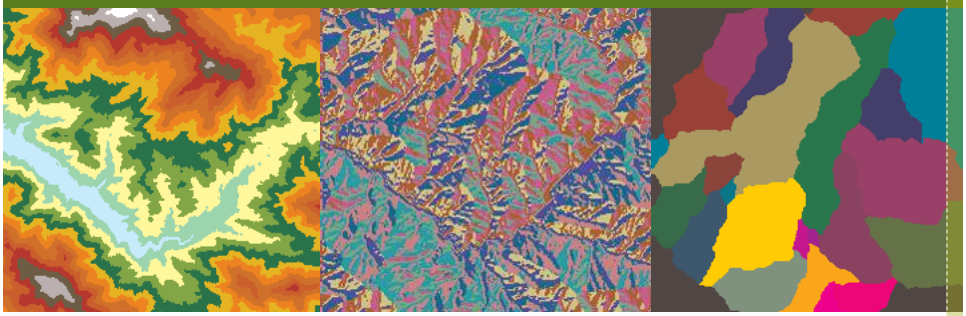
Watershed Delineation



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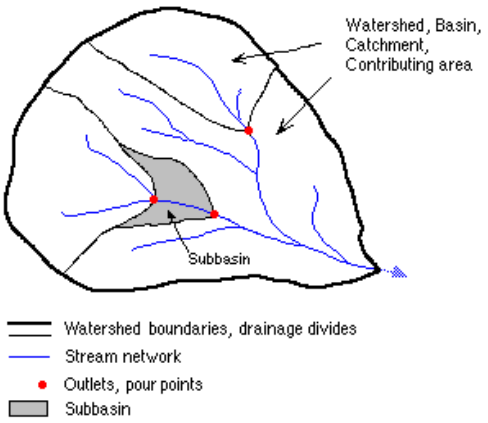
Hydrological Analysis of Terrain Data

Stream links



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Flow Direction

Single vs multi-flow directions

- D4, D8

(a)

6	7	8
5	0	1
4	3	2

(b)

64	128	1
32	0	2
16	8	4

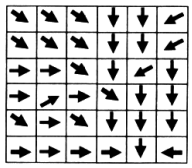
(c)

32	64	128
16	0	1
8	4	2

(a)

78	72	68	73	60	48
75	68	56	50	46	50
70	55	45	40	39	47
65	57	53	26	30	26
67	60	48	23	18	20
75	55	45	12	10	12

(b)



(c)

2	2	2	4	4	8
2	2	2	4	4	8
1	1	2	4	8	4
1	128	1	2	4	4
2	1	2	4	4	4
1	1	1	1	4	16

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Sinks (depressions, pits, ...)

- All neighboring cells are higher than the sink cell
- Two cells flow into each other
- Sinks have undefined flow directions and are assigned a value that is the sum of their possible directions.
- For example, if the steepest drop and, therefore, flow direction, are the same to both the right (1) and left (16), the value 17 would be assigned as the flow direction for that cell.
- A digital elevation model (DEM) that has been processed to remove all sinks is called a depressionless DEM.

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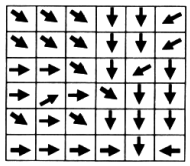
Flow Accumulation

(a)

78	72	68	73	60	48
75	68	56	50	46	50
70	55	45	40	39	47
65	57	53	26	30	26
67	60	48	23	18	20
75	55	45	12	10	12

(b)



(c)

2	2	2	4	4	8
2	2	2	4	4	8
1	1	2	4	8	4
1	128	1	2	4	4
2	1	2	4	4	4
1	1	1	1	4	16

(a)

0	0	0	0	0	0
0	1	1	2	2	0
0	2	7	5	4	0
0	1	0	20	0	1
0	0	1	0	22	2
0	2	3	7	35	3

(b)

0	0	0	0	0	0
0	1	1	2	2	0
0	2	7	5	4	0
0	1	0	20	0	1
0	0	1	0	22	2
0	2	3	7	35	3

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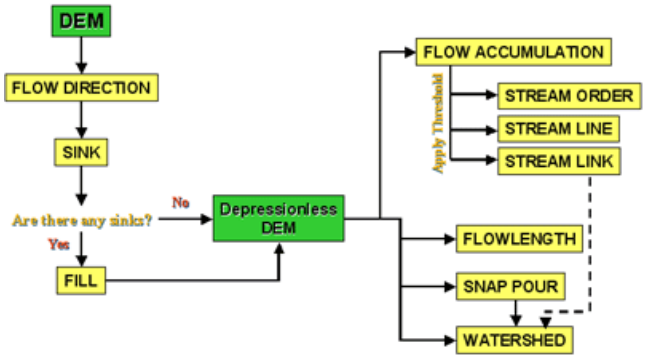
Watershed Delineation Steps



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Baker, M. E., Weller, D. E., and Jordan, T. E. 2006. Comparison of Automated Watershed Delineations: Effects on Land Cover Areas, Percentages, and Relationships to Nutrient Discharge. PE&RS 72(2): 159-168.

