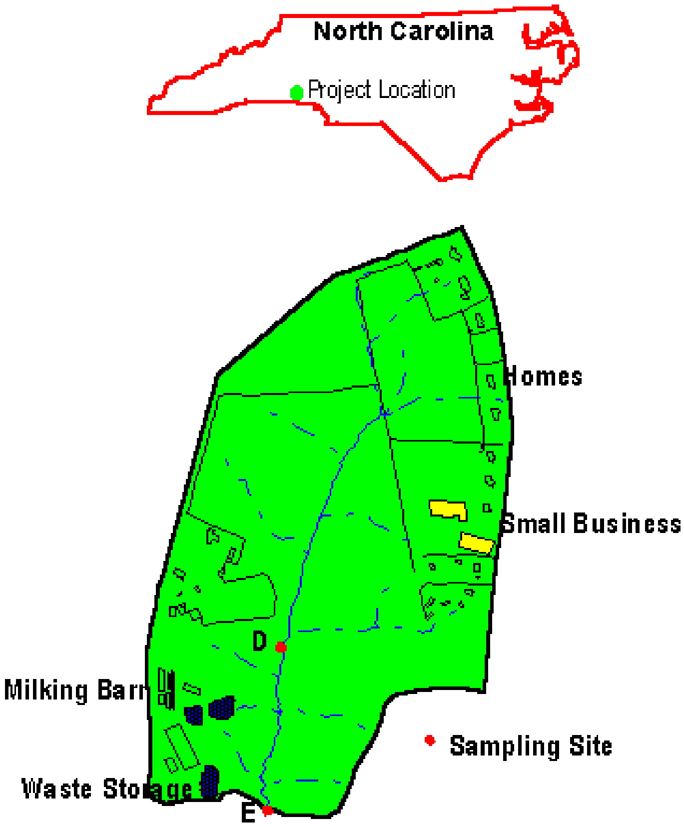
Long Creek Watershed Example

A 140-acre gaged watershed of the Long Creek 319 National Monitoring Program project was used as an example to test the GRASS-AGNPS tool. The watershed (pictured below) is primarily pasture with several residential homes and a small business along the periphery of the upper drainage area (upstream of site D). A large dairy operation including a small feedlot is located in the lower part of the watershed. The upper area is moderate to lightly grazed by replacement heifers while the lower area is heavily grazed by cows. Continuous discharge measurement and storm-event sampling occur at sites D and E. The small tributary draining the watershed has a normal baseflow of less than 0.1 cfs with storm discharges of up to 110 cfs.

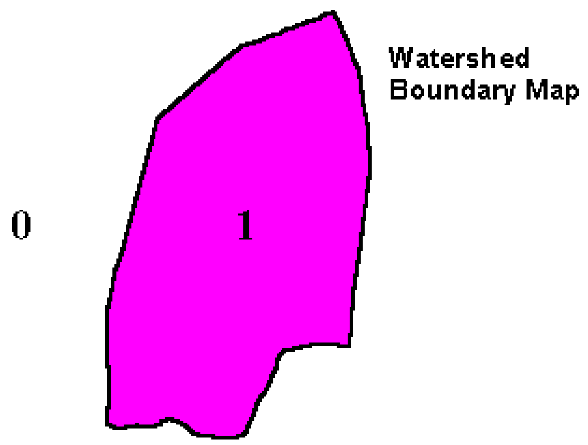


Because of the difficulty of graphics conversions and the use of a broader array of colors, the data layer maps shown in this example are not exact replicas of those used in the actual example. In addition, figures shown here were created from vector maps to conserve memory while map layers used by the GRASS-AGNPS modeling tool are raster maps. Raster map layers in the actual example were created from vector maps.

