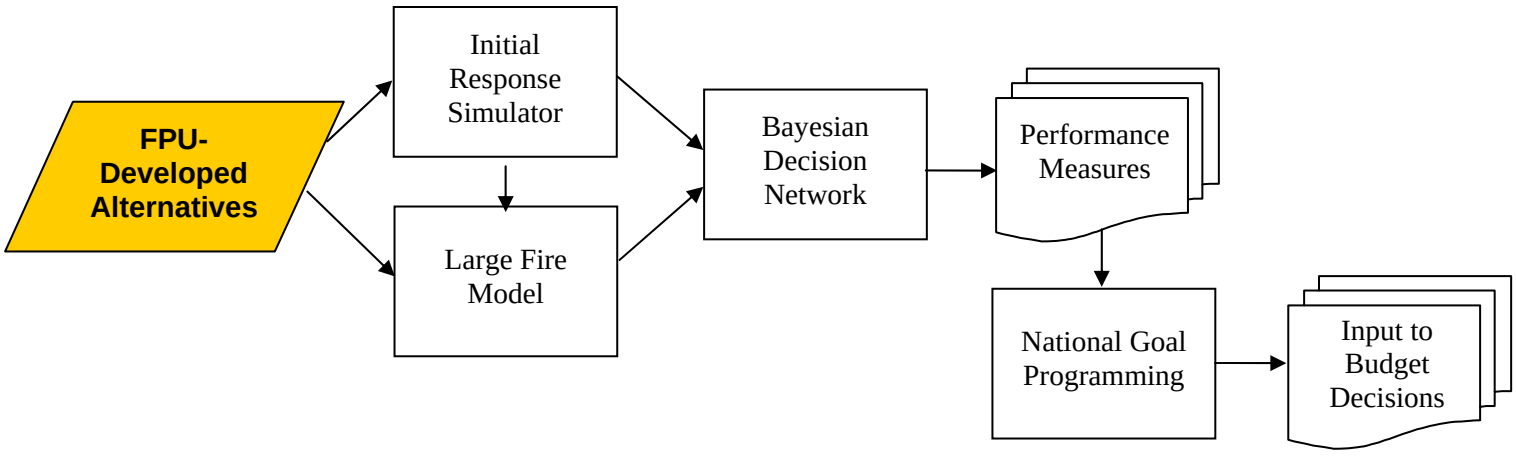
System Components: Alternatives

Investment alternatives describe varying strategies for achieving land management goals in a Fire Planning Unit (FPU). Developed by FPU planners, the investment alternatives are combinations of these three options:

> **Initial response options** are organizations of personnel on engines, crews, helicopters, etc. - the fire resources that produce fireline that are funded by the FPU's budget. These resources are modeled to show how they affect initial response success.
>
> **Prevention options** describe prevention activities that include prevention education, engineering and enforcement. These activities affect the number of person-caused fires.
>
> **Fuels treatment options** describe on-the-ground projects by the total number of acres treated, treatment cost, the cost of the fuels program supporting those treatments, and the changes in fuels conditions resulting from the treatment. Fuels treatment options are used by the model to show how they may affect the success of initial response and large fire suppression.

The FPU investment alternatives are extremely important to the FPA process because they are modeled for probable success in meeting the performance measures and for their associated costs. The modeled performance measures and costs for each alternative can be compared enabling the FPU planner to select combinations of investment alternatives that are likely to be the most cost efficient.

Performance and cost are modeled values used to compare alternative investments. They are not absolute measures or targets, but are used for comparison when making trade-off decisions.

