Probabilistic Safety Assessment & Management Conference
June 26th – July 1st, 2022, Hawaii, USA.

Wildfire Risk Assessment And Management of Power Grids

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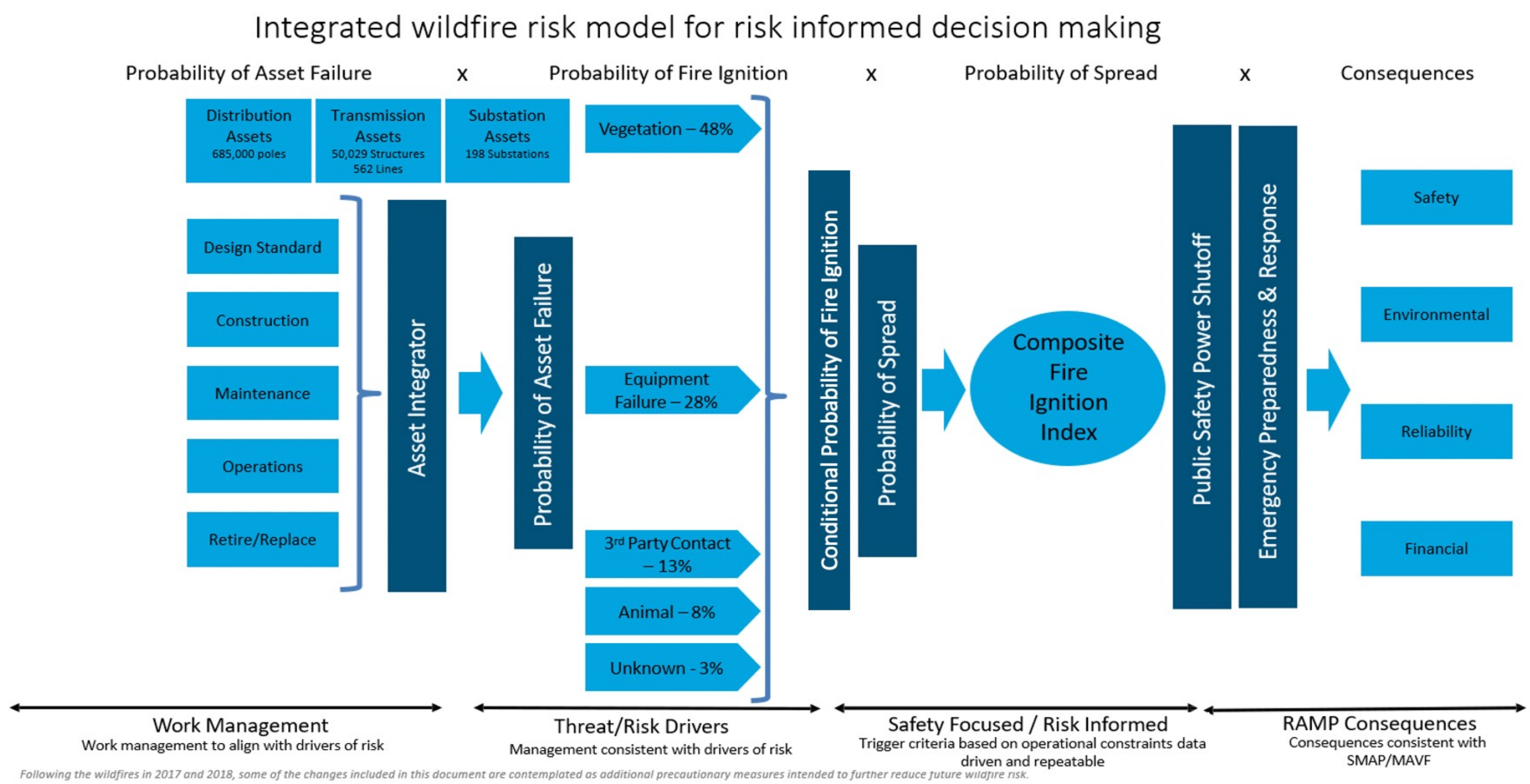
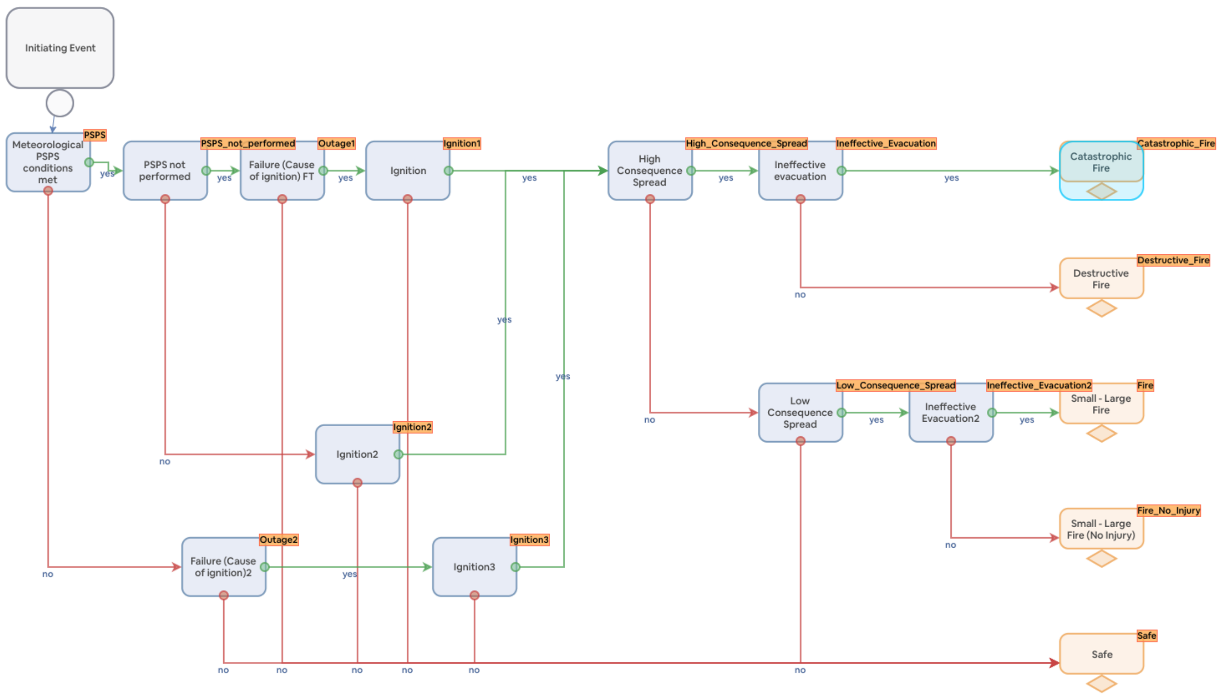
Objectives