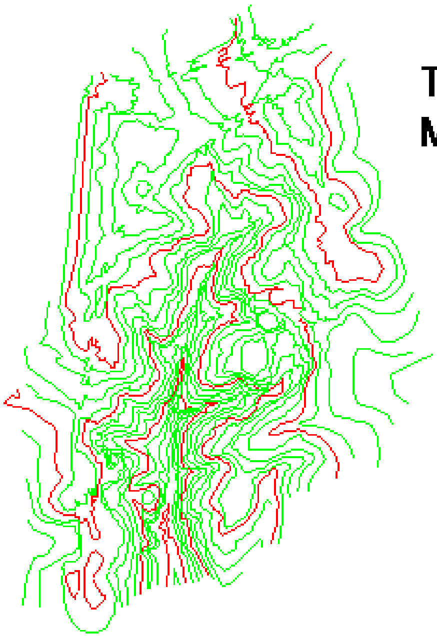
GRASS-AGNPS Input Map Layers

The following are examples of map layers needed for certain applications of the GRASS-AGNPS modeling tool. Depending on the application, some map layers are optional.

Watershed: The first data layer required is the watershed boundary map (shown below). This layer becomes the mask for all other layers, in that, it is used to determine the area of the watershed. The area in the watershed must have a category value of 1 or greater while outside the watershed the values must be zero. Also, there should be no undefined areas in the map.

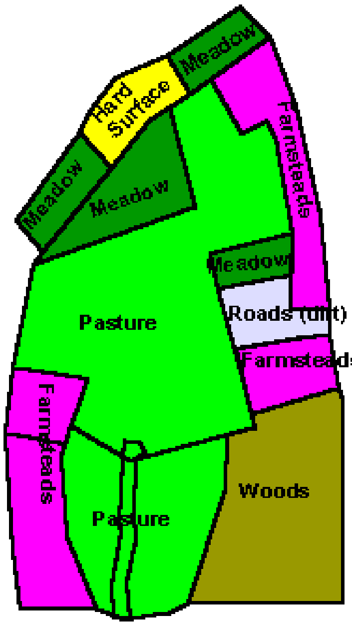


Topographic: The topographic map layer (shown below) must have elevations in meters and must extend beyond the watershed boundary at least two cell widths. For example, if the user plans to have a cell width of 100 m, the topographic map must extend at least 200 m beyond the watershed boundary in every direction. This is necessary to compute slopes and aspects at the watershed boundary. The map shown below is a vector map and covers a larger area than the watershed boundary map.



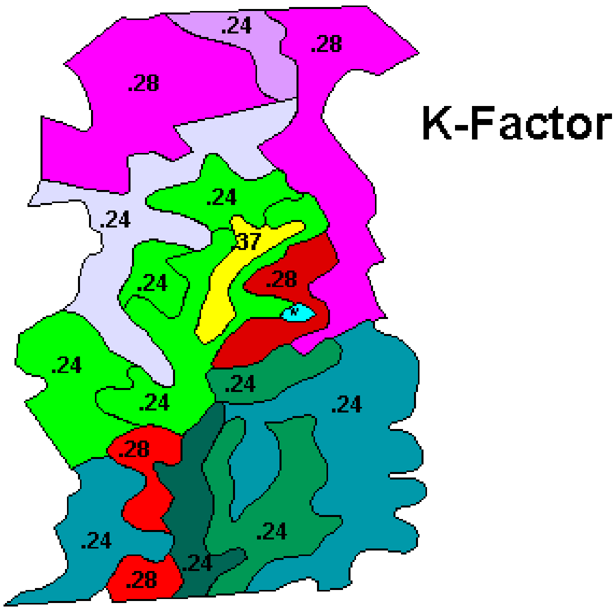
Topographic
Map

Land use: A land use map layer is also needed (shown below). This layer, like all others, must cover, at the least, the area inside the watershed map. The category labels for the example watershed are shown on the areas. Dividing the map into several areas before converting to raster facilitates modeling different scenarios, in that, a single colored area can be changed with one command.

