

# Fire And Smoke Model Evaluation Experiment (FASMEE)

A Large Integrated Multiagency Fire Study

<http://fasmee.net>

## Project Leads

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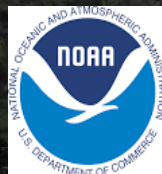
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IBBI

Boulder, CO

July 10-11, 2017



# Outline



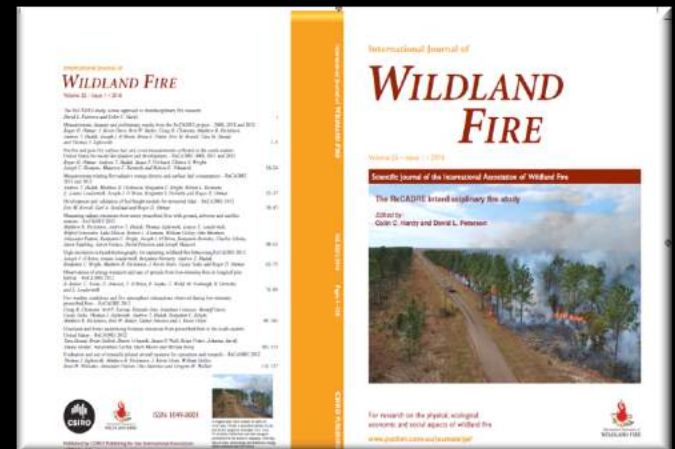
- **Background**
- **The Science Question & Goal**
- **Overview**
- **Phases, Process, and Study Plan**
- **Multiagency Integration**
- **Selected Sites**
- **Timeline, Milestones and Questions**





# Background

- Grew out of a need for a collaborative data set across the research community to:
  - Evaluate current fire & smoke models
  - Develop next generation fire & smoke models
  - Assess new measurement techniques
- 2008 Core Fire Science Caucus & 2011 RxCADRE did this informally
- Formalized through the JFSP grant:
  - RxCADRE-Eglin AFB (2012)
    - Data repository
    - IJWF special issue
    - Lessons learned
- FASMEE (Phase 1) developed from the success of RxCADRE and guidance from
  - Smoke Science Plan (2013)
  - JFSP Smoke workshop (2013)
- Funding from the JFSP and DoD ESTCP for Phase 1



# FASMEE Science Question and Goal



*Joint Fire Science Program: "Research in response to the emerging needs of policymakers and fire managers"*

**Science Question:** How do fuels, fire behavior, fire energy, and meteorology intercombine spatially to determine the dynamics of plumes and the long-range transport of smoke and its chemical evolution?



**Goal:** To use innovative and efficient measurement techniques to collect critical observational data necessary to evaluate and advance operationally used fire and smoke modeling systems.