Develop an integrated Wildfire PRA methodology and software platform for PSPS, asset management, and other risk mitigation decisions

Starting Point…



Implementation Approach



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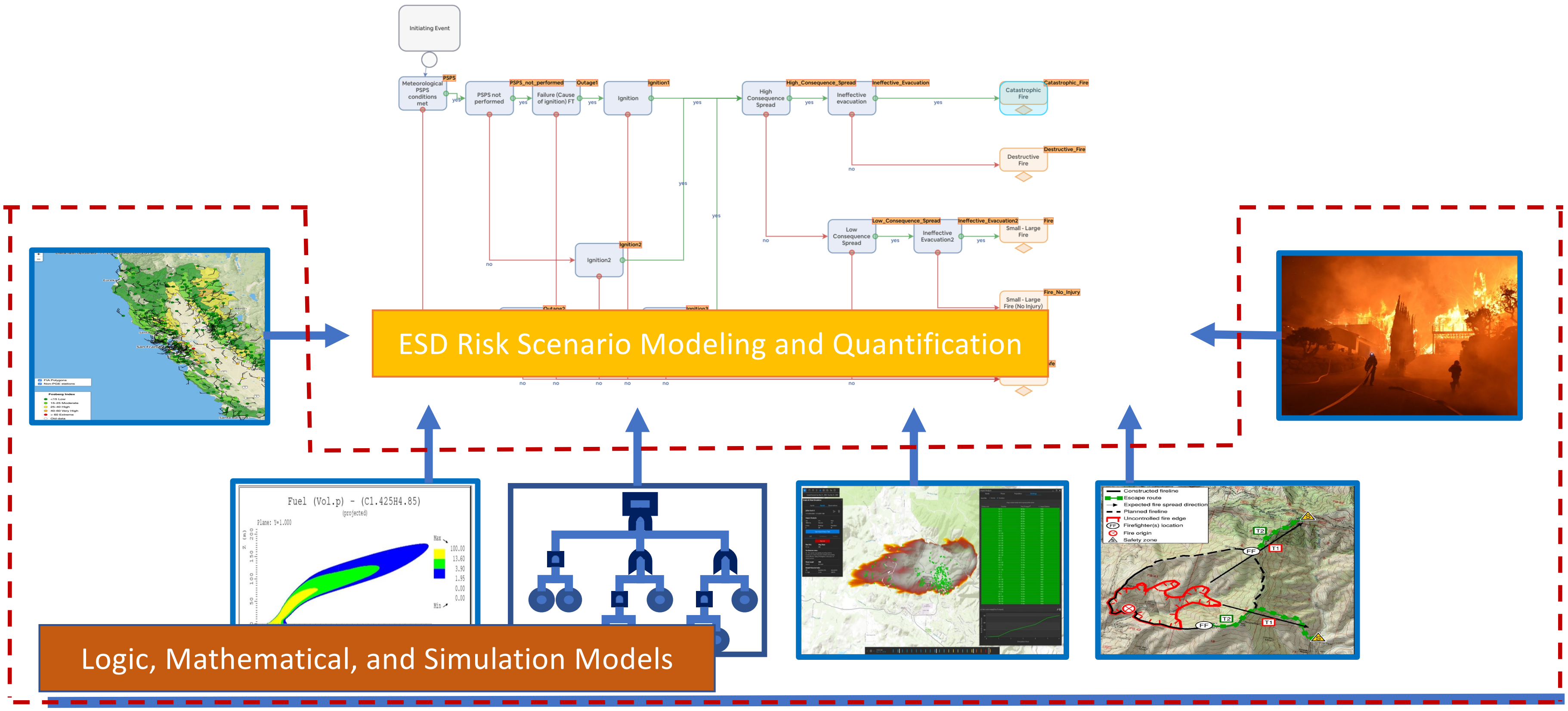

Application Modes

1) **Planning Mode** for long-term risk management and decisions such as asset management strategies and prioritization of risk mitigation options;