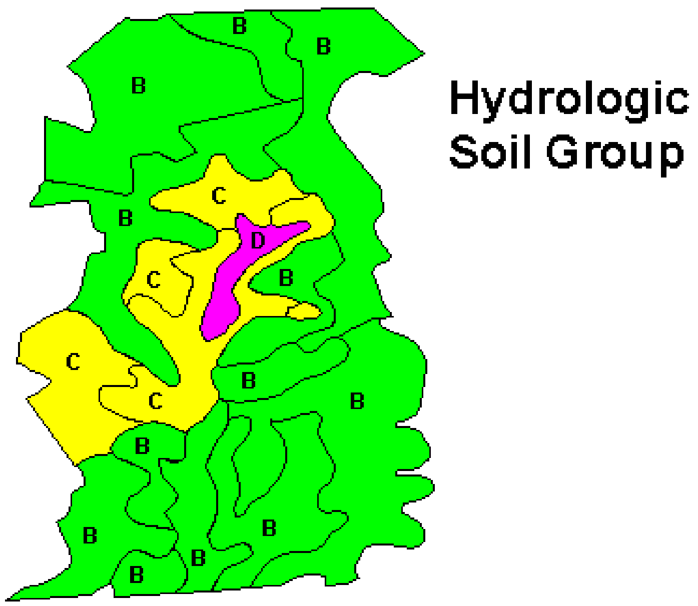


Land Use

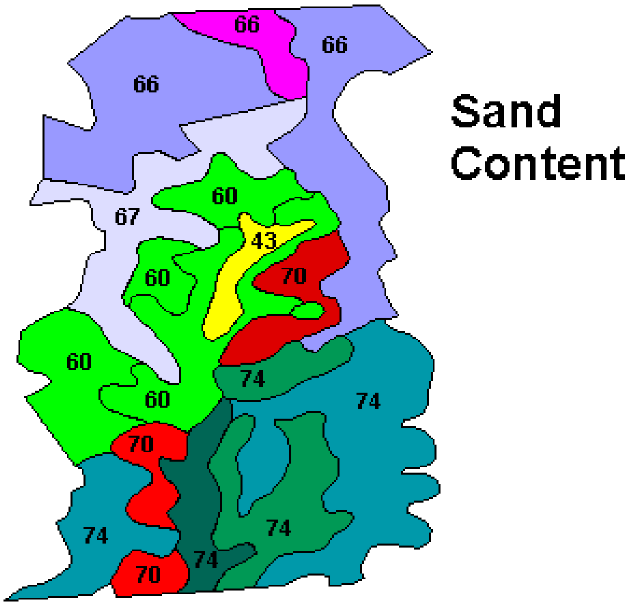
USLE K-factor: The K-factor layer should have the value of the K-factor as the category value for each area as shown in the figure below. This layer, like the next three, is simply the soils map with different category values for each area. The small ’w’ label in the middle right of the map indicates water. This label must be changed before this map can be used.



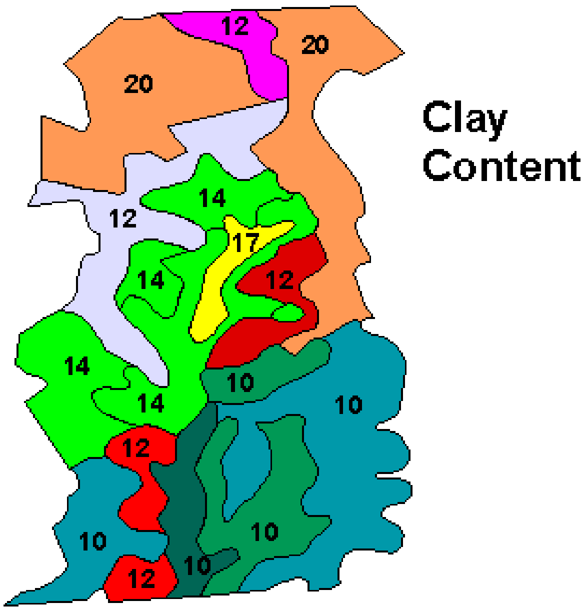
Hydrologic soil group: The hydrologic soil group is shown below. The group for each soil was obtained from the appropriate soil survey book. Possible groups are A,B,C, or D.



