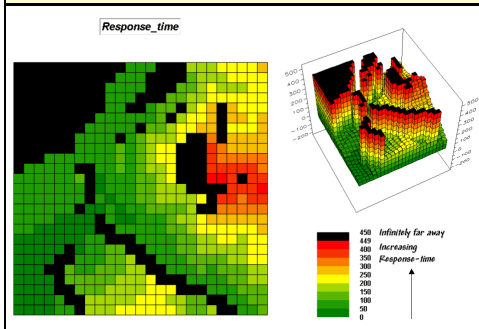
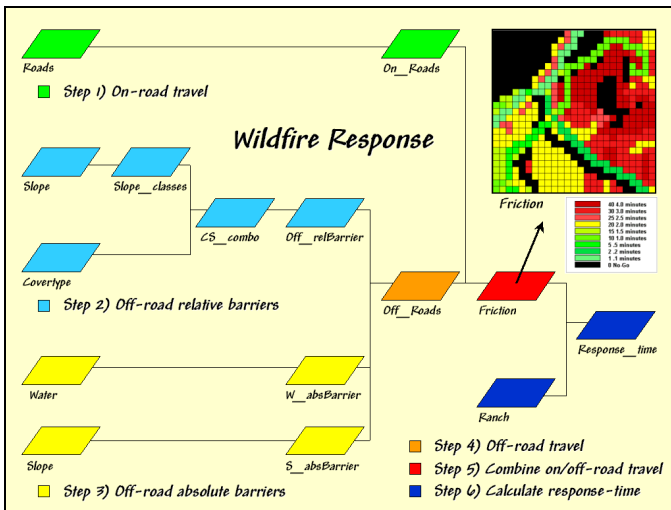


Applying MapCalc Map Analysis Software

Mapping Wildfire Response: The on- and off-road response-time throughout a project area is need for county-wide emergency planning and fire risk modeling. The initial response model considers on-road and off-road travel depending on terrain and land cover conditions.

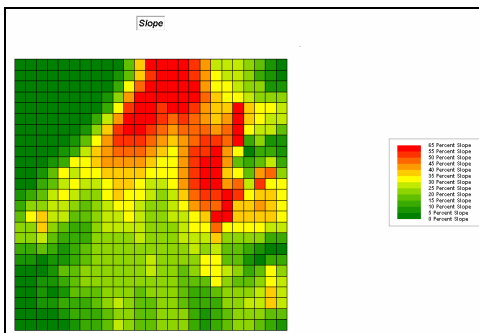
[click here](#) for a printer friendly version (.pdf)

Processing Flow.

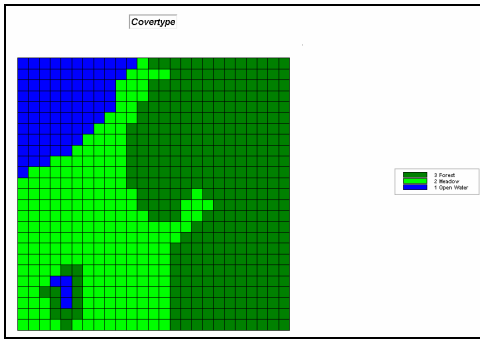


Response-Time Map.

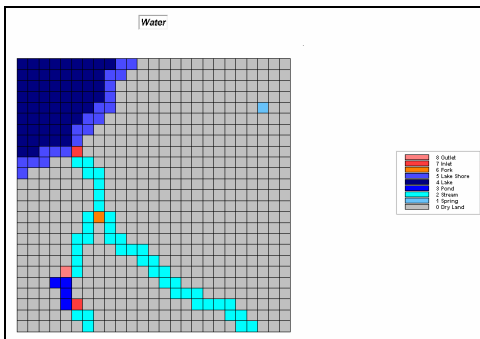
Base Maps. The Base Maps needed include:



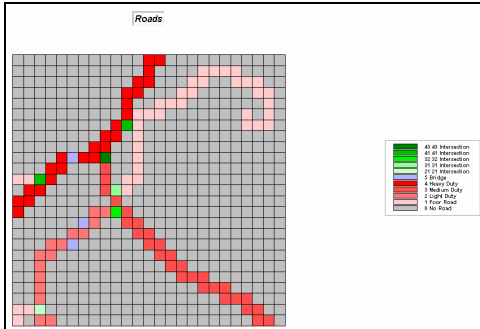
Slope map. Each grid cell value identifies terrain steepness.



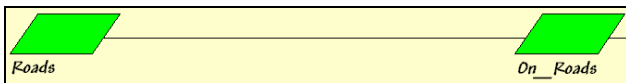
Covertypes Map. Each grid cell value identifies land cover.



