Restoring ecologically beneficial fire to the Lake Tahoe Basin:

A planning and management approach

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Background

- Forest Service focus is increasing resilience and sustainability of LTB forest resources in the face of multiple stressors
  - Using pre-Euroamerican conditions as a short- to medium-term waypoint
- Disruption of natural processes:
  - Fire suppression, urbanization, fragmentation, climate change, Comstock logging, mining, grazing, …
- The forest matrix has changed significantly
  - Conditions in the LTB necessitate active management
  - This includes structural manipulations, application of prescribed fire, and managed wildfire when possible

Current Conditions

- Two main forest types where fires and management activities occur in the LTB:
  - **White Fir-Mixed Conifer**
    - Lake level to ~7500 ft., most common on Northwest & West shores
    - Associate species: JP, SP, LP, RF, IC
    - % LTB forest cover (Year) = <10% (1935); >20% (2003)
  - **Jeffrey Pine**
    - Lake level to >8000 ft., dominant up to 7500 ft. especially in Carson Range
    - Associated species: WF, RF, LP, WWP, IC
    - % LTB forest cover (Year) = ~40% (1935); 19% (2003)

Desired Conditions

- Historic annual area burned = 2000 - 8000 acres
  - Varies by forest type, elevation, literature source
- Mean fire size = 500 – 600 acres (dependent upon slope, aspect, etc.)
  - Median fire size are much smaller (dominated by small/very small fires)
- Fires typically burned in the conifer dormant season
  - Typically beginning in Aug./Sept. for this area
  - Shown in many dendrochronological fire scar studies where scars are found in latewood

Forest Type	TPA (>1"dbh)	BA (ft^2/ac)	Snags/ac (>20" dbh)	CWD* (tons/ac)	Patch (ac)
JP	<70	<100	1-2	0.5-6.0	0.01-0.50
WF-MC	100	<250	2-10	1.0-10.0	0.05-0.75

*** Coarse Woody Debris is highly variable [range= 0.0-150.0]**

Desired Conditions

- White Fir-Mixed Conifer (uneven-aged)
  - Fire type: ground/surface fire, active canopy fire rare
  - Fire Return Interval (w/ surrogates): 10-30 years
  - Contiguous crown fire area: <10 acres
  - Stand replacing fires occur on 15% of burned acres
  - Composition (WF : shade intolerant)= 1:1 (2:1, mesic)
- Jeffrey Pine (uneven-aged)
  - Fire type: surface fire primarily, no active canopy fires
  - Fire Return Interval (w/ surrogates): 7-20 years
  - Contiguous crown fire area: <5 acres
  - Stand replacing fires occur on 5% of burned acres
  - Composition (JP : shade tolerant)= 3:1 (< 3:1, mesic)

Constraints & Complexity

- Conditions in which fire can be put on the ground are limiting factors/ constraints:
  - Current forest/fuel structure
    - Pre-treatment needed (hand/mechanical)
  - Regulations
    - CARB Burn Days
    - Environmental
  - Resource availability
    - Staffing, contingency resources, funding
  - Policy
    - Only natural ignitions for resource objectives in designated areas
- LT Basin Complexity:
  - 2 States
  - 6 counties, 1 rural area
  - 7 Fire Protection Districts
  - Multiple towns/cities, permitting agencies, special interest groups…
  - Class 1 airsheds
  - 'Smoke Sensitive Receptors'
  - Highly regulated water resources

Objectives

- Quantify and compare the limiting factors associated with implementing Prescribed & Managed Wildfire in terms of:
  - Average occurrence and consecutive burn days within burn plan prescriptions (Rx)
  - Estimated acres of potential managed wildfire (natural ignitions outside of WUI-DZ)
  - Seasonality of fire resource/personnel availability

Analyses & Data

1) Burn Days in Prescription (Rx)

- Multiple consecutive burn days
- Seasonality of available days
  - Data: RAWS and CARB

2) Potential Managed Wildfire

- FS Pro (Fire Spread Probability) model
- Best-case analysis (every lightning ignition = managed wildfire)
  - Data: Historical lightning strikes & ignitions

