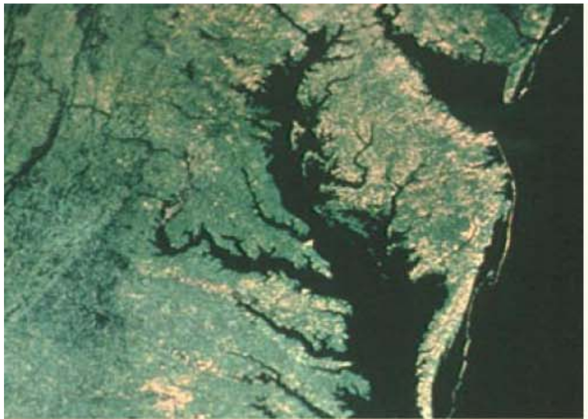


Chesapeake Bay Program

A Watershed Partnership

Tree Canopy, Riparian Forest Buffers, and Urban Stream Corridors

Land Use Workgroup Coordinator:

Peter Claggett, U.S. Geological Survey

Phase 6 Tree Canopy

What is it?

10m pixels with tree canopy covering 1-100% of the pixel that are not adjacent to forest*.

> * Forest = 10m pixels with 100% tree canopy within or adjacent to 1-acre min. bounding circles of 100% tree canopy.

Unique loading?

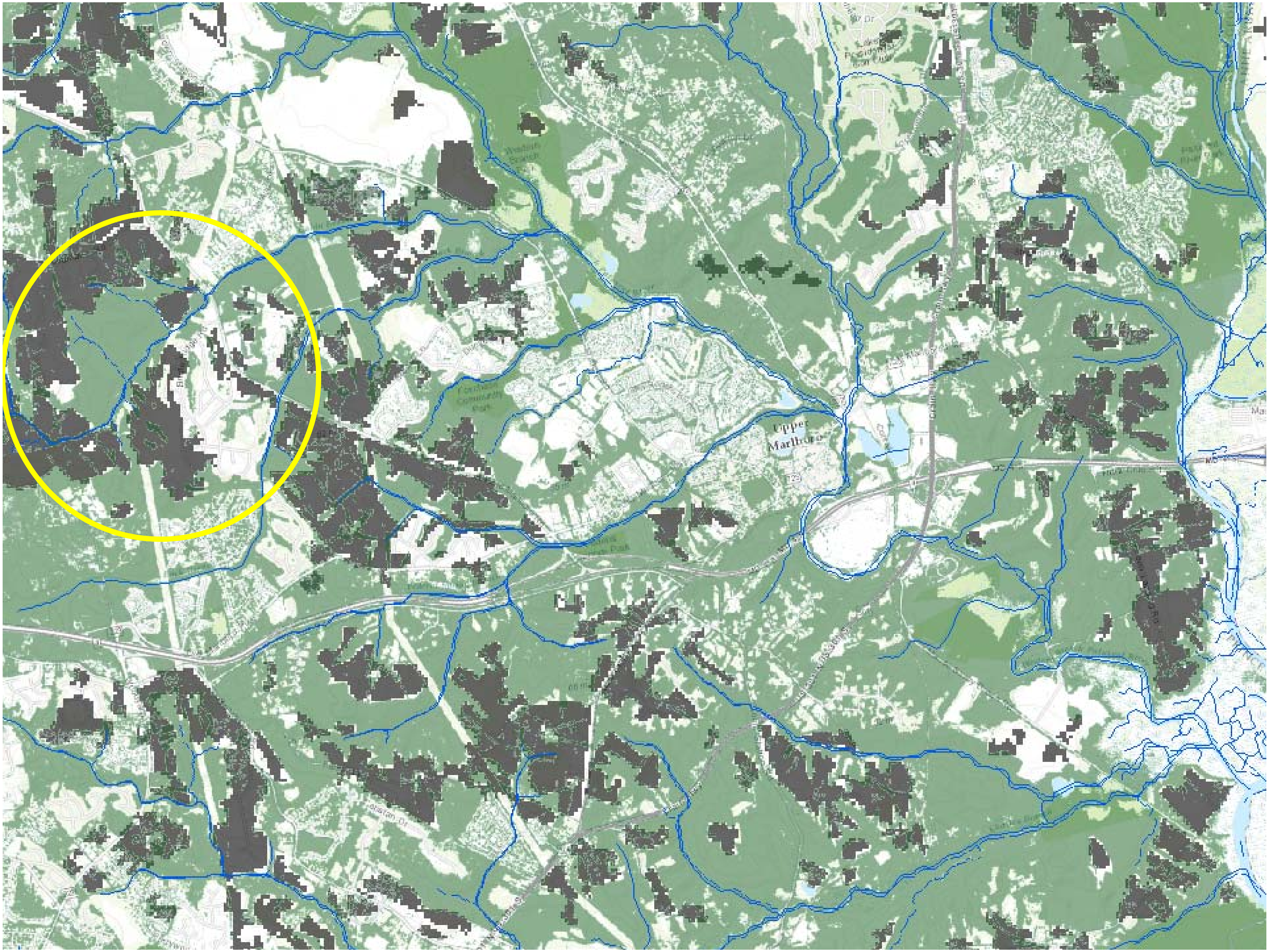
Under investigation by USFS with iTree-Hydro model and UTC expert panel. Presumed to load less than forest and developed open space.

