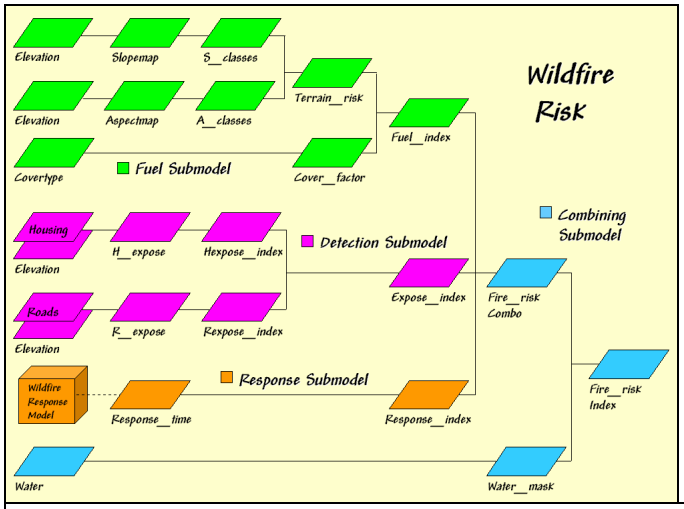
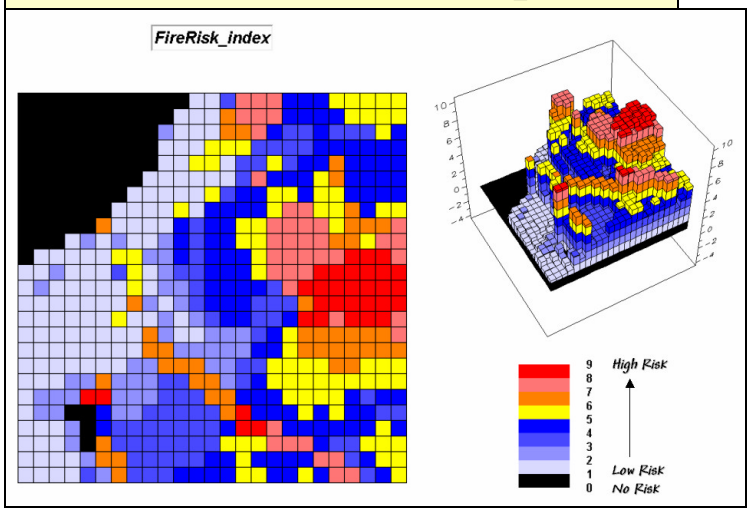
# *Applying MapCalc Map Analysis Software*

**Mapping Wildfire Risk**: *A fire risk map for the project area is needed for county-wide emergency planning. To meet this need an initial Wildfire Risk Model was developed that considers 1)* ***Fuel Loading*** *based on terrain and cover type conditions, 2)* ***Fire Detection*** *based on visibility to housing and roads and 3)* ***Fire Response-time*** *based on relative and absolute barriers to emergency vehicle movement.*