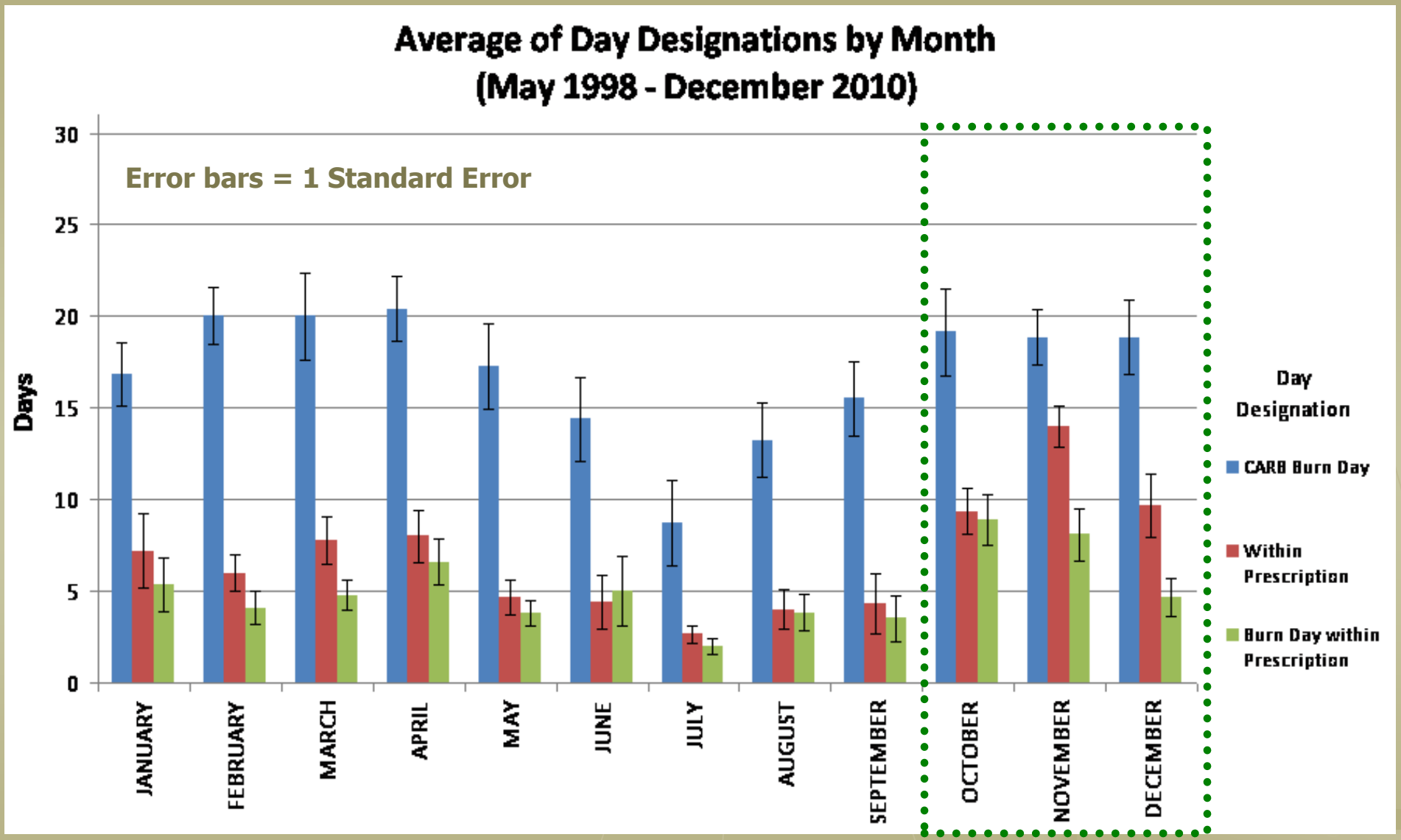
3) Fire Resource Availability

- Feasibility of Rx & Managed Wildfire in season
  - National & NOPS (Nor. Calif.) GACC Preparedness Levels (PL)

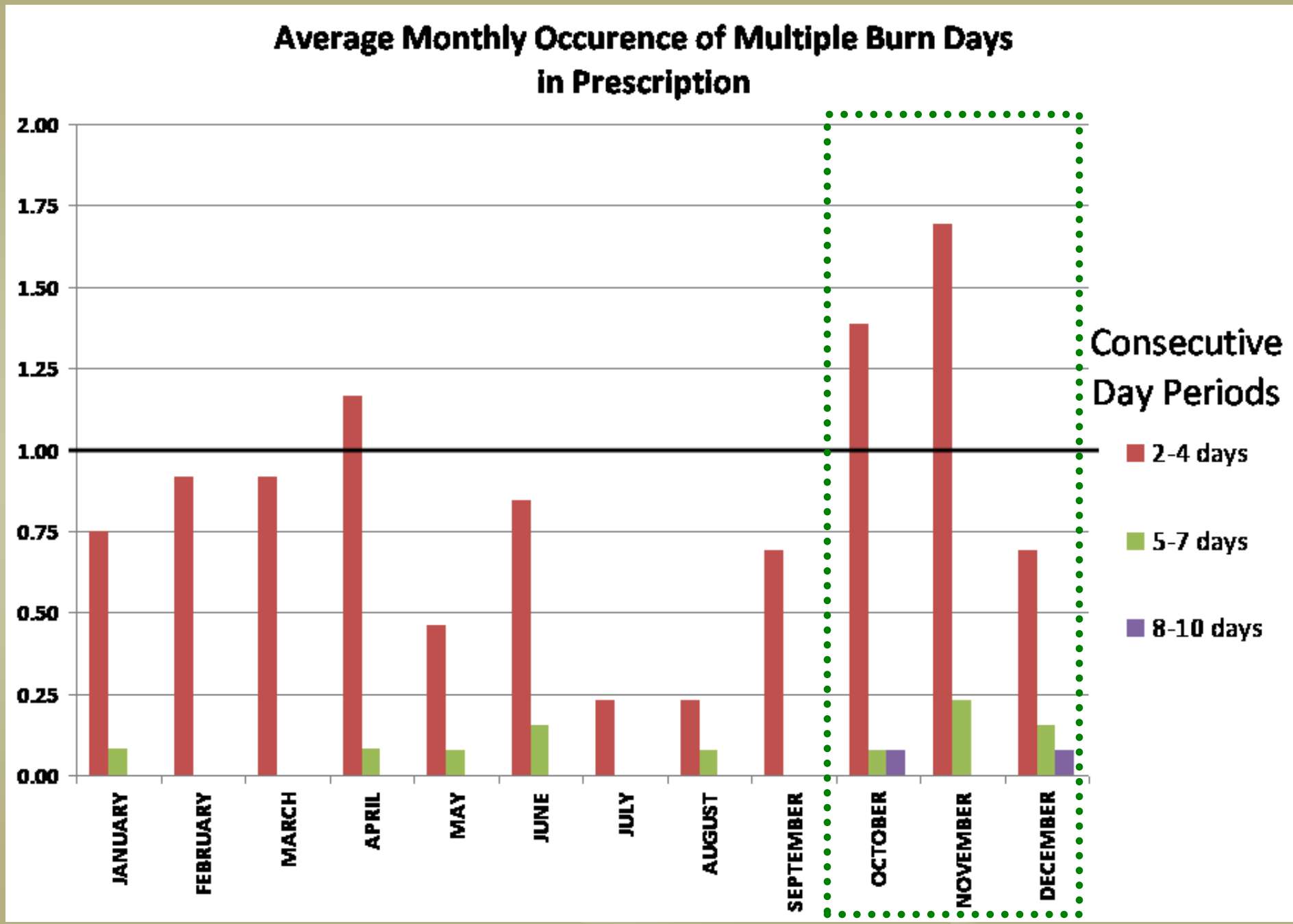
Analysis of Burn Days in Prescription

- 1) Burn Plan Rx:
  - *RAWS data: Meyers, CA*
  - Relative Humidity
    - 20-50%
  - 20-foot 10-minute average windspeed
    - <25 mph
  - 10-hr Fuel Moisture
    - 7-20%
- * All three measures must be within Rx limits for ignition.