2) **Operational Mode** for continuous risk monitoring and decision support based on real time or near real time information to inform operators of the changing risk levels;
3) **Event Mode** for decision support during an active fire situation.

All three modes use the same fundamental risk model structure

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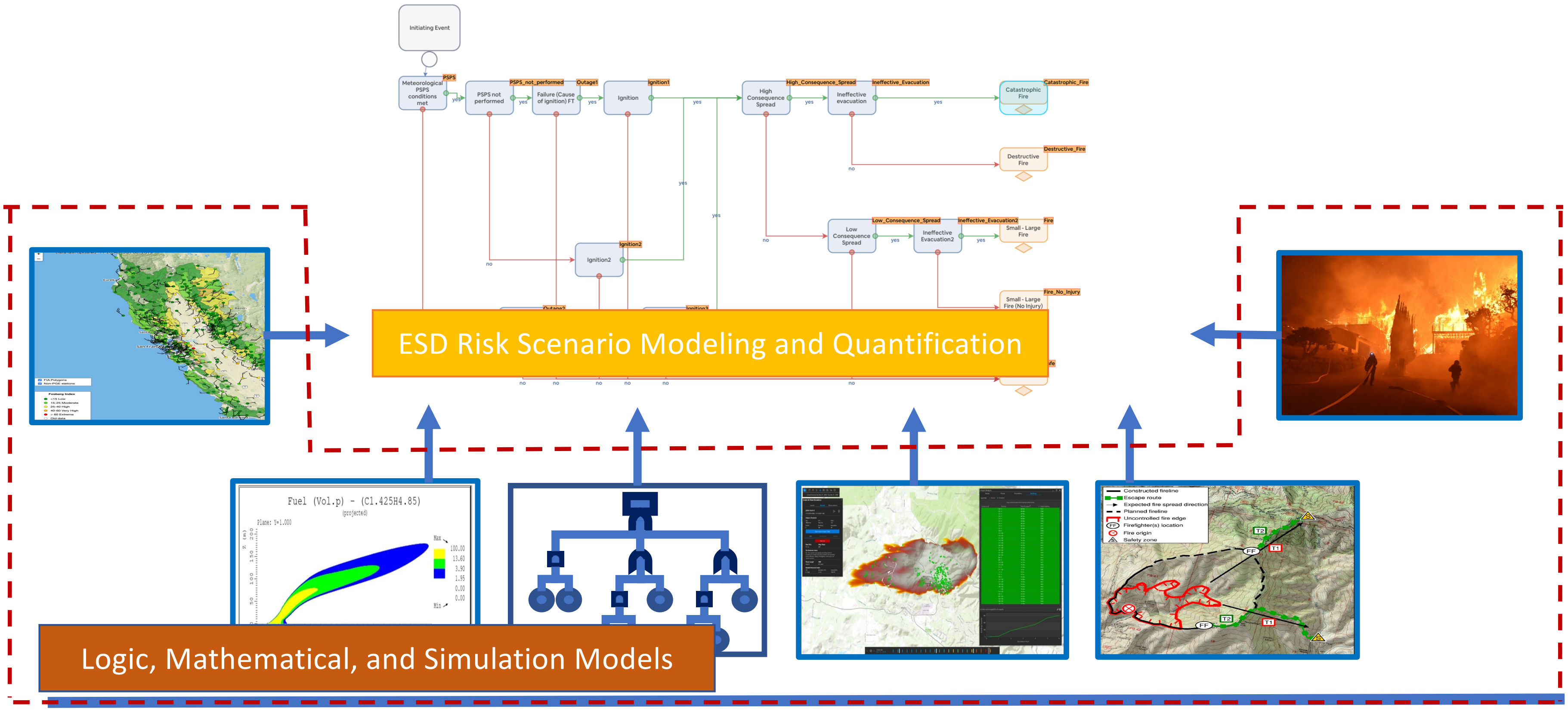