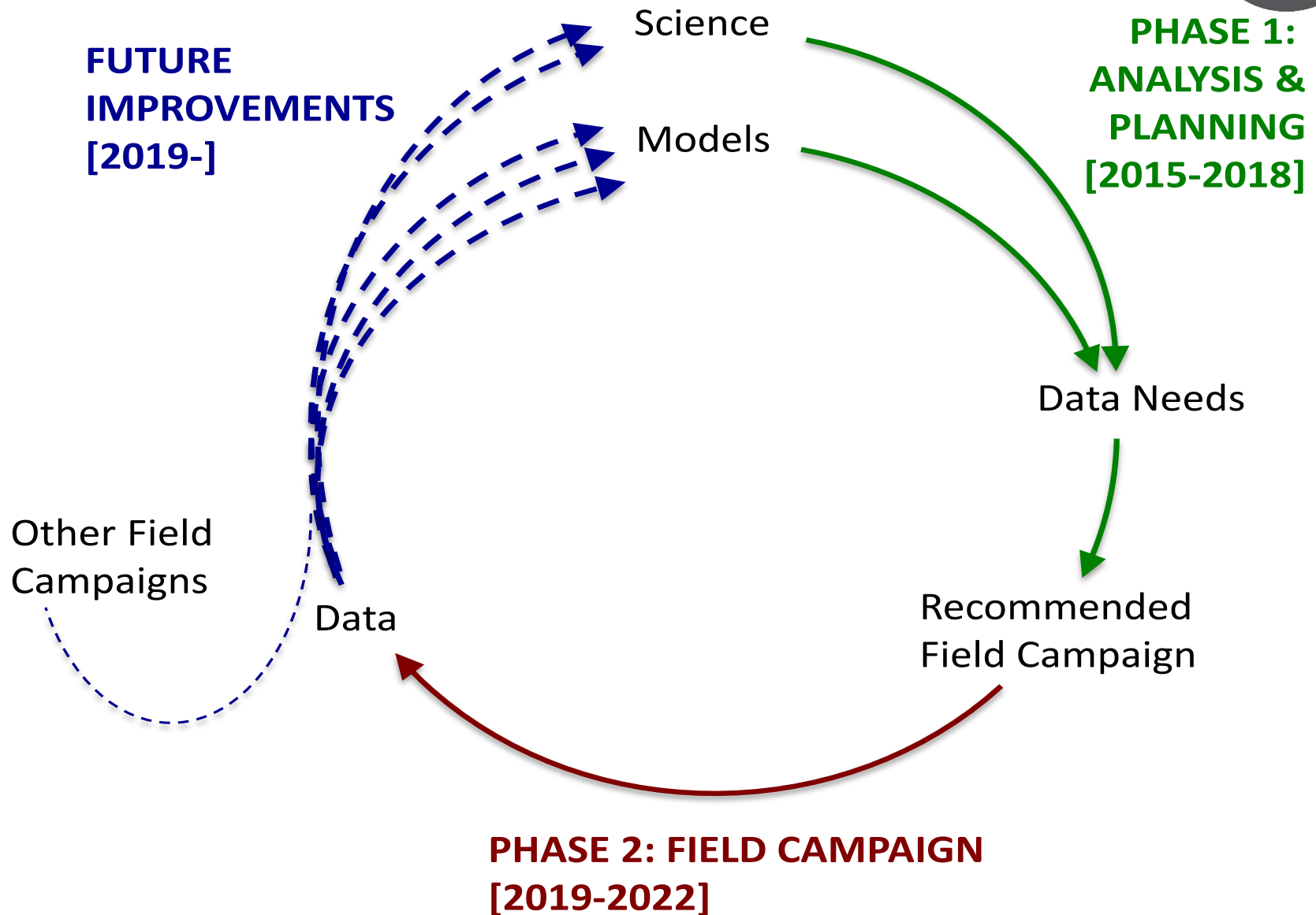
# Quick Overview



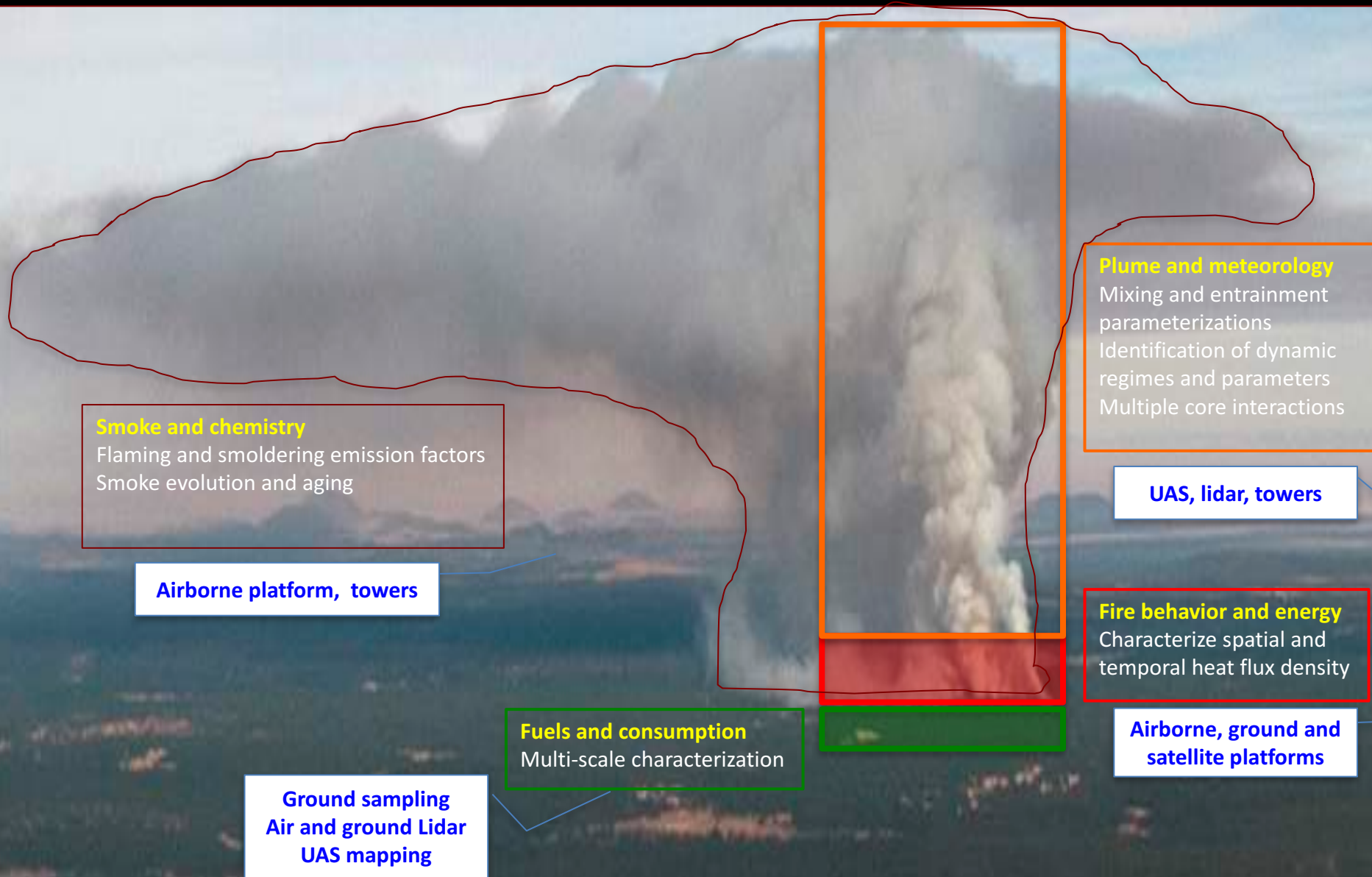
- **Large field campaign**
  - >500 acre prescribed burns /wildfires
  - Intensively instrumented
    - 140 + scientists & technicians
    - 20 + government agencies and Universities
  - High end of fuel load and intensity
- **Study sites in the**
  - Western US
  - Southwest US
  - Southeast US
- **Interrelated disciplines**
  - Fuels and consumption
  - Fire behavior and energy
  - Plume development and meteorology
  - Smoke emissions and chemistry
  - Modeling
- **Core set of targeted measurements**
  - Designed by discipline and modeling leads
  - Fuel and fire characterized to support plume and smoke measurements
- **Integrating with FIREX (NOAA), FIREChem (NASA), EPA, and NSF**
- **Opportunity for additional measurements and agency partnerships (i.e. ECOFASMEE)**



# Phases



# Key model improvements and evaluation



## Smoke and chemistry

Flaming and smoldering emission factors  
Smoke evolution and aging

Airborne platform, towers

## Plume and meteorology

Mixing and entrainment parameterizations  
Identification of dynamic regimes and parameters  
Multiple core interactions