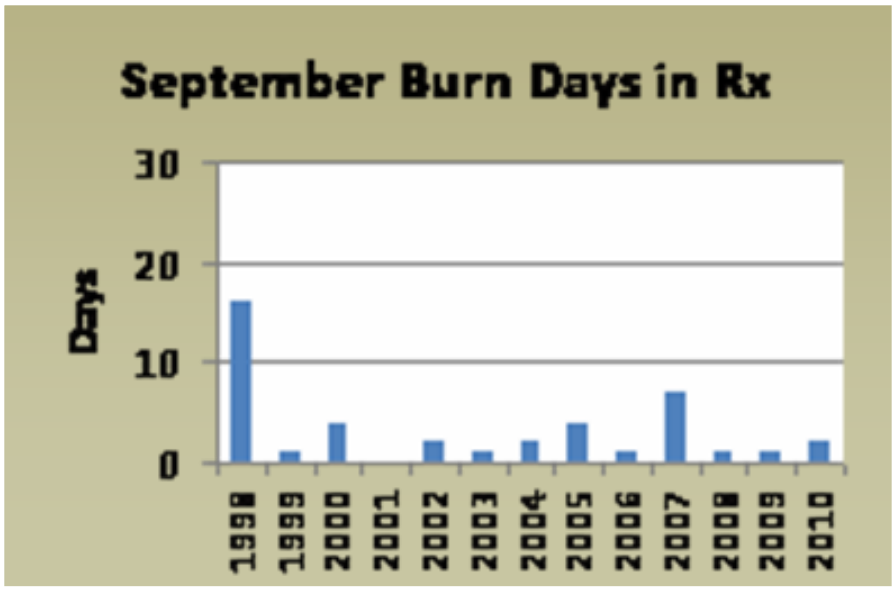
- 2) CARB Burn Day
  - Ultimate decision
    - Burn Day vs. No Burn Day
    - Marginal, amended, etc.
  - Created binary dataset
    - 1 = CARB Burn Day
- **3) BURN DAY in Rx**
  - All FOUR criterion (1 & 2) must be valid.
- **Multiple Consecutive Burn Days in Rx**
  - "Count" equation in Excel based on previous day's determination

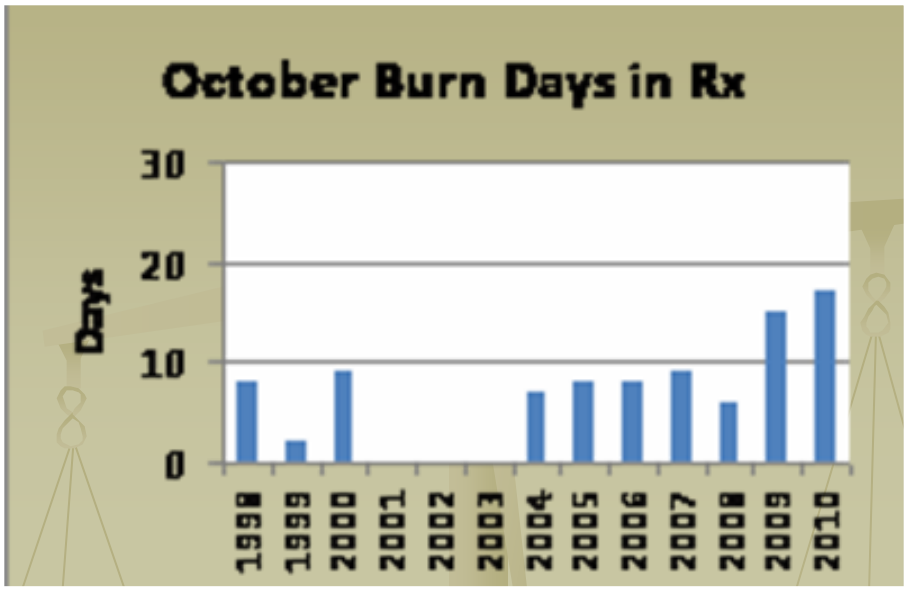


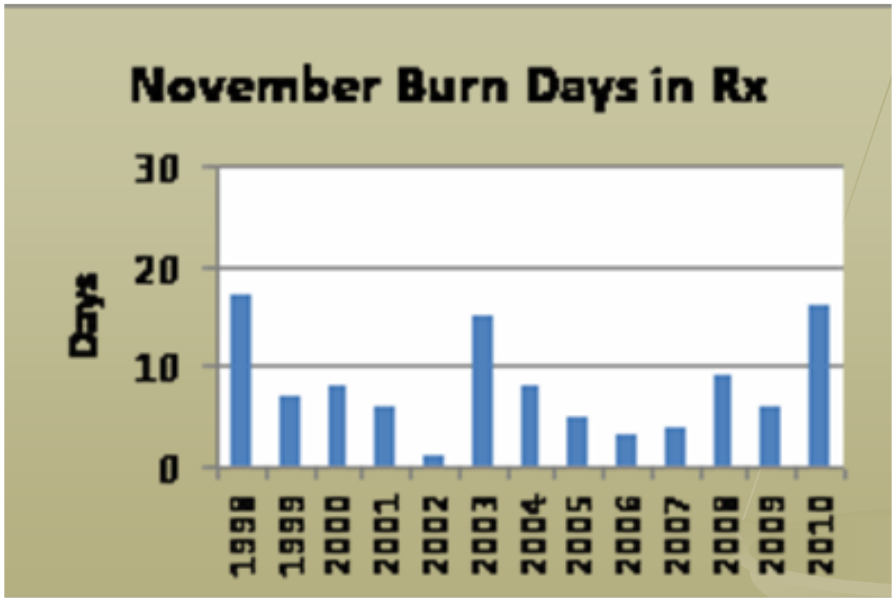
(Data is continuous from May 1998 through December 2010)

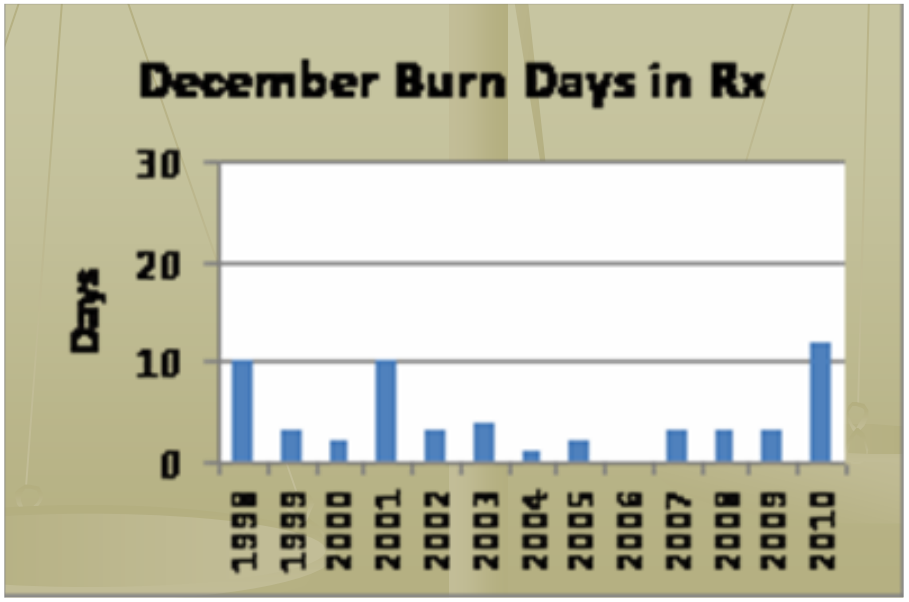

Average Monthly Occurence of Multiple Burn Days in Prescription
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
Consecutive Day Periods
2-4 days
5-7 days
8-10 days

