
 - Elevated: 12-14
 - Extreme: 15-17

Current FPI

Fire Potential Index for Tuesday 10/06/15:



SDGE FPI Outlook



Seven Day FPI Outlook:

	Today 10/05	Tue 10/06	Wed 10/07	Thu 10/08	Fri 10/09	Sat 10/10	Sun 10/11	Mon 10/12
ME	Normal 11	Normal 11	Normal 11	Elevated 12	Elevated 12	Elevated 12	Elevated 12	Elevated 12
RA	Normal 11	Normal 11	Normal 11	Normal 11	Elevated 12	Elevated 12	Elevated 12	Elevated 12
EA	Normal 11	Normal 11	Normal 11	Normal 11	Elevated 12	Elevated 12	Elevated 12	Elevated 12
NE	Normal 11	Normal 11	Normal 11	Normal 11	Elevated 12	Elevated 12	Elevated 12	Elevated 12
OC	Normal 9	Normal 9	Normal 9	Normal 10	Normal 11	Normal 11	Normal 11	Normal 10
NC	Normal 9	Normal 9	Normal 9	Normal 10	Normal 11	Normal 11	Normal 11	Normal 10
BC	Normal 9	Normal 9	Normal 9	Normal 10	Normal 11	Normal 11	Normal 11	Normal 10
CM	Normal 9	Normal 9	Normal 9	Normal 10	Normal 11	Normal 11	Normal 11	Normal 10

Normal	Elevated	Extreme
< 12	12-14	15-17

Wildfire Data and SDGE



- SDGE reviewed available fire data, and correlated it to calculated FPI levels.
- Damage from fires is nearly non-existent when the FPI is normal.
- At FPI levels of 13, 14, rare and small damage of property has been noted.
- Damage of 10 homes or more has occurred only when FPI is 15+
- The large, well-known fires in San Diego occurred during FPI of 16 or 17
- SDGE changes its operating procedures progressively when in Elevated or Extreme
 - Includes changes to system protection, planned outages, usage of fire suppression contractors, “opening” the Emergency Operating Center

Wildfire Data

- Data strongly suggests that large wildfire is only likely during severe conditions:
 - Strong winds
 - Dry air
 - Dry vegetation
- Data also supports that outages and ignitions have a higher rate of occurrence during strong winds
- All events involving strong dry winds are known days in advance; and measures are taken
 - Meteorology staff

Ignition Data

- Since 2005, SDG&E has tracked fires that are “associated” to its equipment
 - Meaning, any fire that originated at or eventually affected an SDGE asset
- When the ignition occurs at an SDGE asset, the data suggests that many different types of triggers cause the ignition
 - Animal contact
 - Vegetation contact
 - Human-made contact (mylar balloon, kite, bullets)
 - Vehicle contact
 - Equipment failure
 - Fuse operations

Ignition Data



- This data has been used at SDGE to evaluate the need to enhance safety programs:
 - Vegetation Management expanded/enhanced their program after 2007
 - Older capacitors have been removed in the FTZ
 - Fusing standards have changed in the FTZ
 - FiRM program to replace poles and conductor where deemed a risk improvement
- But because there is no single trigger that causes a majority of ignitions, SDG&E has focused on all-around programs
 - System protection
 - No reclosing when Elevated FPI
 - Sensitive settings on relays in Extreme FPI
 - Adding more intelligent switches to allow for more refined settings
 - Lowering SGF values
 - Enhanced inspections
 - Fire-safety focused inspections of all poles in HRFA, every 3 years
 - Backcountry design guide

Wind Data

- SDGE built a 50 year wind map
 - With academic and consulting support
 - Can be modified to determine longer return intervals
- Wind data allows SDGE to determine areas that need focus
- All new construction in FTZ will utilize the wind speed (including appropriate safety factors) from the models.
- Models also help SDGE understand likelihood of fire weather

Tying the Data together



- Large fires are rare (thankfully!), but fires are not so rare – which provides data in such a way that allows the analyst to correlate contributing factors
 - Weather
 - Fuel
- Fire behavior and historical fires allow the utility to estimate which locations have the potential for largest societal impact
- Ignition data indicates a wide array of triggers and the need for both targeted programs as well as all-around mitigating programs
- Because data exists for fire history, utility-associated ignitions, and wind SDG&E believes the data set regarding wildfire is satisfactory for risk analysis.