Water Map. Each grid cell value identifies surface water present.



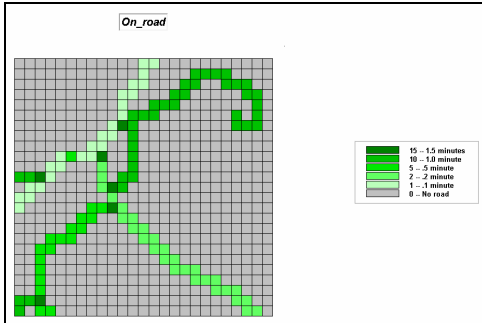
Roads Map. Each grid cell value identifies the type of road present.



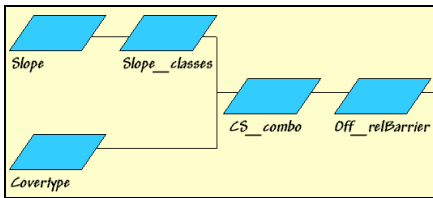
Step 1, On-road travel.

The “on-road travel” step calibrates the **Roads map** with the base unit of effective distance as 1= .1 minute for crossing a Primary road cell (Road map value 4 assigned a new value of 1). The remaining road types are assigned relative impedance values...

RENUMBER Roads ASSIGNING 10 TO 1 ASSIGNING 5 TO 2 ASSIGNING 2 TO 3 ASSIGNING 1 TO 4 ASSIGNING 5 TO 5 ASSIGNING 15 TO 21 THRU 43 FOR On_road



On_road Map.



Step 2, Off-road relative barriers. The “off-road relative barriers” step considers the relative ease of travel depending on the slope and cover type present. First, the *Slope map* is divided into three classes (1= 0 to 10 %slope= gentle; 2= 10 to 30% slope= moderate; 3= 30 to 65%= steep)...

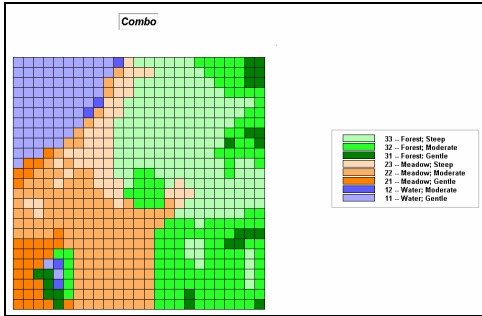
RENUMBER Slope ASSIGNING 1 TO 0 THRU 10 ASSIGNING 2 TO 10 THRU 30 ASSIGNING 3 TO 30 THRU 65 FOR S_classes



S_classes Map.

Next, the *Covertype map* and the *S_classes map* are combined to form a 2-digit code with the cover type indicated by the first (ten’s) digit and the slope class by the second (one’s) digit...

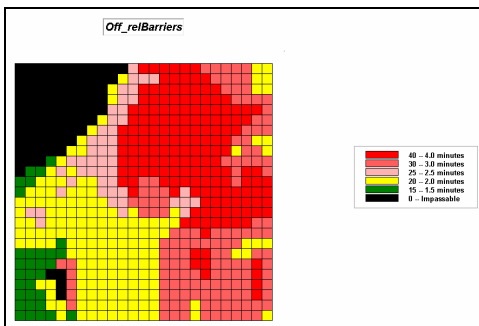
COMPUTE Covertypes Times 10 Plus S_classes FOR Combo



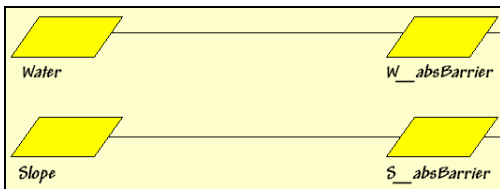
Combo Map.

Then calibrate the *Combo map* for relative ease of off-road travel...

RENUMBER Combo ASSIGNING 0 TO 11 ASSIGNING 0 TO 12 ASSIGNING 0 TO 13 ASSIGNING 15 TO 21 ASSIGNING 20 TO 22 ASSIGNING 25 TO 23 ASSIGNING 20 TO 31 ASSIGNING 30 TO 32 ASSIGNING 40 TO 33 FOR Off_relBarriers

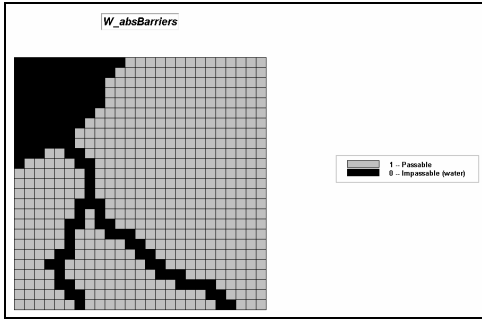


Off_relBarriers Map.