Annual Burn Day Variation



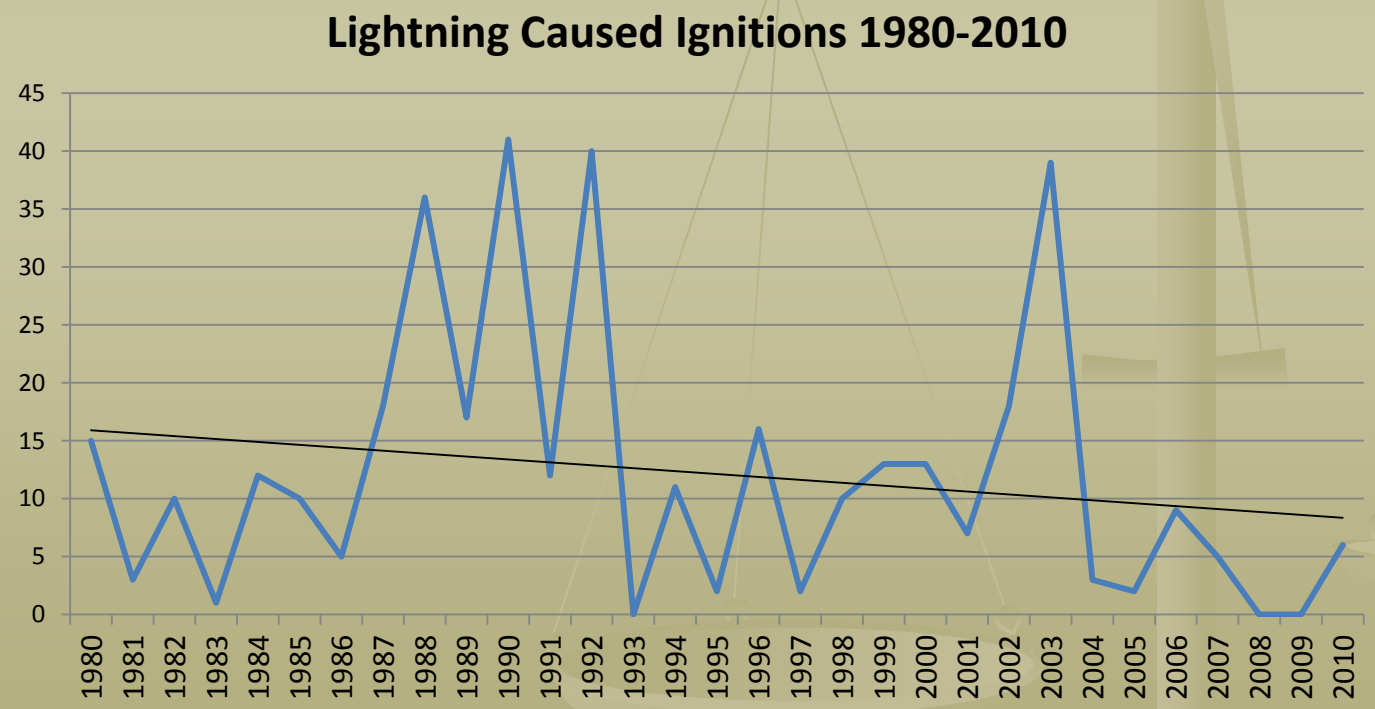






Potential Managed Wildfire

- Average natural ignitions/year= 11.9 (SE=0.62)
  - Only averaging 3 ignitions per year last 9 years (including 4 ignitions in 2011). Probably cyclic.
  - 4.2% of lightning strikes cause an ignition
  - However, related more to receptive fuels