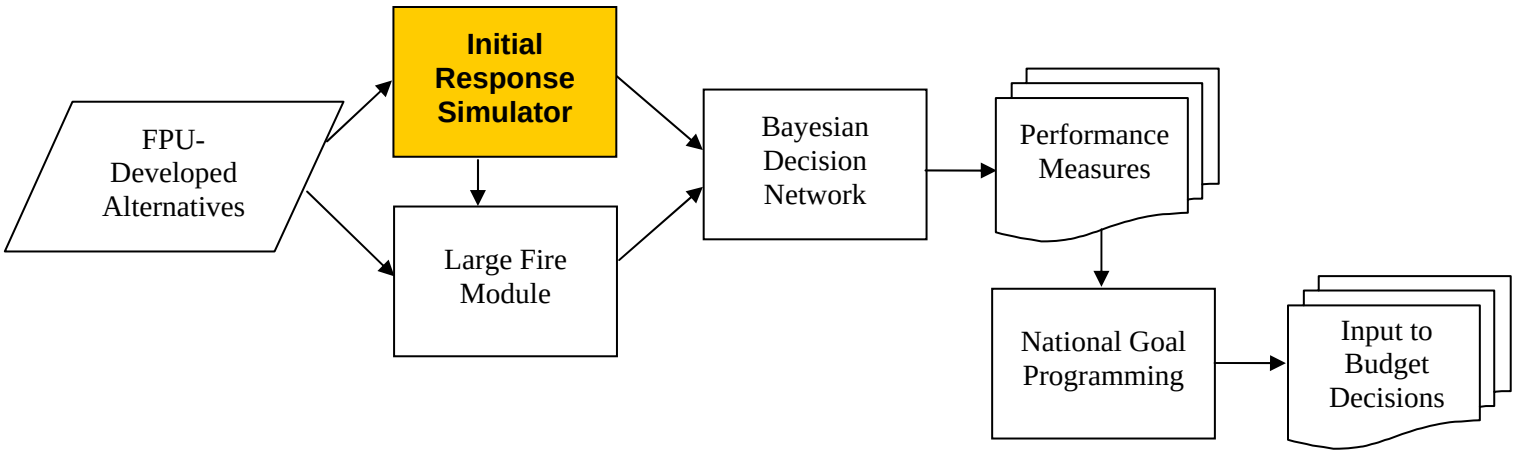


System Components: Initial Response Simulator

The Initial Response Simulator (IRS) is a strategic model that mimics a Fire Planning Unit's initial response to wildland fires.

The IRS uses data drawn from interagency databases for the Fire Planning Unit (FPU) to develop potential fire seasons, or "Fire Event Scenarios." After calculating fire behavior for each fire in a Fire Event Scenario, the model simulates fire growth and containment considering the interaction between the fire growth and fire line built during initial response. Resources are dispatched to fires under user defined conditions that mimic decisions made in dispatch response plans or by duty officers.

This module enables fire planners to compare efficiencies and probable costs for alternative initial response organizations, prevention programs and fuel treatments.



Inputs into IRS:

- Historic fire occurrence records
- Weather observations
- Topographic data
- LANDFIRE fuels model data
- Fire Planning Units and their component Fire Workload Areas (if any)
- Dispatch locations
- Initial Attack Fireline Production Rates (NWCG)
- FPU-designed initial response organizations
- FPU-designed prevention programs
- FPU-designed fuels treatments

Outputs from IRS:

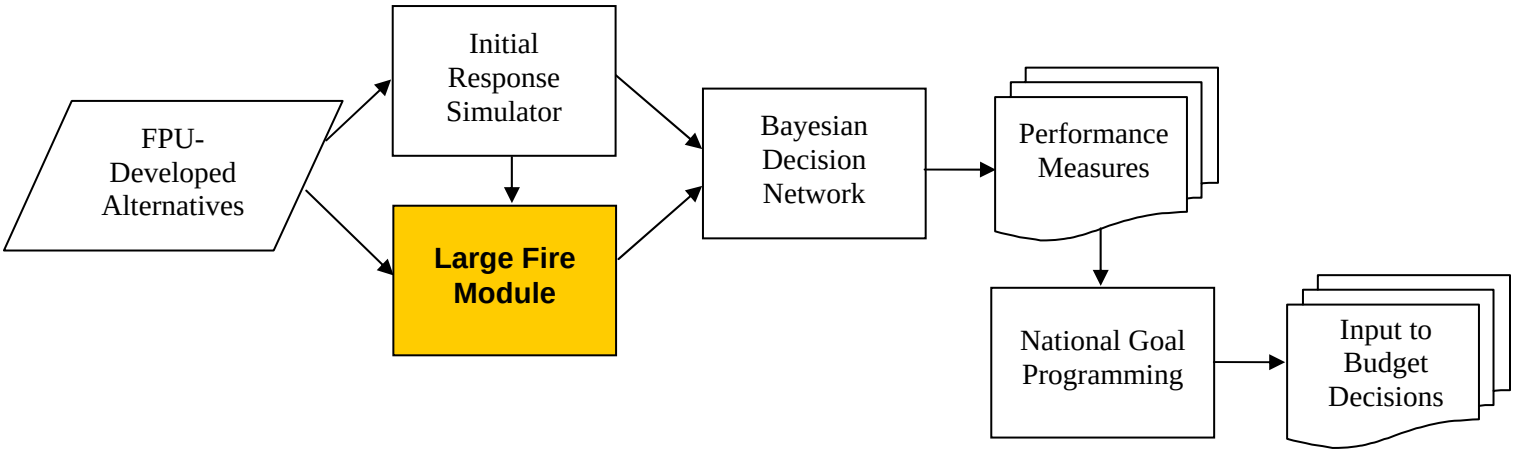
- Number of fires contained
- Number of fires exceeding simulation limits.
- Size of Fires
- Potential costs of fire