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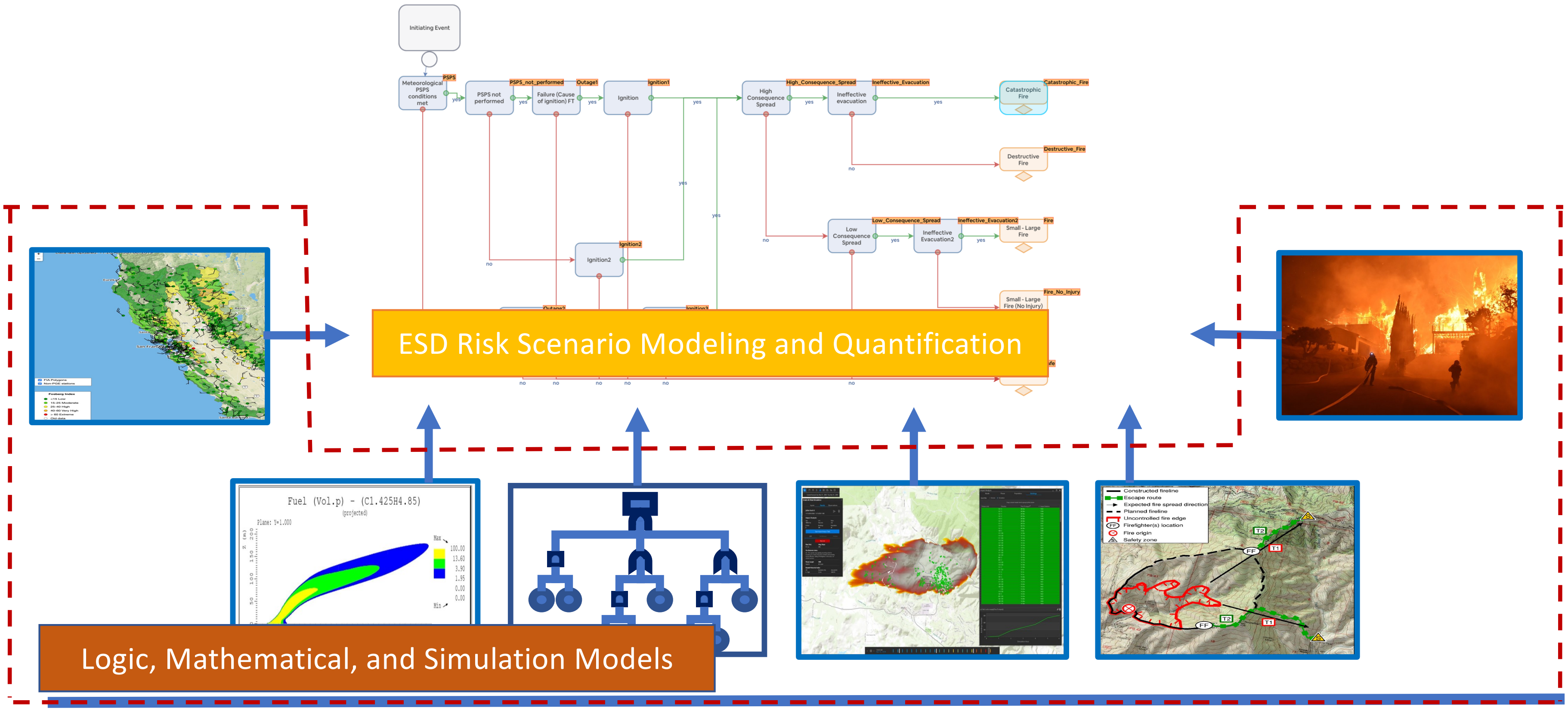