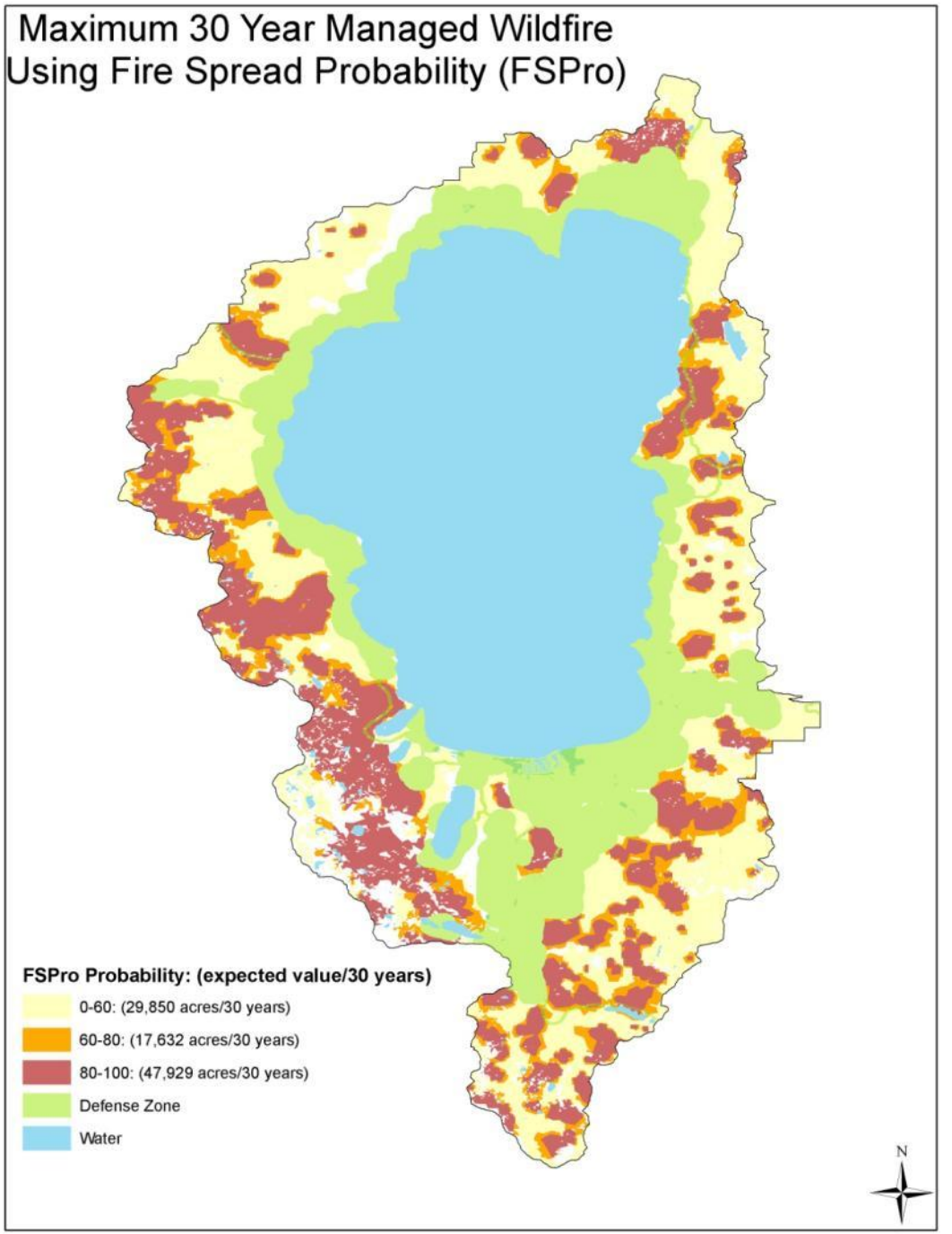


Potential Managed Wildfire

- FS Pro- Geospatial model
  - Parameters & Assumptions
    - Best-case: Every lightning ignition (1990-2009)
    - 500 fire growth iterations for each ignition point
    - 7-day burn modeled for Aug. 1st ignition (2007, 2009, 2011)
      - Dry, average, and wet precipitation year (respectively)
      - Majority of lightning strikes and ignitions occur in July-August
  - Output: Each cell assigned to a probability bin based on number of times burned
    - Expected Value = polygon acres x mid-bin probability value
    - 0-60% (Not included in estimate due to low confidence)
    - **60-80%, 80-100%** (Potential Managed Wildfire)
  - Fire spread restricted by:
      - Other ignition's fire spread
      - Boundaries of the Lake Tahoe Basin and WUI Defense Zone

- **Results:**
  - Annual Average
- **80-100% = 1,598 ac.**
- **60-80% = 588 ac.**
- 0-60% = 995 ac.
- *Potential Mean Annual Managed Wildfire = 2186 ac*

  - Total (30 years)
- **80-100% = 47,929 ac.**
- **60-80% = 17,632 ac.**
- 0-60% = 29,850 ac.
- *Potential total area burned in model = 65,561 ac*



Potential Managed Wildfire

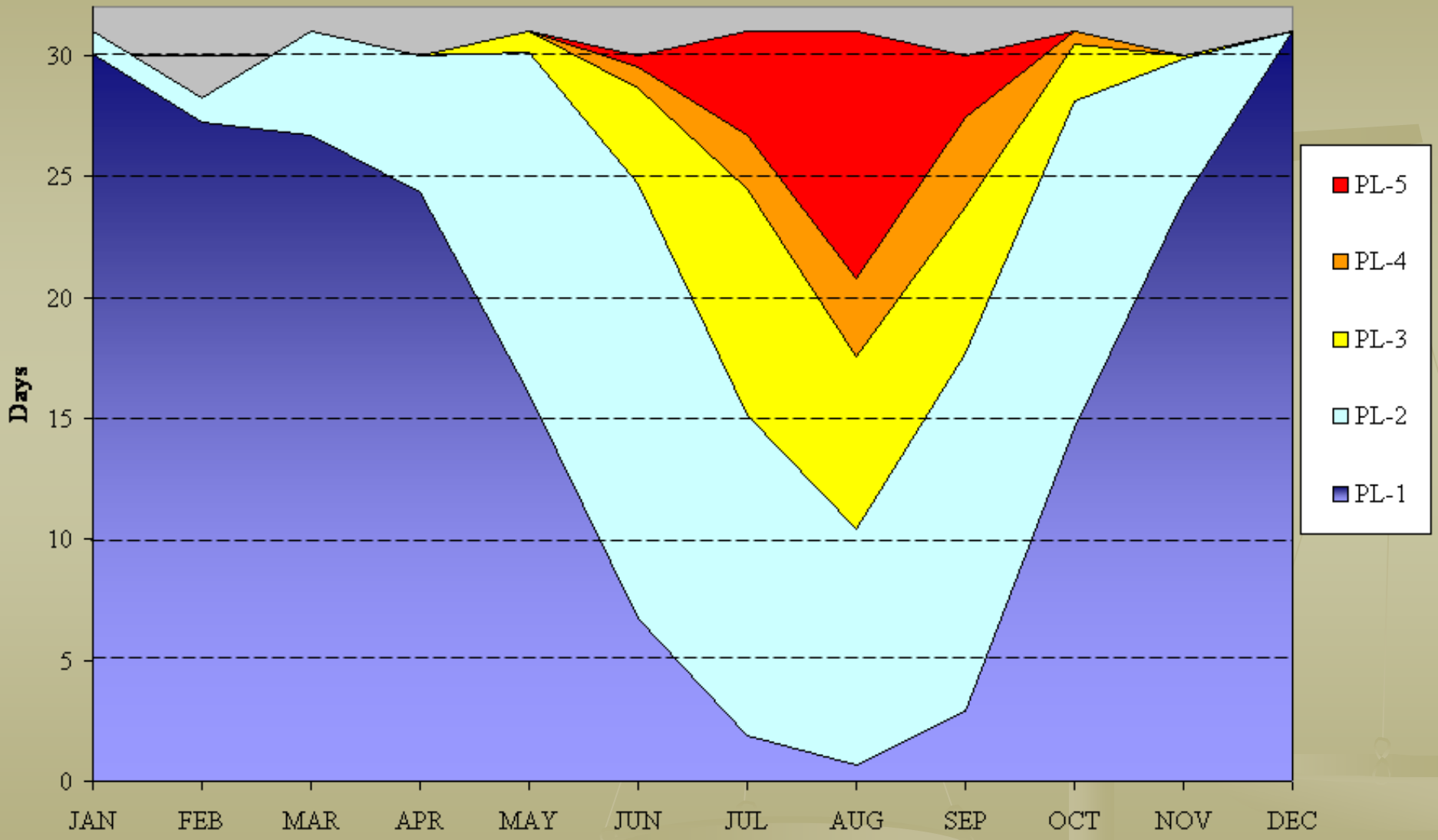
- Additional FSPro outputs
  - Also model runs for 2007 and 2011
  - 2007 was a dry year conducive to large fires
  - 2011 followed a record precipitation year for the LTB
  - 2009 an average precipitation year for LTB