System Components: Large Fire Module

The Large Fire module predicts final fire size and relative costs for different resource investment alternatives at the Fire Planning Unit level. Weather, topography, fuels and burn duration are variables used in both the Initial Response and Large Fire models.

The Large Fire model combines statistical analysis with fire simulations based on the Fire Spread Probability (FSPro) model developed at the Missoula Fire Sciences Laboratory. The FPA implementation of FSPro runs a series of simulations that vary fuels, weather, suppression, and treatments to calculate the probability of large fires for points on a landscape. A statistical regression model uses these calculations to determine relationships between fuels, weather, topography, and burn duration to predict final fire size. The results from the statistical analysis are used to extrapolate the impact of fuels treatments and suppression on large fires. The statistical analysis is used in lieu of running computer-intensive FSPro software for each FPU alternative.

The Large Fire Module enables fire planners to evaluate investment alternatives in terms of effectiveness, efficiency and cost.



Large Fire Model Inputs:

- Historic fire occurrence records
- Weather observations
- Topographic data
- LANDFIRE fuels model data
- Fire Planning Units and their component Fire Workload Areas (if any)
- FPU-designed fuels treatment alternatives
- Number of fires exceeding simulation limits

Large Fire Model Outputs:

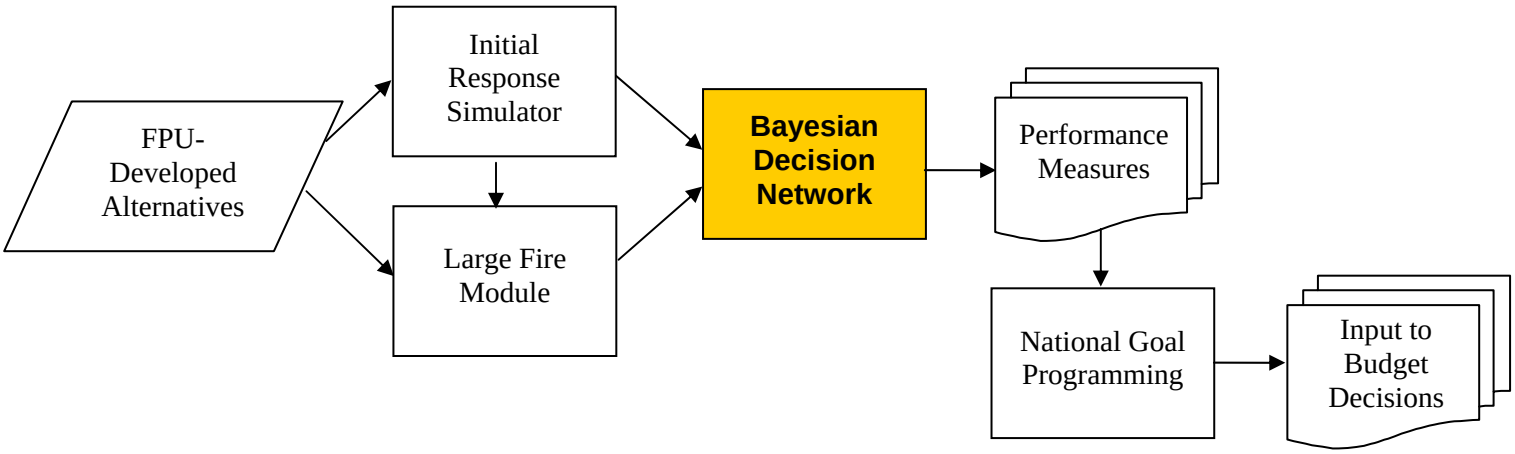
- Burn probability
- Fire intensity level
- Large fire costs estimated using the Stratified Cost Index
- Effects of fuel treatments on large fires
- Final fire size

System Components: Bayesian Decision Network

The key components of the Fire Program Analysis (FPA) system are an initial response simulator, large fire module and a Bayesian Decision Network decision support tool. Combined, these modules form the basis of the FPA system. The Bayesian Decision Network (BDN) helps a Fire Planning Unit planner evaluate the effectiveness of alternative fire management strategies for meeting fire and land management goals and objectives.