*<click here> for a printer friendly version (.pdf)*

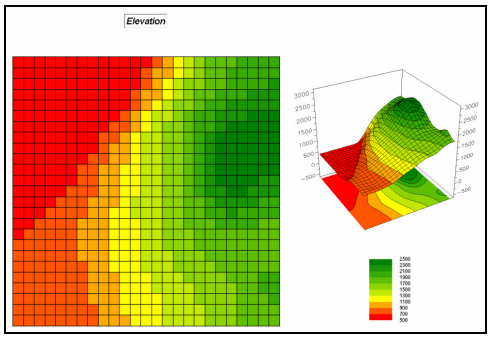
***Processing Flow.***



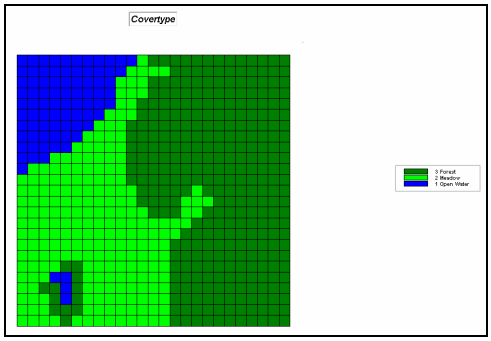




***Fire-Risk Map.***

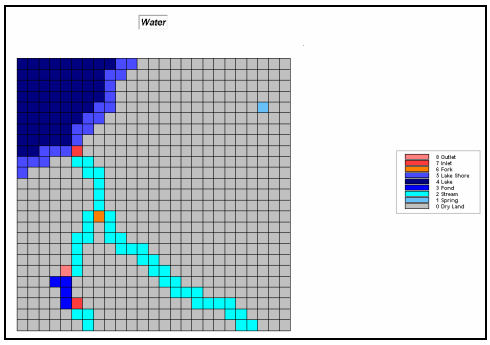
***Base Maps.*** The *Base Maps* needed include:



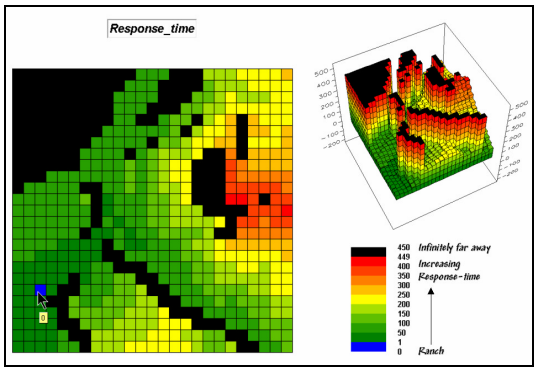

***Elevation map.***



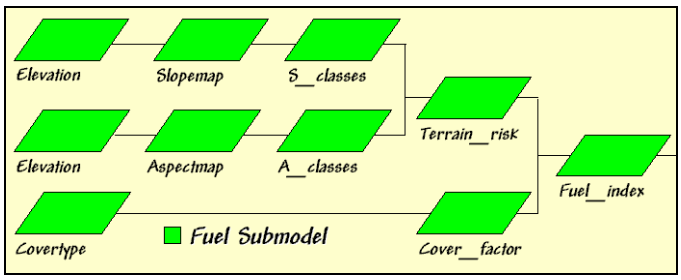

***Covertype map.***




***Water map.***



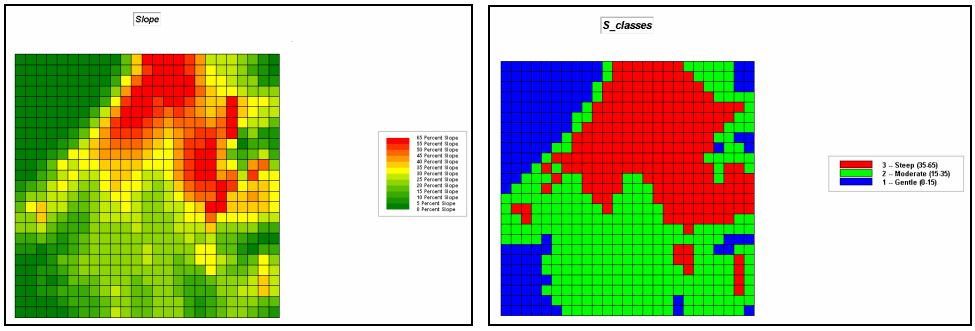

***Response-time map.***




***Fuel Submodel.*** Fuel Loading is dependent on two factors—Terrain and Cover type conditions. Terrain conditions assume fuel drying on steep southern slopes identify the highest risk; gentle north-facing slopes identify the lowest; and all other slope/aspect combinations form risk indices in between.