Year	0-60	60-80	80-100	60-100
2007 (dry)	957	796	3,883	4,679
2009 (avg.)	995	588	1,598	2,186
2011 (wet)	999	441	663	1,104

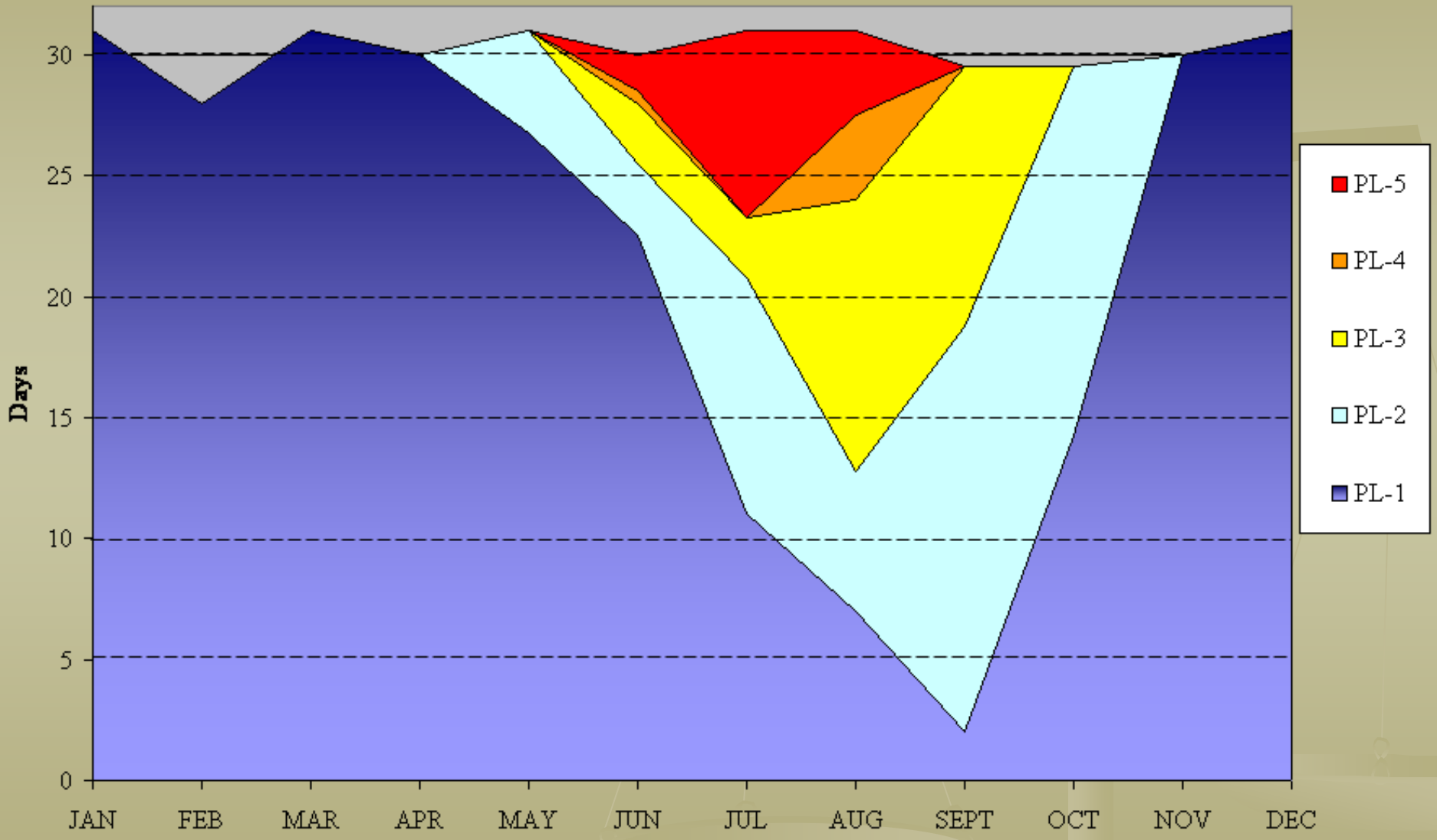
Fire Resource Availability

- National & NOPS Preparedness Level (PL)
  - Measures the proportion of committed resources for the given geographic area daily (IMTs, crews)
  - Surrogate measure for 'availability'
  - Levels 1 – 5 (e.g. 'PL-5' most resources committed)
- Assumption:
  - More committed resources means fewer assigned and contingent resource coverage for Rx & Managed Wildfire implementation
  - PL-3 -- PL-5 = inadequate available resources
    - >50% of resources committed to incidents in more than two geographic areas