UAS, lidar, towers

## Fire behavior and energy

Characterize spatial and temporal heat flux density

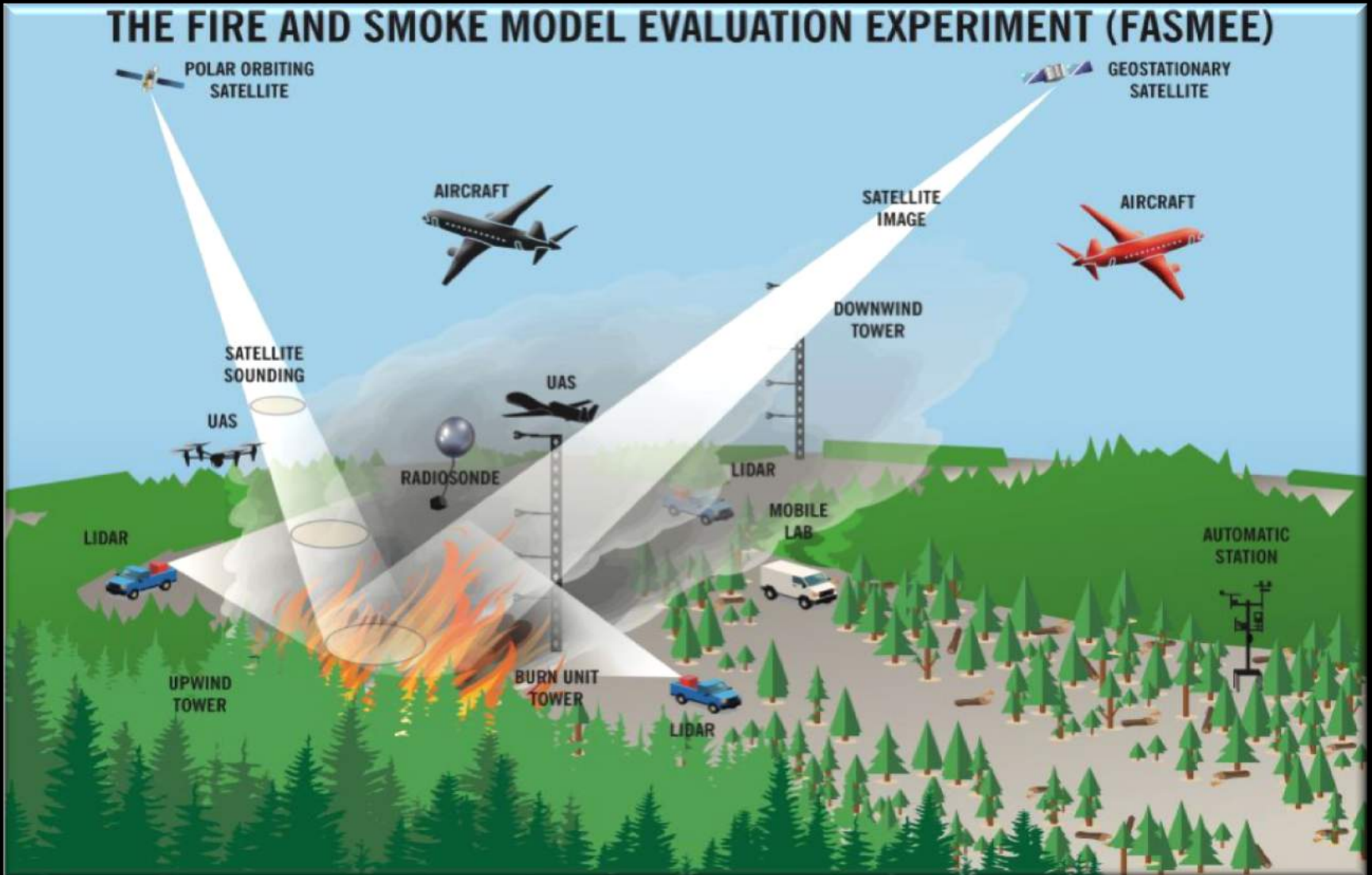
Airborne, ground and satellite platforms

## Fuels and consumption

Multi-scale characterization

Ground sampling  
Air and ground Lidar  
UAS mapping

# Integrated experiment with sharing of resources







# Study Plan

- Discipline and modeling expertise
- Background and context
- Modeling needs
- Recommended measurements and justification
- Use of data collected
- Logistic and specialized sub-plans (e.g. data management plan, Incident Action Plan, safety plan, etc.)
- Leadership, hosts, liaison
- Peer review (June); distribution mid-July



# Coordination with FIREX, FIREChem, NSF, and EPA smoke and chemistry measurements



The FIREX and FIREChem campaigns as well as US EPA and NSF research projects are aimed at advancing our understanding of smoke and how it influences the chemistry of the atmosphere.

- FIREX: P-3 and other aircraft
- FIREChem: DC-8
- NSF: C-130
- EPA: Mobile lab

## Mutual Benefits:

- **Achievement beyond accomplishment by individual program or agency**
- **Characterize entire smoke modeling chain**
- **Advances collaboration**
- **Best interest of respective organization**
- **Marketing**

