# United States Forest Service (USFS) NRIS-INFORMS-Fire/Fuels Analysis Tool [1]

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## Introduction

INFORMS is a decision support framework currently designed specifically for the Forest Service IBM platform. The acronym comes from "Integrated Forest Resource Management System." INFORMS was engineered to support planning tasks associated with watershed and project-level planning, and is used to assist forest- and district-level users in resource project management for the purpose of decision-making following the National Environmental Protection Act (NEPA) process.

The INFORMS interface is built primarily upon ArcView, with additional Oracle Forms as needed to support essential functions. Some custom (i.e., non-Oracle Forms and non-ArcView) windows within INFORMS are used when neither Oracle nor ArcView could support the needed functionality.

The underlying Oracle data structure behind INFORMS supports numerous planning functions, including the ability to:

- Support the entire NEPA process and improve decision quality and quantity
- Capture and isolated project or decision support data sets from corporate spatial and attribute databases
- Define project team members and define their access to INFORMS functions
- Access and run a range of analytical tools such as models, scripted queries, Arc Macro Language routines, and rule bases (a knowledge base component)
- Build and retain project alternatives via ArcView themes and Oracle datasets
- Track progress on projects on decisions via access to an event log or analysis record

Analytical tools used in INFORMS will vary from site to site since users at each site determine the suite of tools they wish to integrate within INFORMS. This can include information needed to make analysis accurate and site specific.

## Vegetative Mapping

Because INFORMS is designed for National Environmental Protection Act (NEPA) analysis in the Forest Service, one of the problems to date has been the ability to look at future conditions of vegetation with and without treatment. This was easily done for single stands using the Forest Vegetation Simulator (FVS), but unless there stand

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exams are performed on each stand, this goal could not be achieved for the landscape of vegetation data for the entire analysis area.

The solution to this problem is the use of the Most Similar Neighbor Analysis (MSN) technology. The INFORMS application team has found that by the use of these two technologies (FVS & MSN) integrated with landsat imagery data, it is possible to create high quality vegetative maps for current and future conditions.

Additionally, this application set has been shown to create excellent landscape vegetation maps for forested lands. The requirements necessary to support this mapping are:

- Forest stand vegetation polygon GIS layer
- Recent spring landsat scene
- Stand exams well-distributed on all vegetation types on ten percent or more of the polygons
- Stand exam data loaded into FSVeg database to standardize the data source
- Digital Elevation Model buffered for the MSN Analysis Area

These are commonly available types of data. With this data set, tools within the INFORMS application will simulate the growth of the stands to the date of the landsat scene to calibrate them more accurately to the reflectance values represented. These stand exams then become what is known as reference stands. Based on the landsat and DEM data, the MSN application will find the most similar stand to use to represent each stand that does not have current data. Subsequently, a "for/use" table is populated. This is simply a pointer table that is used when an application in INFORMS needs data for a stand that has not been examined.

This process also creates very high-quality current vegetation GIS coverage data with accurate attributes for all stands. The current output is used to produce actuate fuels vegetation maps for use in public meetings, fuels analysis, and for planning fire suppression activities with FARSITE .

Efforts are currently underway to produce more attributes that are useful to all types of resource analysis. These attributes include:

- Basal area of tree species
- Tree species of the first 3 species in descending dominant order
- Average stands height
- Quadratic mean diameter
- Tree species crown cover

These are attributes that traditional image processing methods usually cannot supply. These results can be produced to a high degree of accuracy that can be improved with more stand exam sampling if needed, representing a systematic method of producing the desired quality of coverage.

Another advantage of this approach is that by simply maintaining the stand polygon layer, obtaining a new land satellite scene annually, and maintaining a minimal stand exam program for data collection, this high-quality current vegetation layer can be maintained quickly and inexpensively from year to year.

## Fire and Fuels Analysis Packages

INFORMS currently is used primarily to support the NEPA process, particularly for Fuels Reduction applications. The application uses data from the FSVeg database projected forward using the Forest Vegetation Simulator, including the Fire and Fuels Extension (FVS/FFE) for the current condition and each decade into the future up to 40 years for no treatment alternatives. It is also possible to create as many treatment alternatives as desired. These can also be portrayed for the same growth periods to compare difference between treatment and no treatment and between alternative treatments.

Tools within INFORMS produce several valuable products:

- Product 1 generates a map for each time period. Known as the "burn model", this is a matrix of torching index (the wind speed that will be required to cause a ground fire to torch trees in the stand) and the crowning index (the wind speed that will be required to sustain a crown fire). The matrix of these two values generated by FVS/FFE is displayed as five classes of burn intensity. This creates a map for each forested stand polygon, which displayed in light to dark shades of red (darker shades representing greater intensity). This map is useful for several purposes in fuels reduction project planning. These include the ability to visualize the areas of greatest concern for possible treatment and their relationship to other areas of concern. The maps give us the ability to compare analysis areas such as watersheds to determine which is the highest priority for treatment. These maps are also quite useful in communicating to the public about the condition of areas they may live near or have concerns about.
- Product 2 is the creation of FARSITE ready data. FARSITE is a fire simulation application that models fire spread and intensity under user-defined conditions. These layers are created for current and future conditions. The primary use of FARSITE in project planning is to run a simulated fire through an analysis area with and without treatment to evaluate the effects of proposed treatments. FARSITE can be used to optimize various treatments; this data also comprises a very helpful tool for communicating with the public.
- Product 3 is the Stand Visualization System (SVS). INFORMS creates files that show how a stand will burn with or without treatment. This is useful for the identification team and public discussion of effects. The establishment of an automated method to accomplish this objective is currently under development.

## Conclusions

The INFORMS application has provided land managers within the Southwestern Region of United States Forest Service (USFS) with a state-of-the-art modeling system. The system has allowed for the assessment of current and future wildfire risk conditions within forested areas with and without wildfire hazard reduction efforts. Various vegetative prescriptions have been modeled to assess their potential effects on current and future wildfire risk. These inputs are processed and wildfire risk maps are produced and displayed for further assessment by various Fire/Fuel Management Specialists. All of these capabilities have aided in directing current and future fuel mitigation and maintenance efforts and the development and modification of environmental analysis and planning within the Southwestern Region.

In addition, the modeling application has allowed for high-level multi-criterion decision making capabilities. This has been accomplished through the GIS interface and has been used to assess decision pathways and parameters through analysis of spatial and geospatial data. Analysis has involved the effects of thinning regimes on real world parameters involving many varied real world issues related to National Environmental Protection Act (NEPA), wildland fire suppression activities, and many other applications.

Inventory, monitoring and analysis efforts within the Southwestern Region have enabled land managers to monitor the effects of landscape disturbances and adjust prescriptions for future land management plans. Recording negative and positive responses to mechanical and prescribed burn treatments both validates current fuels mitigation strategies and provides the agency with more complete, current data sets with which to measure the effects of current land management practices. This enables land managers to adjust prescriptions based on scientific data collected using standardized protocols and the most up-to-date sampling techniques. Moreover, it helps ensure that we maintain a healthy, vibrant, and resilient forest ecosystem for now and into the future.