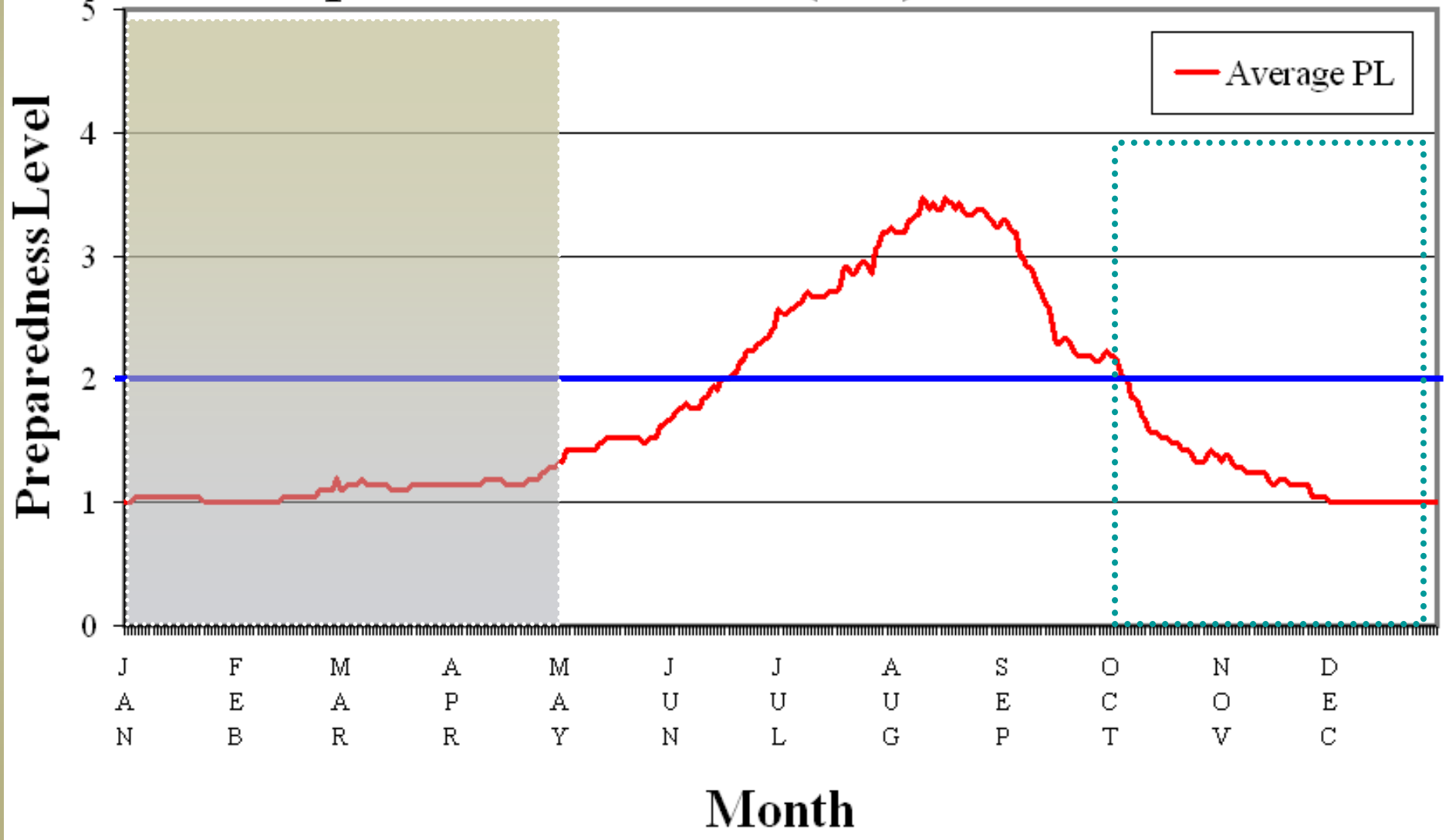
Average Monthly National Preparedness Level Days (1990-2009)



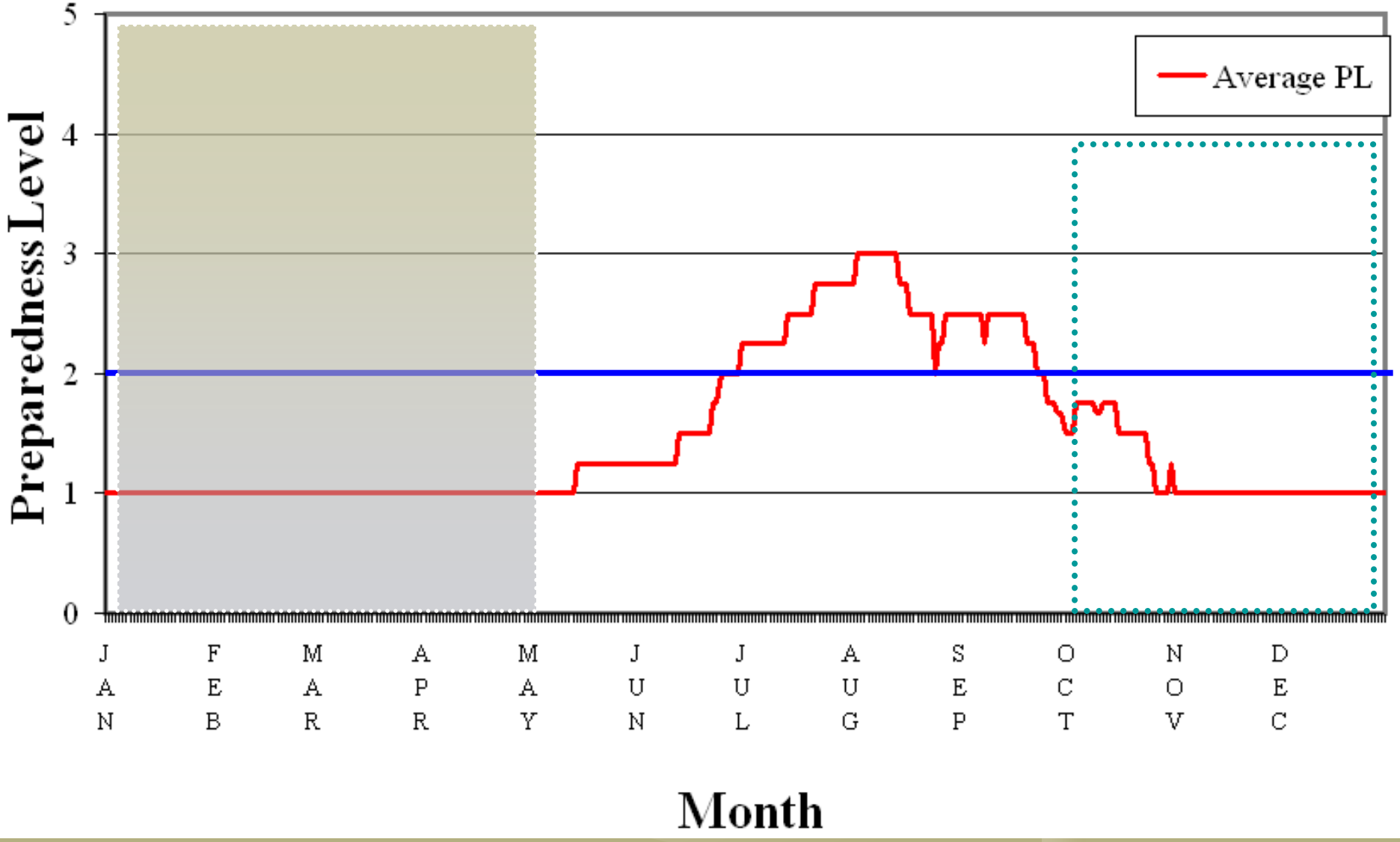
Average Monthly NOPS Preparedness Level Days
(May 2008 - Mar. 2012)