## Fire Influence on Regional and Global Environments Experiment (FIREX)

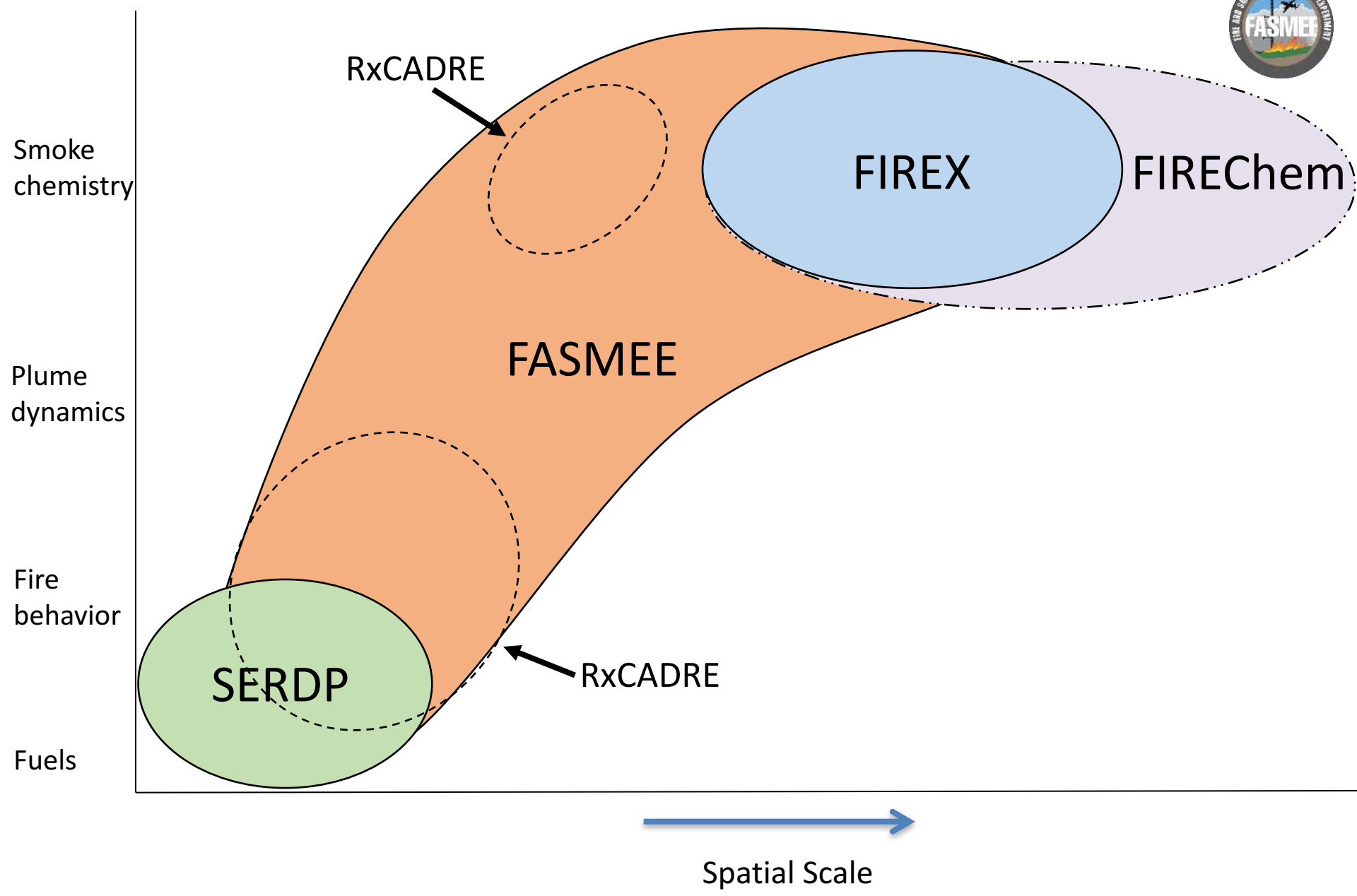
The Impact of Biomass Burning on Climate and Air Quality:  
An Intensive Study of Western North America Fires