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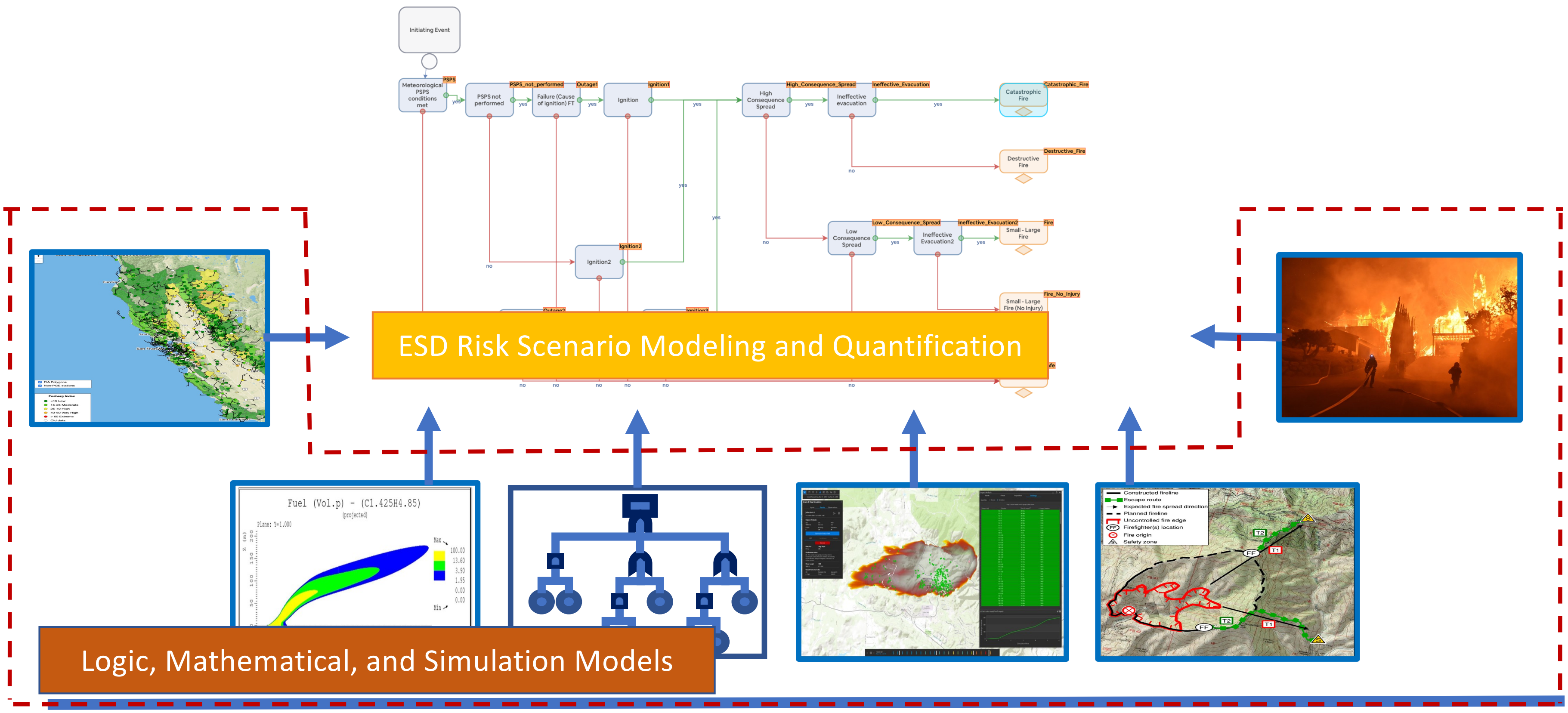