20-Year Daily Average of National Preparedness Level (PL); 1990-2010



4-Year Daily Average of NOPS (GAC) Preparedness Level; May 2008- Mar. 2012



Summary of Results

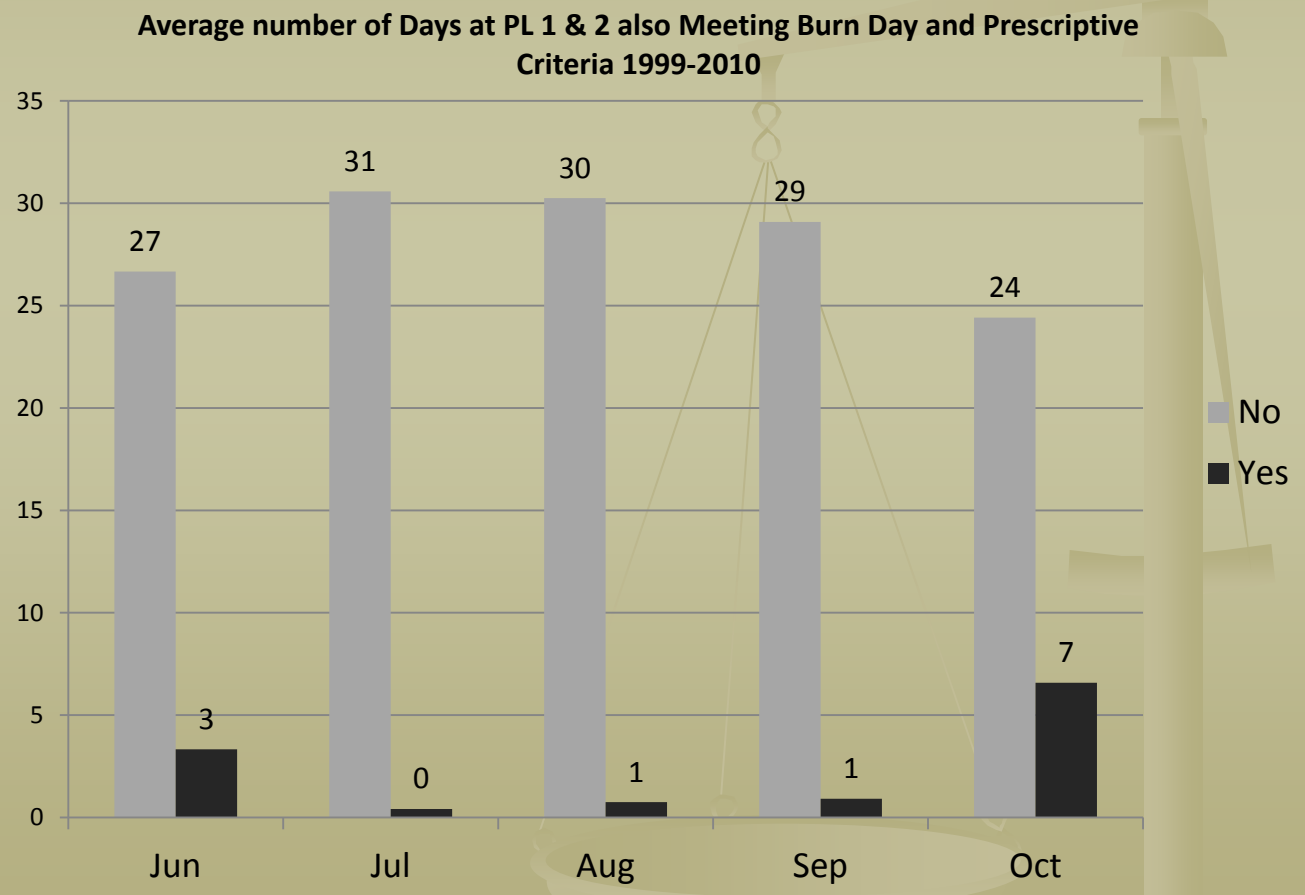
- Burn Day Analysis:
  - Average Late Season (Oct-Dec) Burn Days = 22
  - Average Consecutive Burn Days:
    - 2-4 day period = >1 per month (most abundant)
    - 5-7 day period = 1 per 2 years
    - 8-10 day period = 1 per 5 years
- Potential Managed Wildfire:
  - Potential Mean Annual Managed Wildfire = 2,186 ac
- Fire Resource Availability:
  - Vast majority of Oct.-Dec.= PL-1 or PL-2 (Nat'l & NOPS)
  - July - September highly variable (>PL-2)
    - National = Questionable; NOPS = Somewhat feasible

Summary of Results

- Most natural ignitions occur July-Sept. (92%) and might continue to spread until first winter storm.
- Therefore the most ecologically beneficial fire (RX or Managed) should be during this period.
- Historically (1999-2010), between June & Oct. NOPS PLs 1 and 2 occur very infrequently (Avg. 12 days total Jun.-Oct. **Only 2 days Jul.-Sep**.).

Summary of Results

- Fire Resource Availability with Burn Day and Prescriptive Criteria Met June-October 1999-2010



Conclusions & Discussion

- Burn **whenever possible!**
  - Which is most likely October - December
    - With valid Burn Days in Rx and available resources
- Restoring pre-Euroamerican influenced fire regime is more difficult than number of acres burned annually.
- Only analyzing 3 limiting factors
  - Social, health and fiscal concerns may trump all analyses presented here
  - Risk aversion/mitigation among line officers and fire managers is always a factor

Conclusions & Discussion

- Forest Service focus on forest resilience and restoration:
  - The quantifiable analyses show a departure between desired conditions and predicted restoration capabilities…
    - Is restoration of ecologically beneficial fire feasible?
  - How can we expect risk to values to affect fire management decisions?
    - Will that impact feasibility?
  - Can the void be filled by Rx, managed wildfire, and fire surrogates? Or are we shooting for the Moon?
    - When you shoot at the Moon, you MIGHT hit the pie in the sky!

Questions?

Thank You

Comments, questions, or suggestions:

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