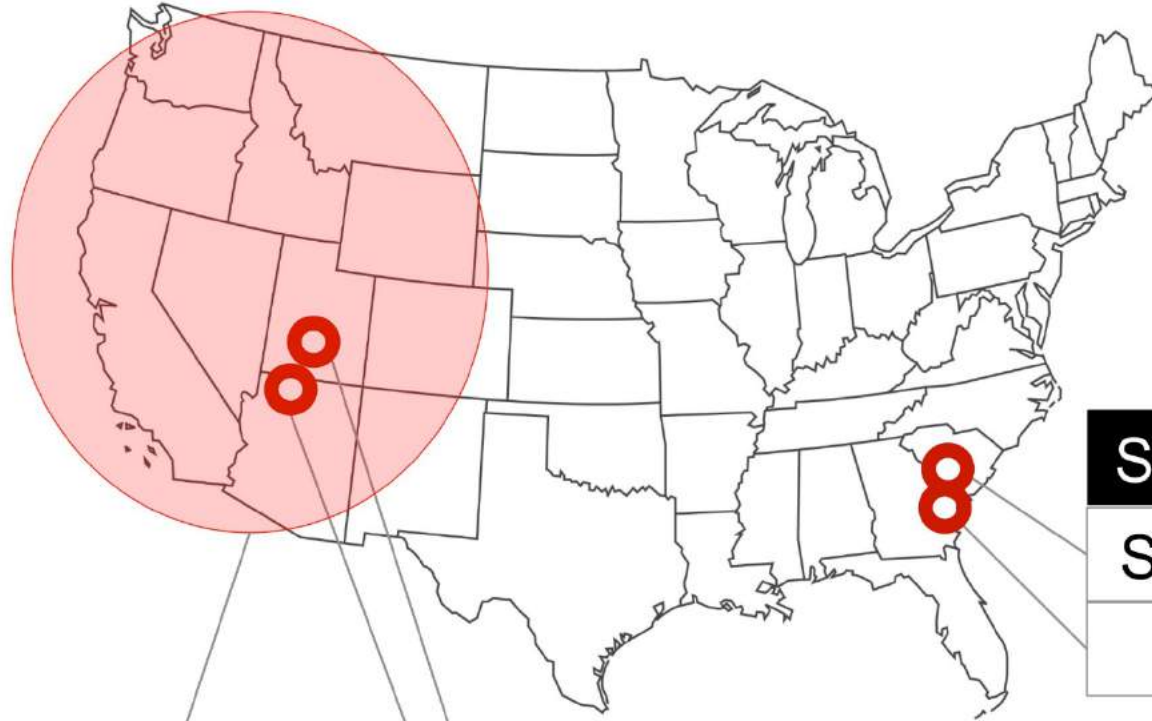
## FIREChem

A cooperative wildfire air quality  
field study designed to  
complement FASMEE and FIREX





# FASMEE Campaigns



**Southeast Campaign**

Savannah River Site

Fort Stewart

**Western  
Wildfire  
Campaign**

**Southwest Campaign**

Fishlake NF

North Kaibab RD



# Western Wildfire Campaign

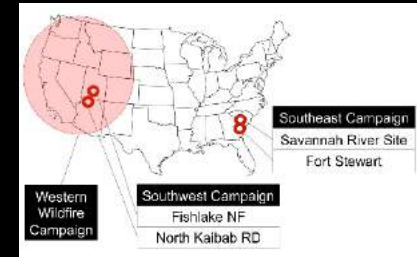


- **Rapid deployment**
- **Planned campaign with FIREEX, FIREChem, NSF: summer 2019**
- **Assist in selecting wildfires**
  - Available pre-fire LiDAR and other fuel map sources fuels maps
  - Potential for dynamic long lasting plumes
  - Reasonable ground access
  - cooperation of Incident Command
- **Source characterization support**
  - Minimal instrumentation
  - Fuel and consumption
  - Fire growth and intensity
  - Plume dynamics





# Southwest Campaign—North Kaibab



- **Planned campaign : Aug/Sept 2019**
- **Data collection**
  - Moderate instrumentation
  - Fuel and consumption
  - Fire growth and intensity
  - Plume dynamics
  - Smoke/chemistry





# Ignition

- 2,000 acres
- Mixed severity, not stand replacement fires
- 3 to 4 day ignitions

**Photo: North Kaibab RD—Fall 2016**



**FASMEE North Kaibab SW campaign projected burn: Fall, 2019**

**Photo: North Kaibab RD—Fall 2016**



**FASMEE North Kaibab SW campaign projected burn: Fall, 2019**





**Photo: North Kaibab RD—Spring 2017**



**Photo: North Kaibab RD—Spring 2017**





# Southwest Campaign—Fishlake National Forest

- Planned campaign: May/June 2021
- Data collection
  - Maximum instrumentation
  - Fuel and consumption
  - Fire growth and intensity
  - Plume dynamics
  - Smoke/chemistry





# Ignition

- **1,200 acres**
- **Stand replacement, free running fire**
- **Single day ignition**