***<u>Step 1</u>, Terrain Conditions—Slope.***

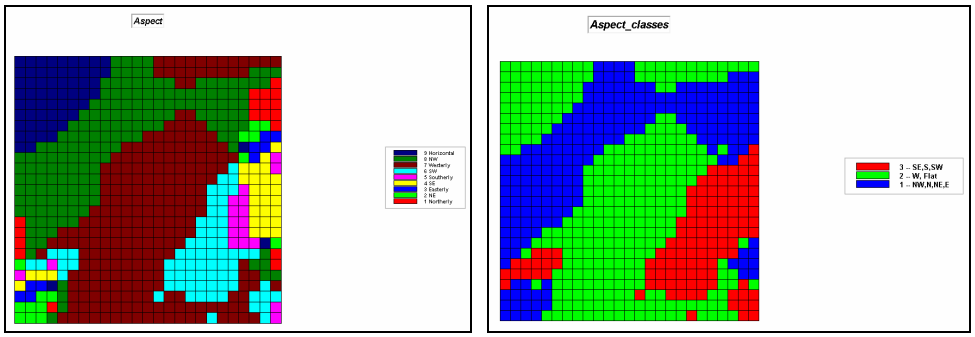
**SLOPE Elevation Fitted FOR Slopemap**
**RENUMBER Slopemap ASSIGNING 1 TO 0 THRU 15 ASSIGNING 2 TO 15 THRU 35 ASSIGNING 3 TO 35 THRU 65 FOR Slope_classes**




***S_classes map.***

***<u>Step 2</u>, Terrain Conditions—Aspect***

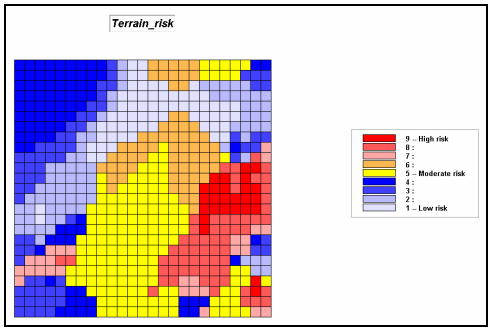
**ORIENT Elevation Octants FOR Aspectmap**
**RENUMBER Aspectmap ASSIGNING 1 TO 1 THRU 3 ASSIGNING 1 TO 8 ASSIGNING 2 TO 7 ASSIGNING 2 TO 9 ASSIGNING 3 TO 4 THRU 6 FOR Aspect_classes**




***A_classes map.***

***Step 3**, Terrain Conditions—combine Slope and Aspect classes*

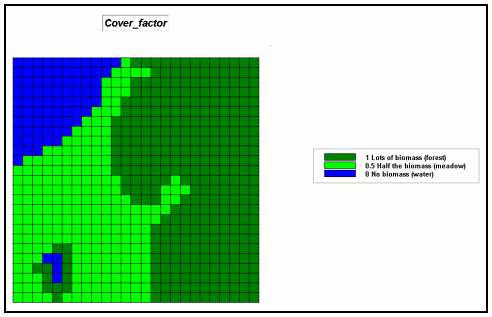
**INTERSECT Slope_classes WITH Aspect_classes ASSIGNING 3 TO 1 AND 1 ASSIGNING 4 TO 1 AND 2 ASSIGNING 7 TO 1 AND 3 ASSIGNING 2 TO 2 AND 1 ASSIGNING 5 TO 2 AND 2 ASSIGNING 8 TO 2 AND 3 ASSIGNING 1 TO 3 AND 1 ASSIGNING 6 TO 3 AND 2 ASSIGNING 9 TO 3 AND 3 FOR Terrain_risk**




*Terrain_risk map.*

***Step 4**, Covertype Conditions—based on the amount of biomass (1.0 Forest; .5 Meadow; 0 Open water)*

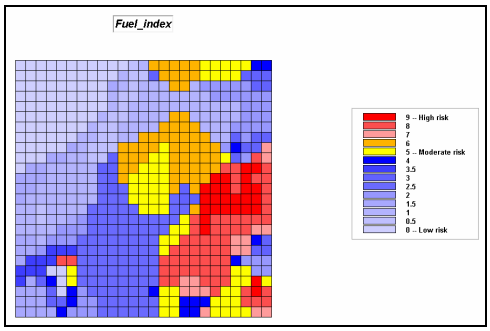
**RENUMBER Covertype ASSIGNING 0.0 TO 1 ASSIGNING 0.5 TO 2 ASSIGNING 1.0 TO 3 FOR Cover_factor**