- Compared manual delineations and ten automated delineations of 420 watersheds in four physiographic provinces of the Chesapeake Basin
  - Appalachian Plateau
  - Appalachian Mountain
  - Piedmont
  - Coastal Plain
- Comparison indexes:
  - Watershed size
  - Land-cover composition (row crop ag)
- Correlated ag% with N concentration

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Automated Methods:

- Un-enhanced
- Stream burning
- Normalized excavation
- Surface reconditioning (AGREE)
- Normalized reconditioning.

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Stream Burning

Raster calculator
"streamg" – stream raster: 1 stream, 0 non-stream
"dem" – original DEM

Con("streamg" == 1, dem – 10, dem)

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AGREE Algorithm

1. Drop/raise the elevation of the cells corresponding to the vector lines a certain amount (Smooth)
2. Buffer the vector lines (Buffer)
3. Assign elevation to the cells inside the buffer so that there is a straight line path from the vector line to the original elevation just outside the buffer
4. Drop/raise the elevation of the cells corresponding to the vector lines a certain amount (Sharp)

http://www.ce.utexas.edu/prof/maidment/gishydro/ferdi/research/agree/agree.html#

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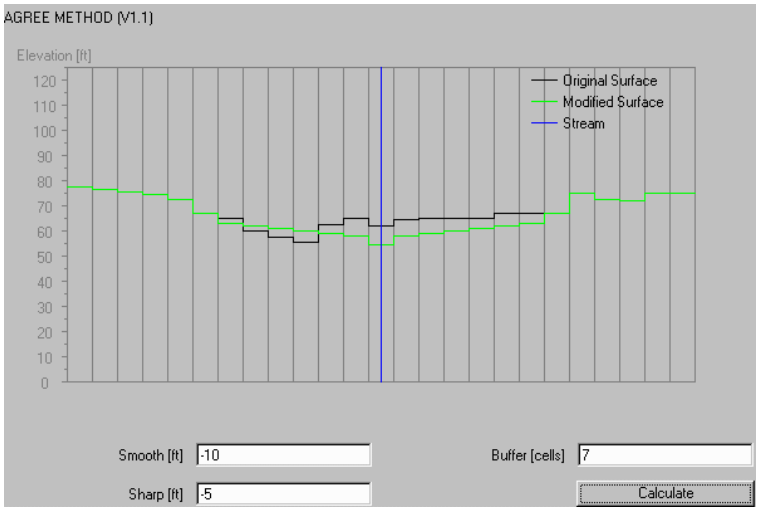
AGREE



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Data Used

- USGS 7.5 minute (~30 m) DEM
- USGS DLG Hydrography map
- NLCD land-cover
- Nitrate concentration data

Results

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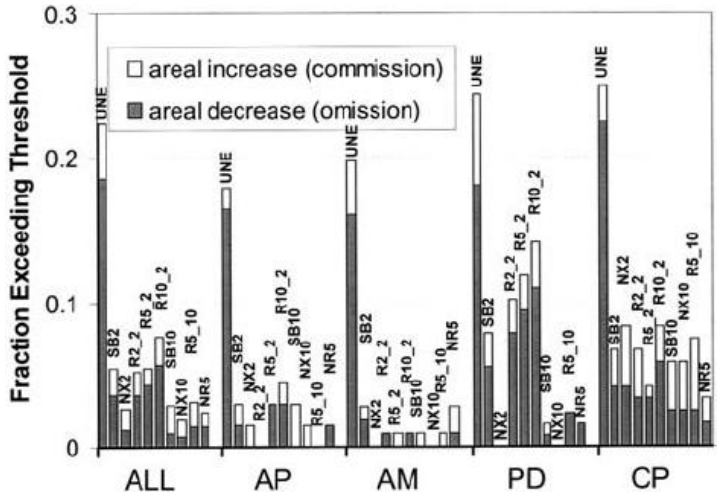

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