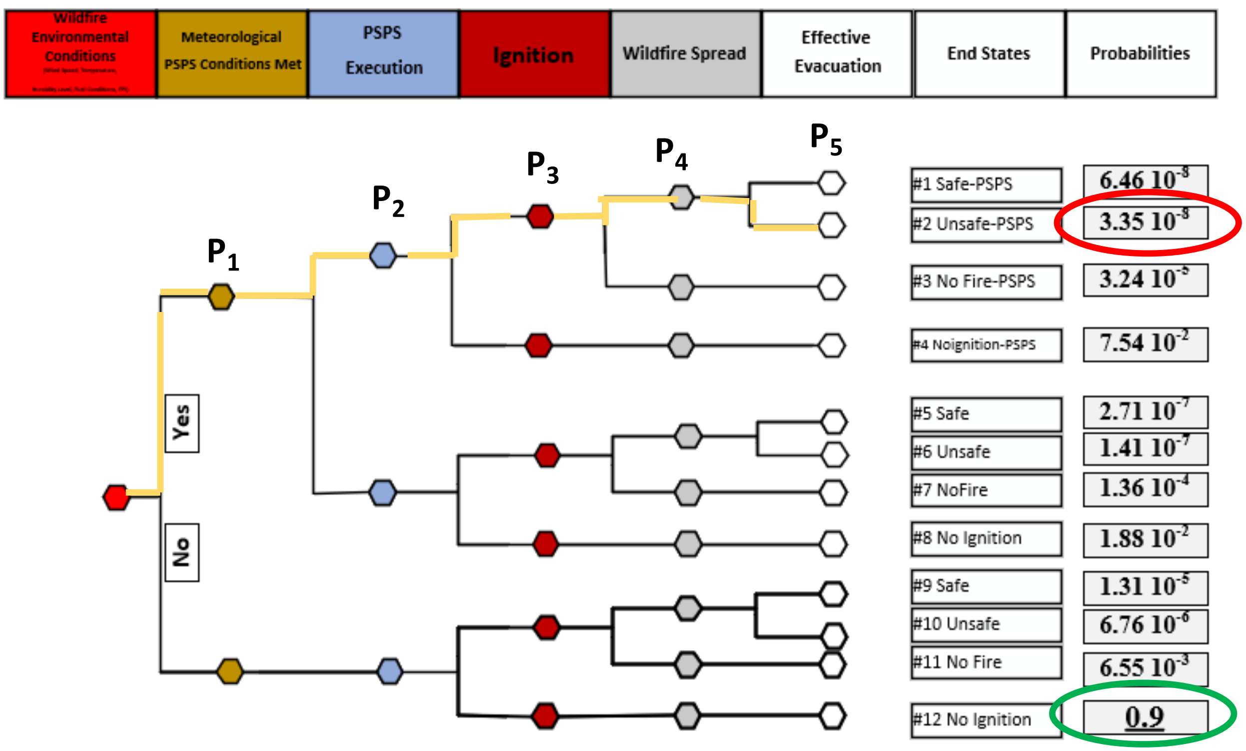
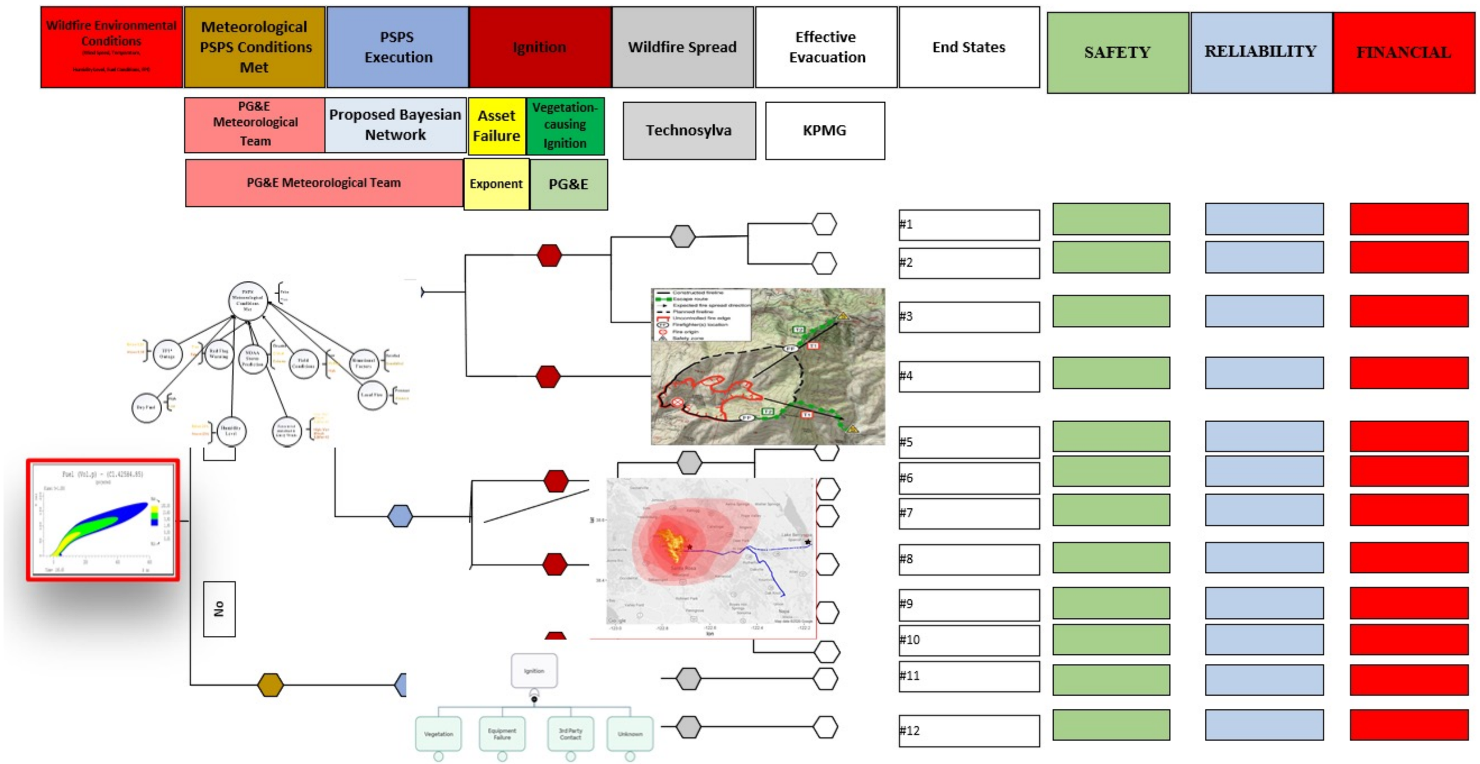