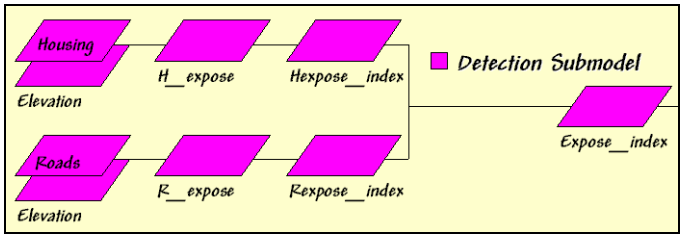

*Cover_factor map.*

***Step 5**, Combine Terrain and Covertype Conditions—update terrain risk based on cover type factor*

**COMPUTE Cover_factor Times Terrain_risk FOR Fuel_index**



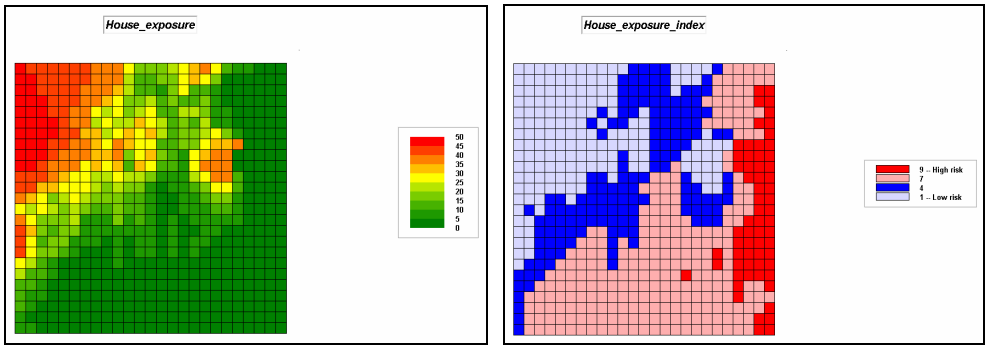

***Fuel_index map.***




***Detection Submodel.*** Early detection of a fire is, in large part, dependent on visual exposure of a location to housing and roads.

***<u>Step 6</u>, Visual exposure to housing—determine the number of times each location is seen from housing locations, then convert to a visual exposure index. Note that the areas with low visual exposure have the higher risk indices as the probability of early detection of a fire is low.***

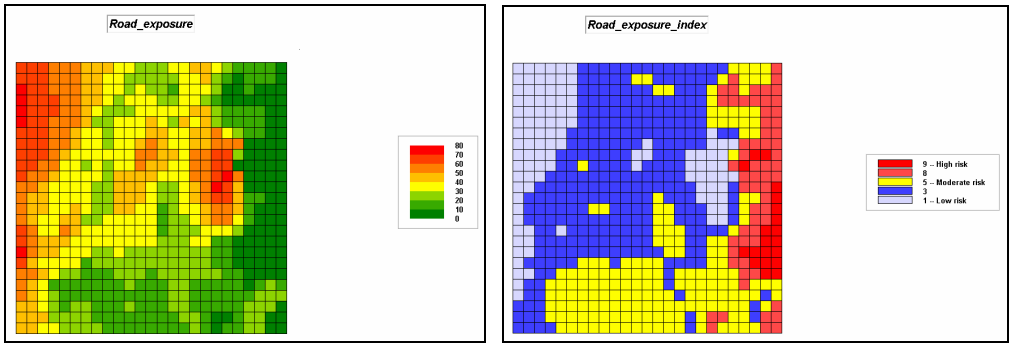
**RADIATE Housing OVER Elevation TO 35 Weighted FOR House_exposure**
**RENUMBER House_exposure ASSIGNING 9 TO 0 ASSIGNING 7 TO 1 THRU 8 ASSIGNING 4 TO 8 THRU 25 ASSIGNING 1 TO 25 THRU 50 FOR House_exposure_index**