## Fuels--Manning Creek Unit—Fishlake NF

Planned Stand replacement fire burn SW  
campaign: Spring, 2021





## **Manning Creek Unit (1000+ acres) Fishlake NF**

**High intensity instrumentation**



Large unit burn example from June, 2016—Fishlake NF

© KR

Post Fire, June 7, 2016



Post Fire, July 11, 2016



Post Fire, July 11, 2016





**Small knob unit--50-200 acres--Fishlake NF**





# Single day, simple ignition ringed free running fire

Small knob unit burn example from June, 2016—Fishlake NF



Post burn, knob unit burn example from June, 2016—Fishlake NF

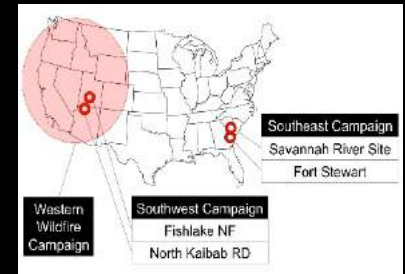


**Brianhead wildfire, June, 2017**

# Southeastern Campaign—Fort Stewart, GA



- **Planned campaign: Jan-April, 2022**
- **Data collection**
  - Maximum instrumentation
  - Fuel and consumption
  - Fire growth and intensity
  - Plume dynamics
  - Smoke/chemistry