Master ESD



$P_{\#2}=P_1*\ldots*P_5$

Extended Master ESD – Consequence Assignment



Extended Master ESD – Consequence Assignment

Step 1:

- ❑Acre burned
- ❑Building impacted
- ❑Population impacted

Extended Master ESD – Consequence Assignment

Step 2:

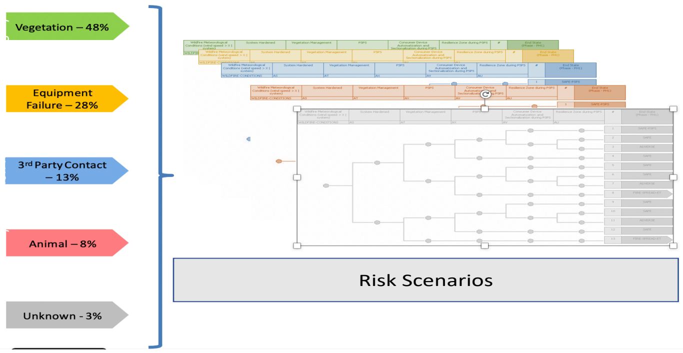
- **Safety** [fatality/number of people]=POP*(fatality factor)
- **Financial** [$]=$A*BU + $B*AC
- **Reliability** [million minutes customer power outage]=

  If AC<300 then Reliability=C
  If AC>=300 & BU<50 then Reliability=D
  If AC>=300 & BU>=50 then Reliability=E

We normalize Financial, reliability and safety histograms.