BDNs model the cause and effect of a system's inputs and outputs. BDNs also allow users to vary inputs, compare outcomes, and track how a particular recommendation or action was reached.

How the Bayesian Decision Network works in the FPA system
The BDN evaluates the simulation results from the Initial Response Simulator and Large Fire module for initial response organizations, prevention programs and fuels treatments entered by the Fire Planning Unit (FPU). The process shows how alternatives meet performance measures enabling managers to compare investment trade-offs and evaluate how different alternatives could influence future local performance. The FPU sends their preferred alternatives to national goal programming for budget development.



Inputs to the BDN:
- Number of contained fires
- Number of fires exceeding simulation limits.
- Acres burned at each fire intensity level
- Estimated fire costs

Outputs from the BDN:
- Numerical values of the effectiveness, efficiency and performance measures for each alternative

System Components: Performance Measures

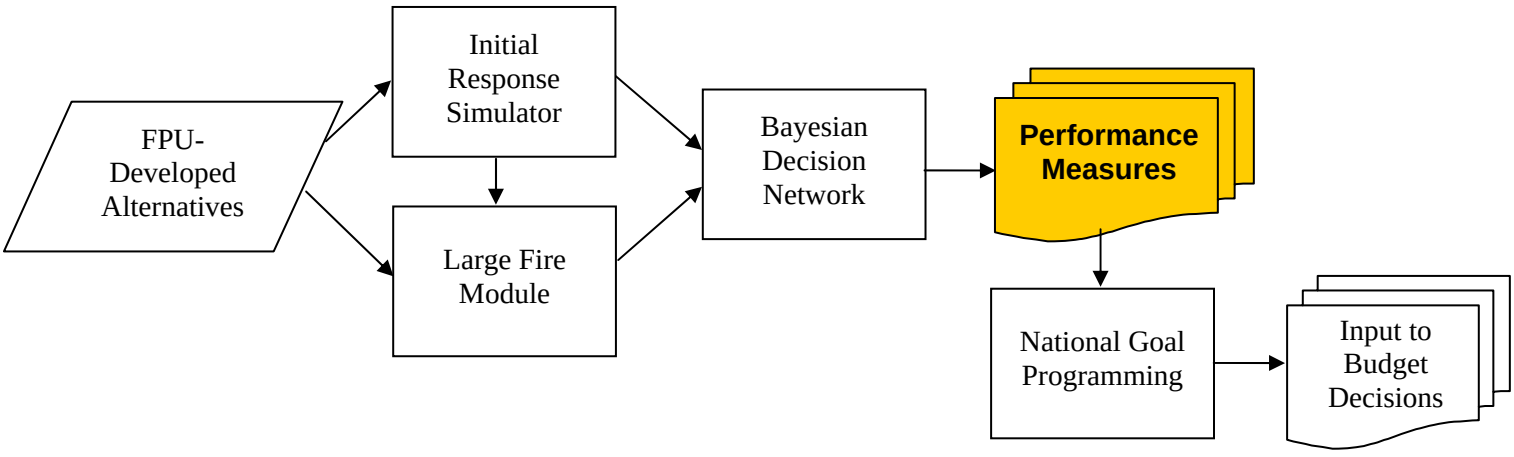
The performance of each Fire Planning Unit (FPU) investment alternative is measured by how well it helps attain the five Effectiveness, Efficiency and Performance Measures or "EEPs:"

1. Reducing the probability of occurrence of costly fires
2. Reducing the probability of occurrence of costly fires within the Wildland Urban Interface (WUI)
3. Increasing the proportion of land meeting or trending toward the attainment of fire and fuels management objectives
4. Protecting highly valued resources areas from unwanted fire
5. Maintaining a high initial attack success rate

EEPs were developed by the FPA Executive Oversight Group and endorsed by the Wildland Fire Leadership Council (WFLC).