***House_exposure_index map.***

***<u>Step 7</u>, Visual exposure to roads—determine the number of times each location is seen from road locations, then convert to a visual exposure index. Note that the areas with low visual exposure have the higher risk indices as the probability of early detection of a fire is low.***

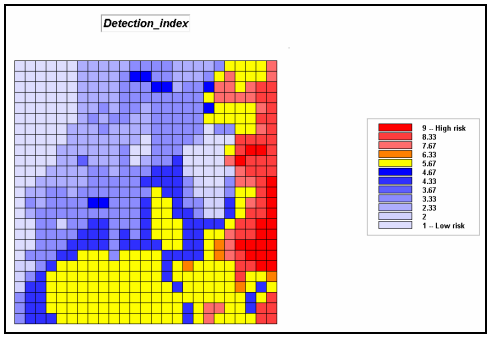
**RADIATE Roads OVER Elevation TO 35 Completely FOR Road_exposure**
**RENUMBER Road_exposure ASSIGNING 9 TO 0 ASSIGNING 8 TO 1 THRU 10 ASSIGNING 5 TO 10 THRU 30 ASSIGNING 3 TO 25 THRU 50 ASSIGNING 1 TO 50 THRU 75 FOR Road_exposure_index**



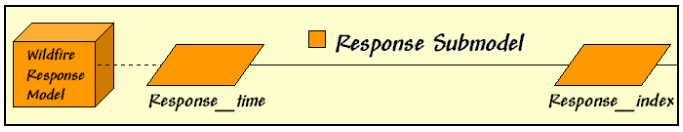

***Road_exposure index map.***

***<u>Step 8</u>, Combined index of visual exposure to housing and roads—the two index maps are averaged with visual exposure to roads as twice as important in determining detection risk.***

**ANALYZE House_exposure_index TIMES 1 WITH Road_exposure_index TIMES 2 Mean FOR Detection_index**



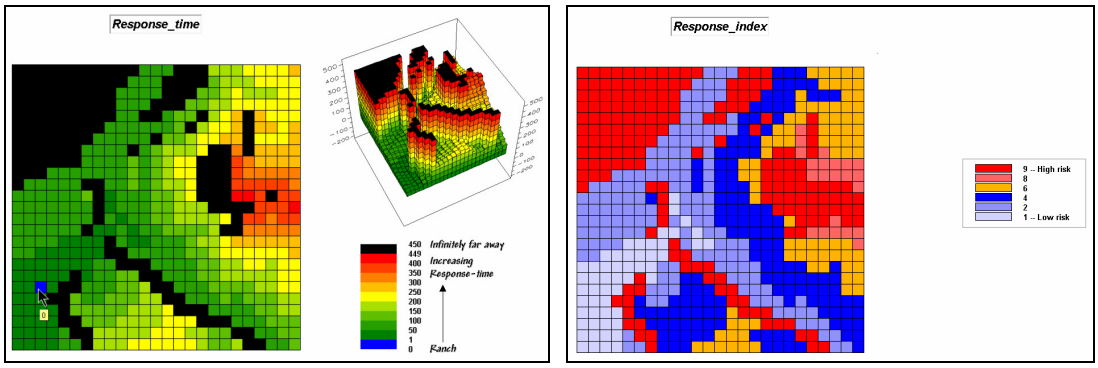

***Detection_index map.***



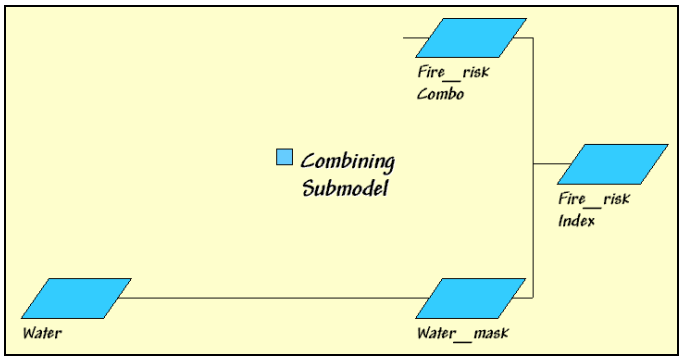

***Response Submodel.*** *Response-time is dependent on both on- and off-road travel for emergency vehicles as determined by relative and absolute barriers derived from road type, terrain conditions and land cover.*