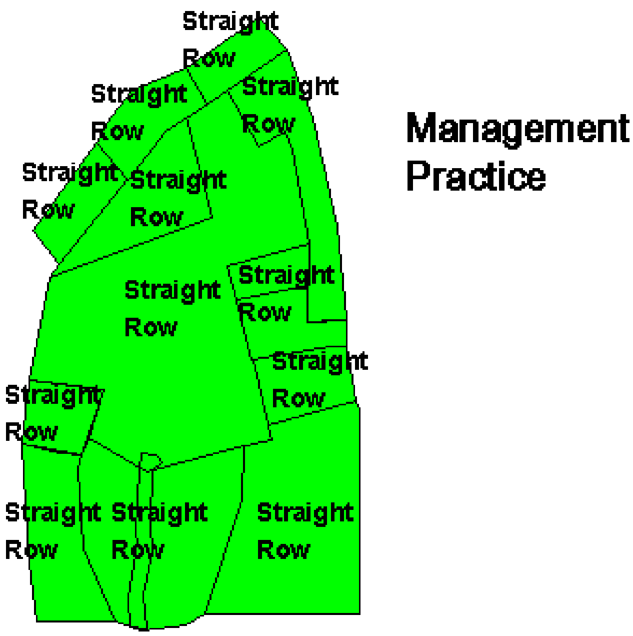
Sand: The percentage of sand-sized particles for each soil series is the category value for each of these areas. These values were obtained from soil series maps and other site-specific information.



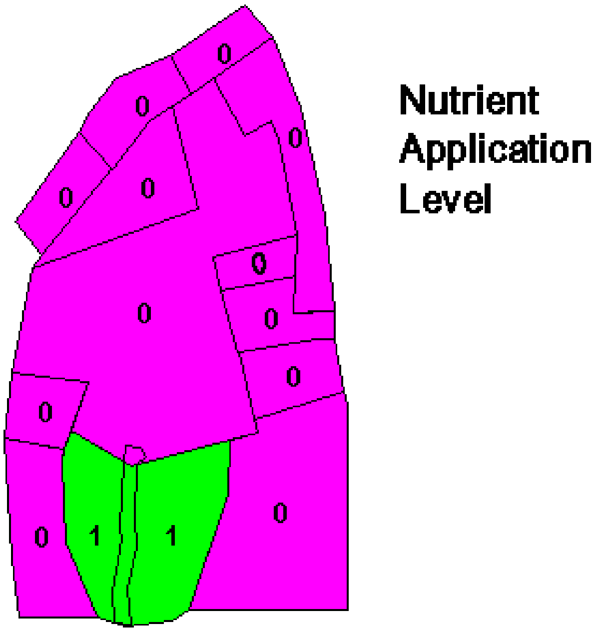
Clay: The percentage of clay-sized particles for each soil series is the category value for each of these areas.



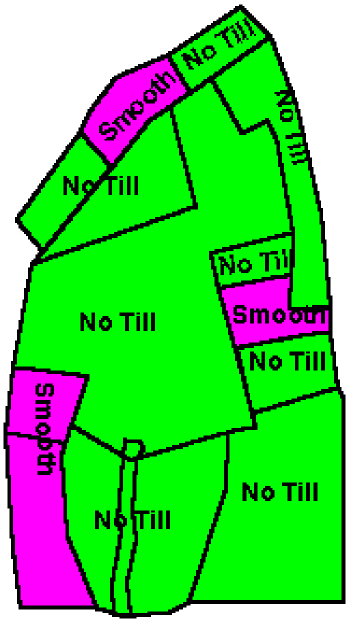
Management practice: One of the three allowable management practices must be the category label for each area. In the example, only straight row is used because no management practices were used; however, contoured or contoured and terraced could also be used.



Nutrient: Category labels for the areas in this data layer should correspond to the application rate of nitrogen and phosphorus (0=none, 1=50 lb/ac N and 20 lb/ac P, 2=100 lb/ac N and 40 lb/ac P, and 3=200 lb/ac N and 80 lb/ac P). Application rates for specific cells can also be entered manually in the interface.