Step 3, Off-road absolute barriers. The “off-road absolute barriers” step identifies locations that the response vehicle cannot go as zero (surface water and very steep terrain) and locations that are passable as one. First the “binary” *Water map* is established...

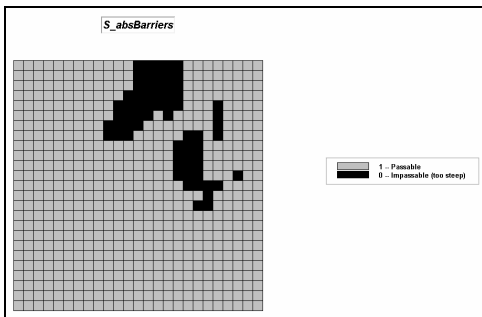
RENUMBER Water ASSIGNING 1 TO 0 THRU 1 ASSIGNING 0 TO 2 THRU 8 FOR W_absBarriers



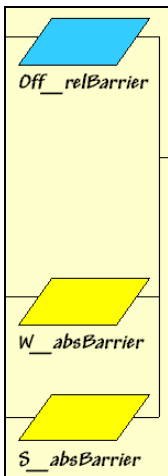
W_absBarriers Map.

Then the “binary” *Slope map* is established...

RENUMBER Slope ASSIGNING 1 TO 0 THRU 50 ASSIGNING 0 TO 50 THRU 65 FOR S_absBarriers

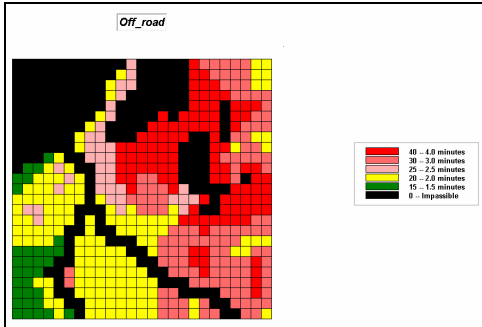


S_absBarriers Map.

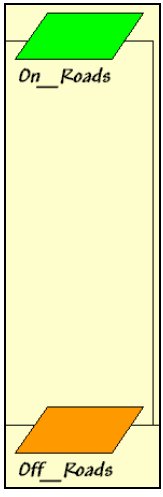


Step 4, Off-road travel (overall). The “off-road travel” step uses binary mathematics to set the no-go areas to zero while retaining the relative barriers to travel for accessible areas.

COMPUTE Off_relBarriers Times W_absBarriers Times S_absBarriers FOR Off_road

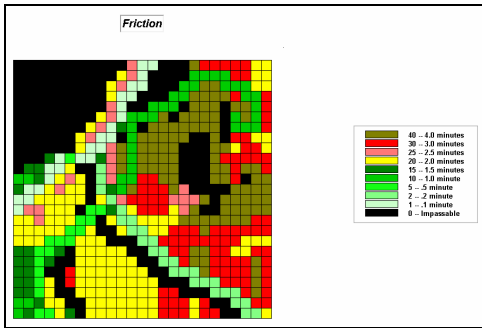


Off-road Map.

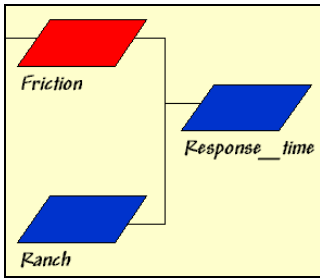


Step 5. Combine on/off-road travel. The “combine on/off-road travel” step uses a point by point overlay technique to update (replace) the off-road information for the areas with on road impedance information

COVER Off_road WITH On_road FOR Friction

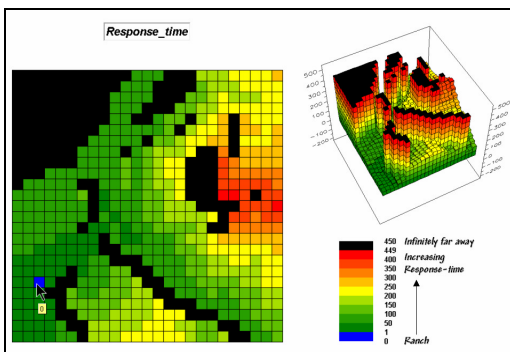


Friction Map.



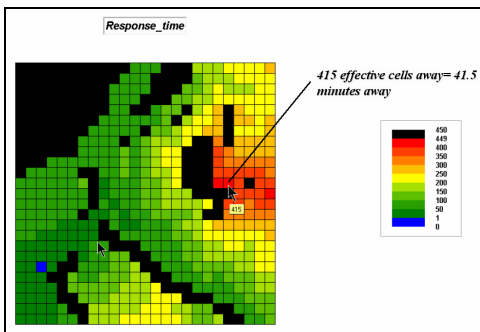
Step 6, Calculate response-time. The “calculate response-time” step uses the Spread command to determine the effective proximity from the ranch to all locations in the project area...