Investment alternatives consist of an initial response organization, prevention program and fuels treatments designed by the FPU fire planner. Results from the Initial Response Simulator (IRS) and Large Fire module are analyzed using the Bayesian Decision Network (BDN). The results of the evaluation are used by fire planners to select alternatives that are cost efficient fire management strategies based on modeled performance measures.

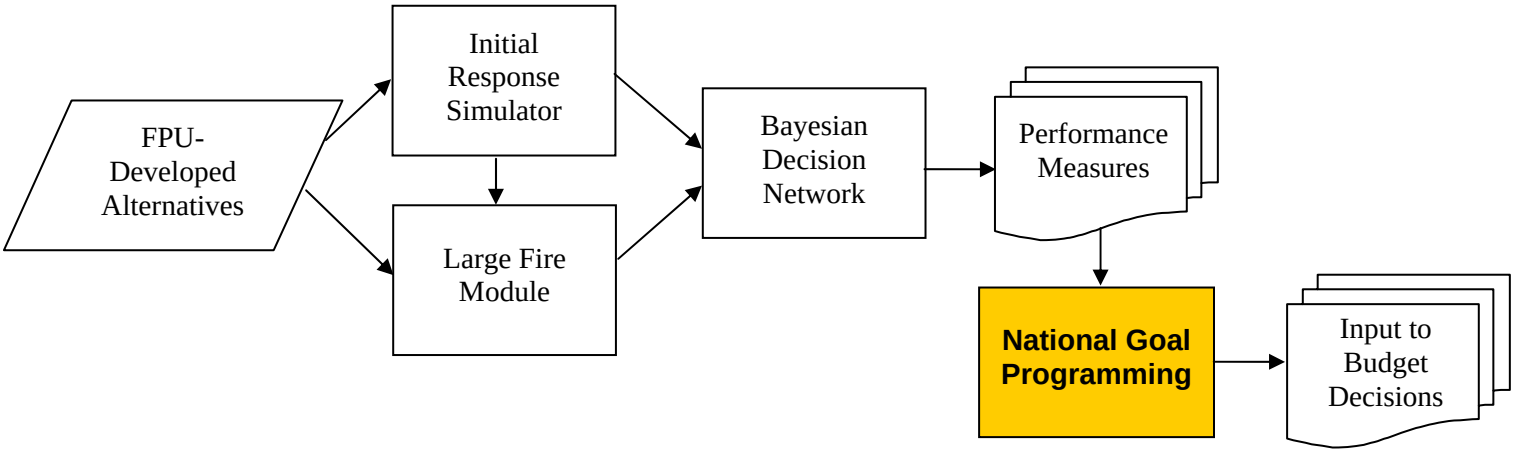
Performance and cost are modeled values used to compare alternative investments. They are not absolute measures or targets, but are used for comparison when making trade-off decisions.



System Components: Goal Programming – National Trade-Off Analysis

The national trade-off analysis module in the FPA system enables budget decision-makers to assess trade-offs between investment alternatives in terms of multiple Effectiveness, Efficiency and Performance Measures (EEPs) at different proposed budget levels.

The effectiveness of proposed investment alternatives submitted by each Fire Planning Unit (FPU) will be viewed with alternatives submitted by other FPUs to find the mix that provides high national performance for the most effective national expenditures. The key concept underlying trade-off analysis is that there is no one "best" answer, but an understanding of the trade-offs between differing investment alternatives. For example, an FPU can increase initial attack success (good for EEP #5 – "Maintaining a high initial attack rate") by containing more fires in the back-country while letting fires in the Wildland Urban Interface escape (bad for EEP #2 – "Reducing the probability of occurrence of costly fires within the Wildland Urban Interface"). In this case, the initial attack success increases while putting more WUI at risk. Trade-off analysis aims at highlighting these conflicts while providing a tool that enables budget decision-makers to come to a national compromise in a transparent manner.



Inputs to Goal Programming:

- Five Effectiveness, Efficiency and Performance Measures for each investment alternative submitted by the FPU
- Modeled costs for each investment alternative submitted by the FPUs

Outputs from Goal Programming:

- A set of five national Effectiveness, Efficiency and Performance Measures using a combination of each FPU's investment alternatives
- A total national cost for initial response organizations, prevention programs and fuels treatments associated with the selected sets of efficient FPU investment alternatives