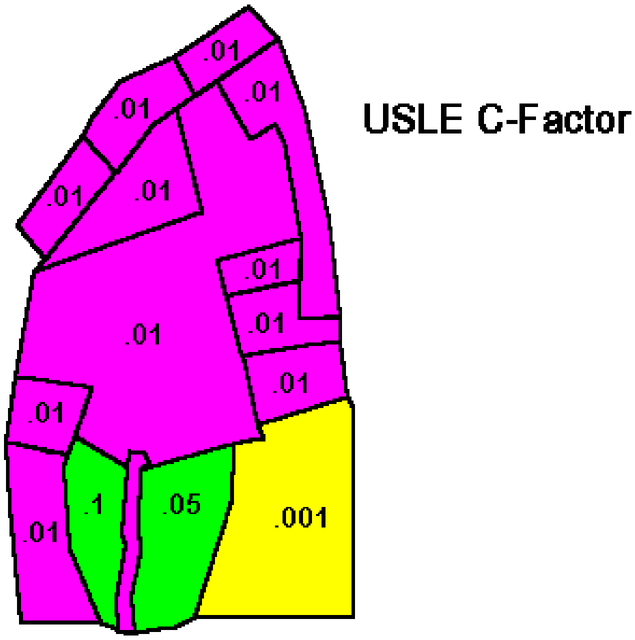


Machine: Category labels for each area should indicate the type of tillage. The example map has no till for the pastures and smooth for the residential/farmstead areas.

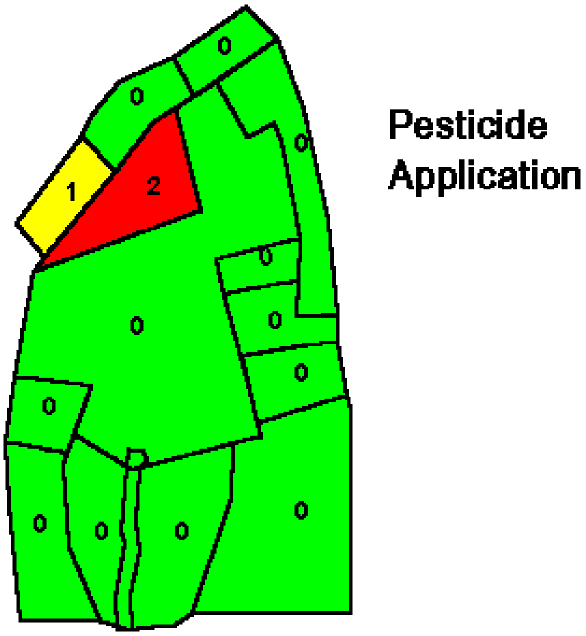


Machinery Practice

C-factor: The USLE C-factor should be the category labels for each area. The lower pasture area has much thinner grass and several denuded spots; therefore, the C-factor is slight greater.



Pesticide: This data layer is optional. Up to three pesticide application scenarios (1,2,3) can be entered as category values. A scenario consists of a unique set of pesticide type, application rate and timing, and method. For example, on the following map the 1 might represent Atrazine applied during preplant at a rate of 2 quart/acre while the 2 represents Atrazine applied postplant at 2 quart/acre. The application rate, timing, and other information for the scenarios must be entered by the user in the interface.



Channel grade: This data layer is optional. The user has the opportunity to enter channel information for specific cells in the interface. If used, this layer should contain channel slopes, in percent, as the category value for each area. If this layer is missing, the channel slope is assumed to be 50% of the overland slope computed from the topographic map. Since channel characteristics were entered for specific cells, no channel grade map was used.

Other input: The following table contains other input data used in the example.