**RENUMBER Locations ASSIGNING 0 TO 2 THRU 5 FOR Ranch
SPREAD Ranch TO 450 THRU Friction FOR Response_time**



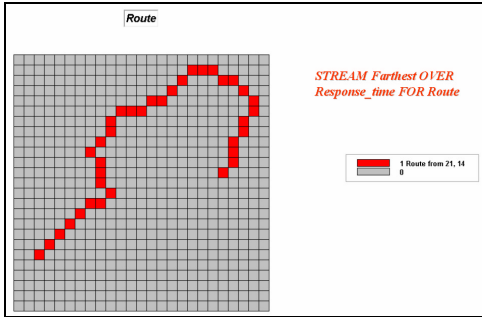
Response-time map.

Using the Response-time map. How far away is the farthest location that can be reached by emergency vehicles?



Farthest location is 41.5 minutes away. Moving the cursor over any map location displays the travel-time from the Ranch to that location.

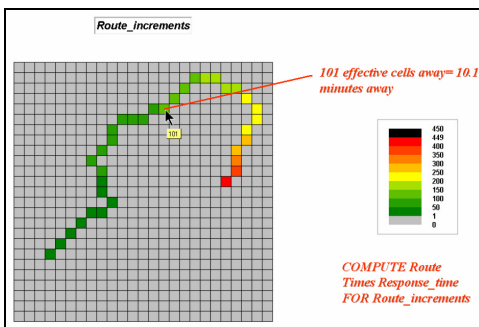
What is the best route to the farthest location?



Optimal route (quickest) to the farthest location.

The optimal route to any location is delineated by entering... **STREAM <Point> OVER Response_time FOR Route**

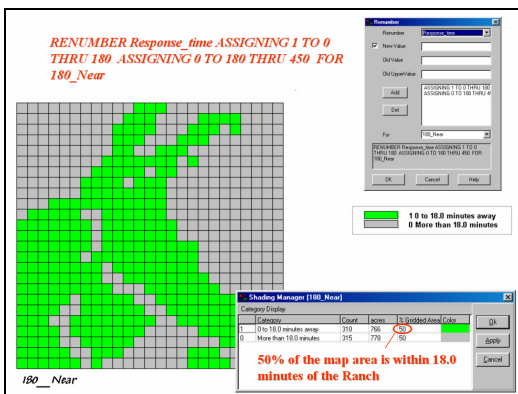
What is the estimated elapsed time at each step along the best route?



Travel-time along the optimal route.

A map of the travel-time for each location along the optimal route is identified by... **COMPUTE Route Times Response_time FOR Route_increments**

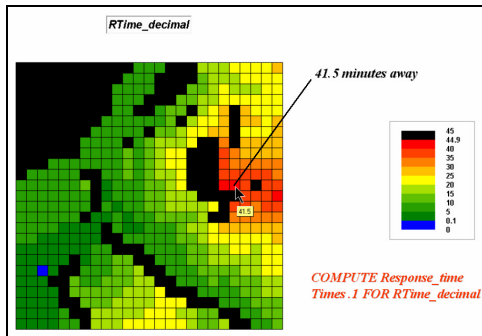
What portion of the map area is within an 18-minute response time?



50% of the area is within an 18-minute

response time. A map identifying the 0 to 18 minute response zone is obtained by entering... **RENUMBER Response_time ASSIGNING 1 TO 0 THRU 180 ASSIGNING 0 TO 180 THRU 450 FOR 180_Near**

Can you display the response map in decimal-minutes instead of the “times ten” units?



Response-time in decimal minutes. Simply multiplying the Response_time map times .1 will convert the map values to decimal-minutes... **COMPUTE Response_time Times .1 FOR RTime_decimal**

Summary. The initial Wildfire Response-time Model uses information about the various types of roads, terrain and land cover condition to simulate emergency vehicle response. The approach considers absolute barriers (surface water and very steep terrain) and relative barriers (road, steepness and cover condition) that “guide” movement. The result is a **Response_time map** that shows an estimated time to get equipment to each map location. Further analysis identifies the optimal route (quickest) to any location. The model can be extended to include different types of equipment, differences in season weather, and time estimates for a crew hiking into areas that are impassable for vehicles.

*Note: see “**Extending Wildfire Response Mapping**” for a discussion of techniques used to assign travel-time values for crews hiking into areas that are too steep for vehicles and absolute barrier areas along streams.*