***<u>Step 9</u>, Response-time index—the results of the Wildfire Response Model is converted to a risk index.***

**RENUMBER Response_time ASSIGNING 9 TO 350 THRU 450 ASSIGNING 8 TO 275 THRU 350 ASSIGNING 6 TO 200 THRU 275 ASSIGNING 4 TO 100 THRU 200 ASSIGNING 2 TO 50 THRU 100 ASSIGNING 1 TO 0 THRU 50 FOR Response_index**



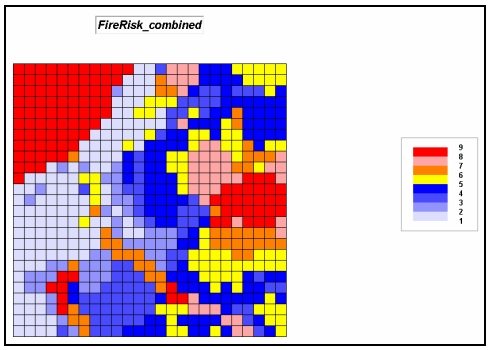

***Response_index map.***




***Combining Submodel.*** Overall Fire Risk is the combination of the Fuel, Detection and Response indices for each map location.

***<u>Step 10</u>, Combined index of Fuel, Detection and Response indices —the individual submodel results are weight-averaged with the Detection index receiving the least weight and the Response-time index the most.***

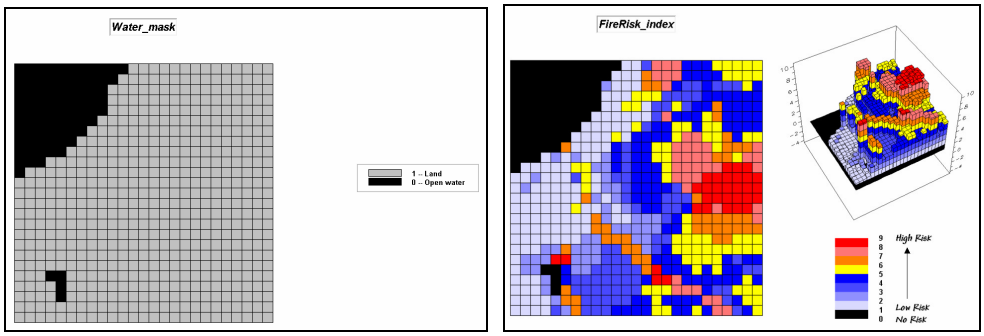
**ANALYZE Detection_index TIMES 1 WITH Fuel_index TIMES 3 WITH Response_index TIMES 5 Mean FOR FireRisk_combined**




***FireRisk_combined map.***

***<u>Step 11</u>, Water mask—the overall index is "masked" to eliminate areas of open water (can't burn water—no fire risk).***

**RENUMBER Covertype ASSIGNING 0 TO 1 ASSIGNING 1 TO 2 THRU 3 FOR Water_mask**
**COMPUTE Water_mask Times FireRisk_combined FOR FireRisk_index**




***FireRisk_index map.***

**<u>Summary</u>**. The initial Wildfire Risk Model considers Fuel Loading, Fire Detection and Fire Response in deriving an overall Fire Risk map. Areas with considerable biomass on steep southerly slopes, minimal visual exposure to houses and roads, and a long distance from where fire crews are located are assigned a high index. Several extensions, such as adjustments for seasonal and short-term weather effects, proximity to water and human activity levels would strengthen the model.