AGNPS Parameter	Value
Initial Input Table:	
Rainfall amount	1.76 inches
Rainfall Energy-intensity	20.48
Rainfall duration	14 hours
Storm type	II
Nitrogen concentration in rainfall	0.8 ppm
Peak flow calculation	AGNPS
Geomorphic calculations	yes

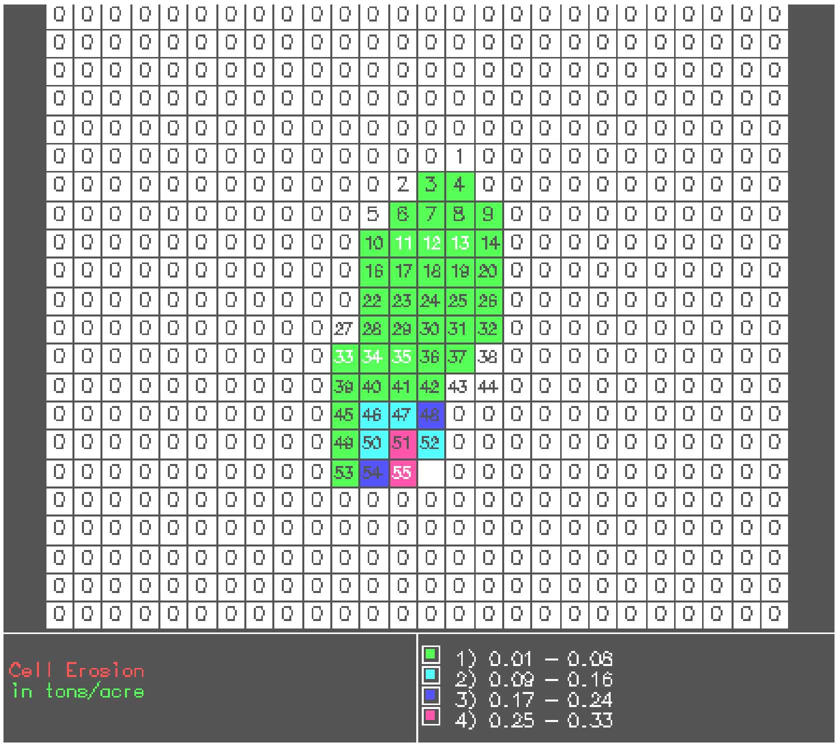
Hydrograph shape factor	K coef.

Channel Input Tables:

Cell selection method	D, enter cell number
Cell	55
Stream type	7, perennial stream
Slope	0.5
Sideslope	10
Length coefficient	153
Length exponent	0.6
Manning coefficient	0.035

GRASS-AGNPS Output

The following figure is an example of a GRASS-AGNPS output map showing cells, cell numbers, and pollutant loads from each cell. This is not the output map from the example above; however, the example map would be similar. Each output map has four colors to represent four levels of pollutant loading, except when the loading is too small to divide by four in which case only one color is shown. Cells that are the background color are less than 0.01 and cells with the number 0 are outside the watershed. The cells that have no visible number (cells 16 and 17) are in the watershed, but the cell number is the same color as the background color. All values shown are for pollutant loadings at the cell outlet, except for cell erosion and pesticide percolation. Thus, cumulative sediment nitrogen loading from all cells draining to cell 55 including cell 55 would be in the range of 0.09 to 0.16 lb/ac.



A table of nutrient, sediment, or pesticide output from each cell can also be viewed (example below). The table includes actual values from the AGNPS output file for each cell selected. Output for other cells can be viewed by entering the cell number.

Summary of Sediment and Nutrient Output

			Nitrogen		Phosphorus	
Cell	**Runoff**	**Sediment**	**Sediment**	**Soluble**	**Sediment**	**Soluble**
	(in)	**(tons)**	**(lb/ac)**	**(lb/ac)**	**(lb/ac)**	**(lb/ac)**
55	0.05	2.12	0.27	0.00	0.14	0.00

Summary of Pesticide Yields

Cell	**Drainage**	**Pesticide**	**Cell Outlet**		**Mass in**
Number	**Area (ac)**		**runoff (lb/ac)**	**sediment (lb/ac)**	**Percolate (lb/ac)**
55	140	ALACHLOR	0.01	0.00	0.09