# Ignition

- 600+ acres
- Underburn
- 2 to 4 units, single day ignitions

06/20/2012

Planned prescribed burns, SE  
campaign: winter, 2022

# Fort Stewart

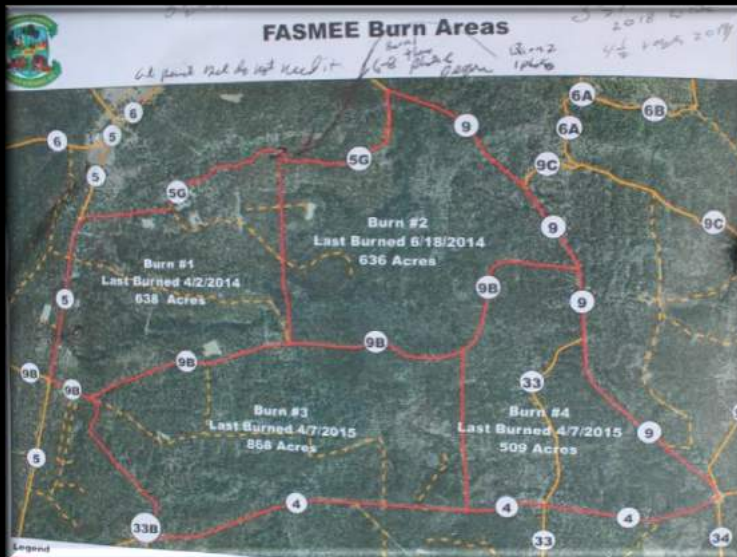
High intensity instrumentation



1 – Year Rough

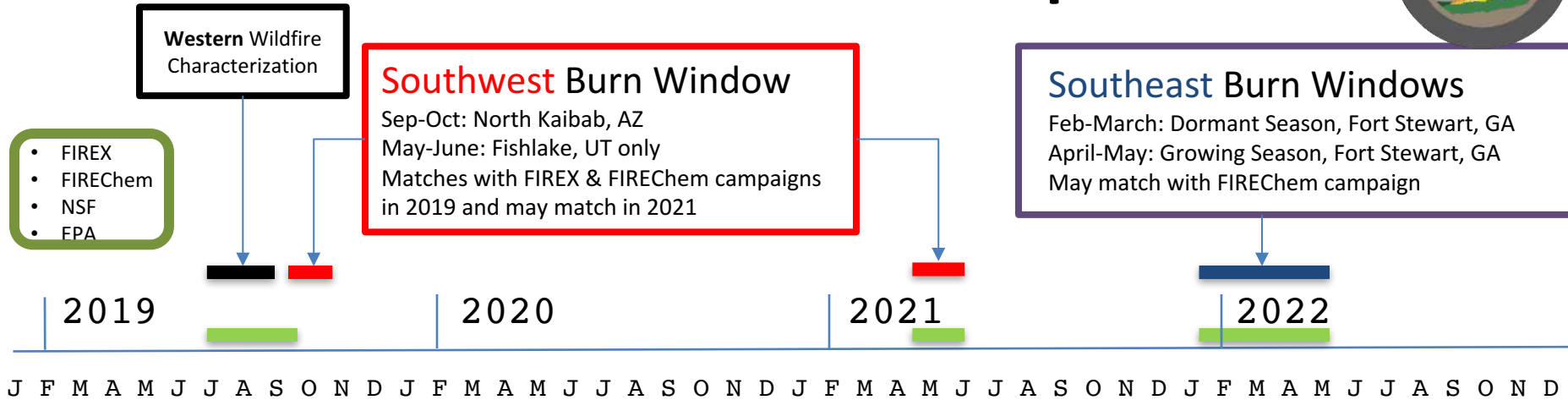


5 – Year Rough

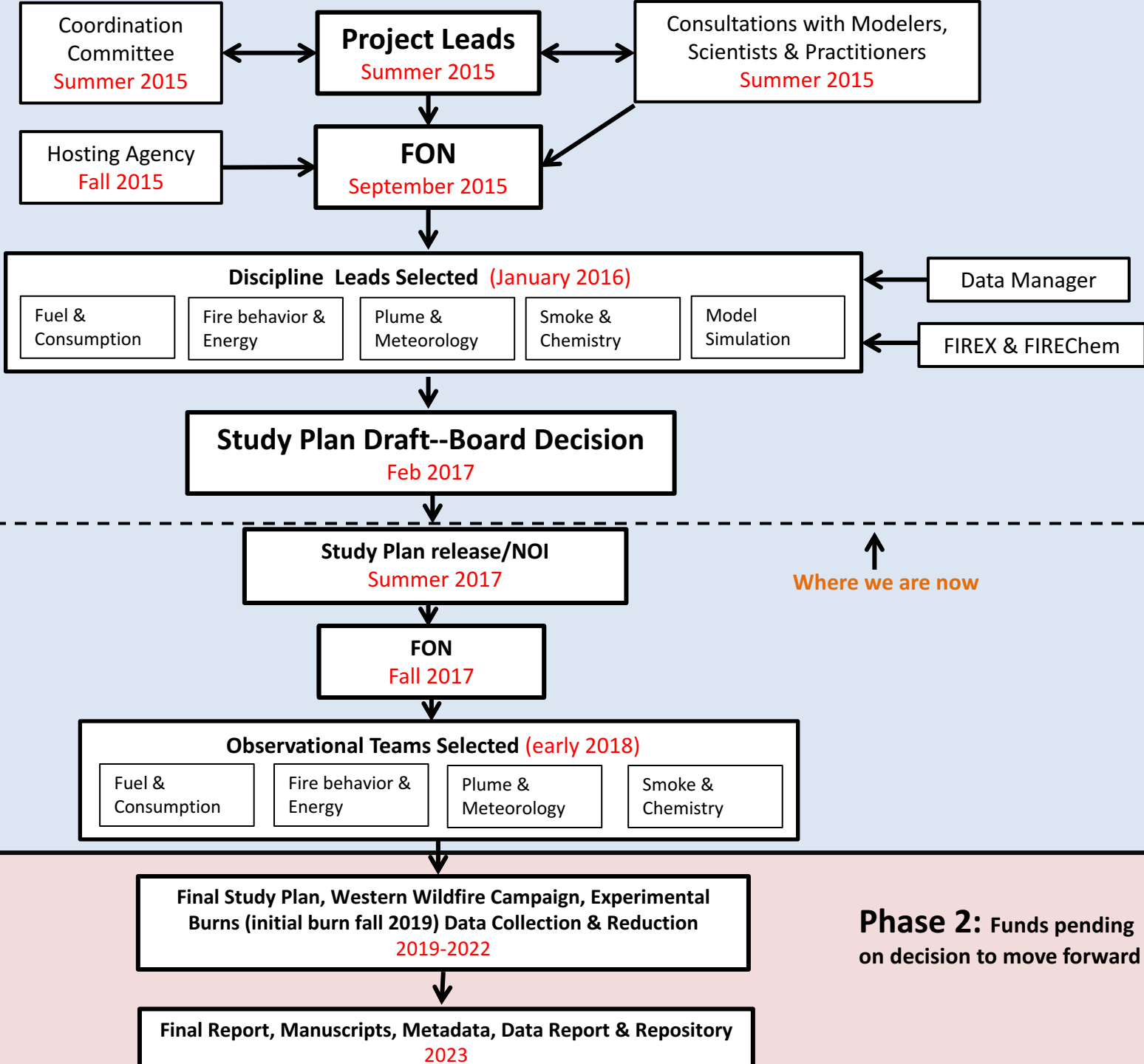




# FASMEE Burn Timeline Options



**Phase 1:** Funded for coordination, planning, marketing, development of funding opportunity notices, western wildfire campaign support, and completion of study plan



Where we are now

Where we are now

**Phase 2:** Funds pending on decision to move forward





# Questions and Discussion