Combined Impact = 0.5*normalized Safety risk curve +
0.25* normalized Financial risk curve +
0.20* normalized Electrical Reliability risk curve+
0.05* normalized Gas Reliability risk curve

Model Integration and Risk Quantification



MAVF

Safety Impact

Reliability Impact

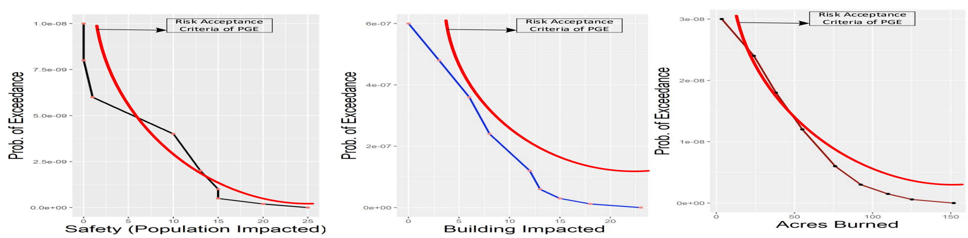
Financial Impact

Environmental Impact

Expected Risk Score
Probability times Consequence

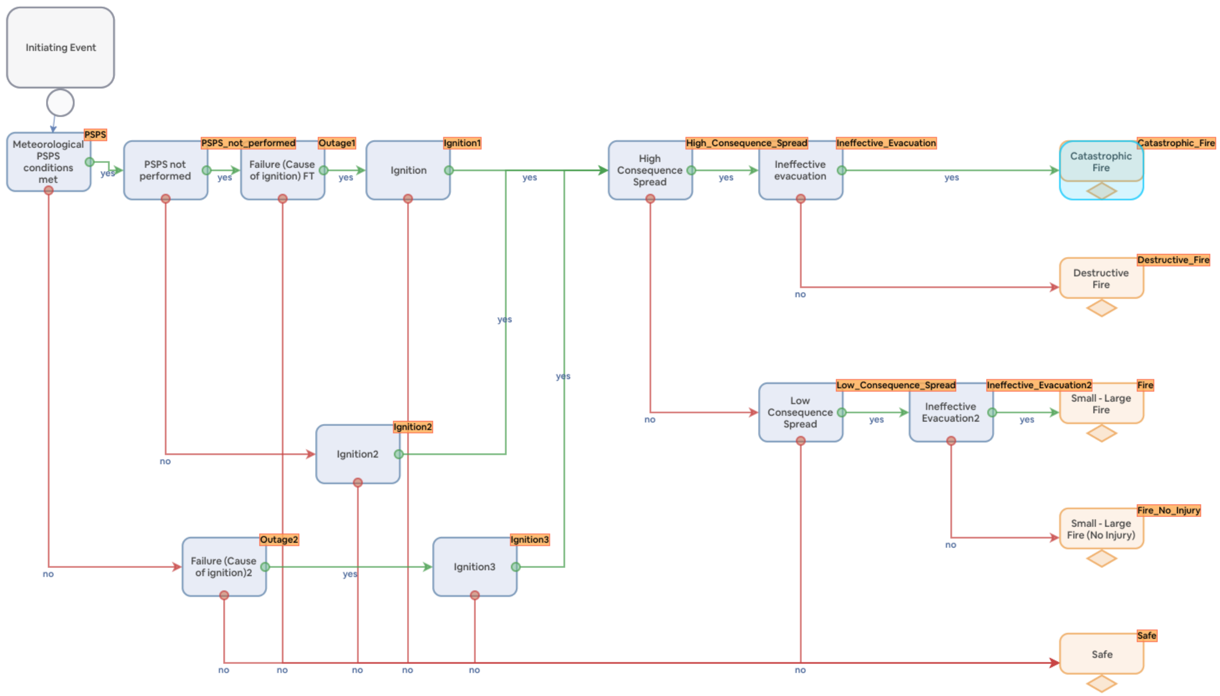
$$R_S = \Phi \sum_{i=1}^{N} P_{Si} S_i \qquad R_R = \Phi \sum_{i=1}^{N} P_{Ri} R_i$$

$$R_F = \Phi \sum_{i=1}^{N} P_{Fi} F_i \qquad R_E = \Phi \sum_{i=1}^{N} P_{Ei} E_i$$



Risk Curve
Probability vs Consequence

Risk Mitigation (e.g., Asset Management)



Summary

- The presentation offered a scenario-based approach which is rooted in a fundamental and popular risk theory and forms the basic platform for integration of techniques and models needed to identify the wildfire risk scenarios and quantify their probabilities.
- The backbone of the framework is the Hybrid Causal Logic (HCL) approach, a multi-layered structure that integrates event sequence diagrams (ESDs), fault trees (FTs), and Bayesian Networks (BNs)
- The proposed methodology covers uncertainties stemming from needed simplifications and approximations in a formal and systematic way.