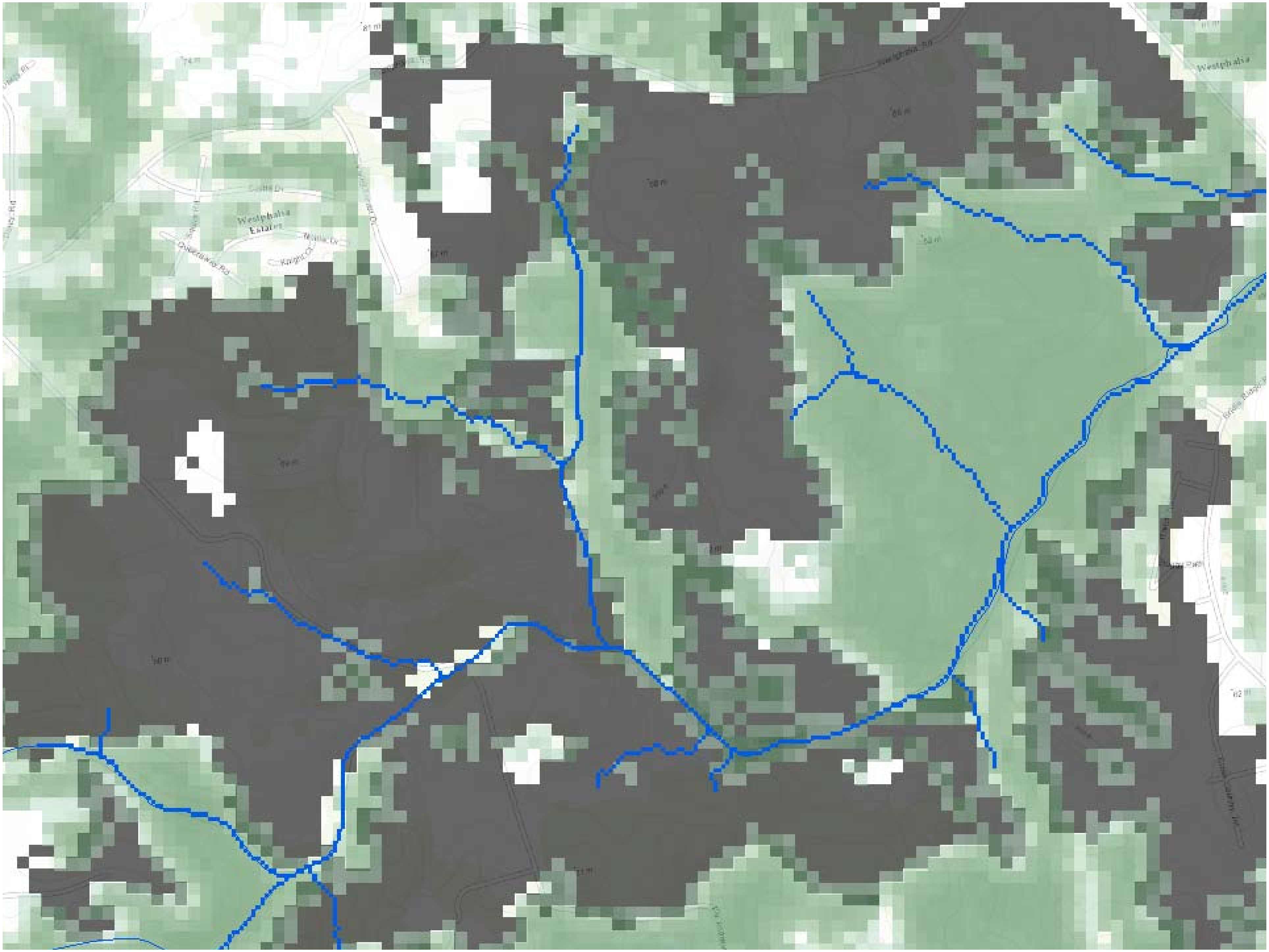
Not restricted to urban areas and therefore not related to Urban Tree Canopy goal.

Phase 6 Riparian Forest Buffer Land Use

What are they?
Areas of forest cover contiguous to streams and within the flow path from upslope agriculture (Baker 2006).

Unique loading?
Loads like forests but with added benefit of reducing loads from upslope cropland (and pasture?).


Upper
Marlboro


Westphalia
Estates
Westphalia

Buffer load reductions options:

BMP method:

1 acre of buffer reduces load from 4 acres of cropland by 25%.

Weller & Baker method:

- Instream nitrogen levels are partly a function of the proportions of cropland in small watersheds that are buffered and unbuffered by riparian forest/wetland cover.

- In the 1990's, existing riparian forest/wetland buffers reduced nitrogen loads from cropland by 22%.

Buffer load reductions options:

SPARROW method:
Add a new variable to SPARROW nitrogen model: percent cropland buffered by forest/wetland cover

If statistically significant, incorporate the regression coefficient for buffered cropland into the land-to-water delivery factors in the Phase 6 model.

Stream Corridors as Sediment Sources in Phase 6

Goals:

- More explicitly account for stream corridors as sources of sediment
- Modify Sediment Delivery Factors in Phase 6 based on fluvial geomorphic conditions
- Develop model relationships between upland runoff reduction and stream restoration BMPs (for Phase 7?).

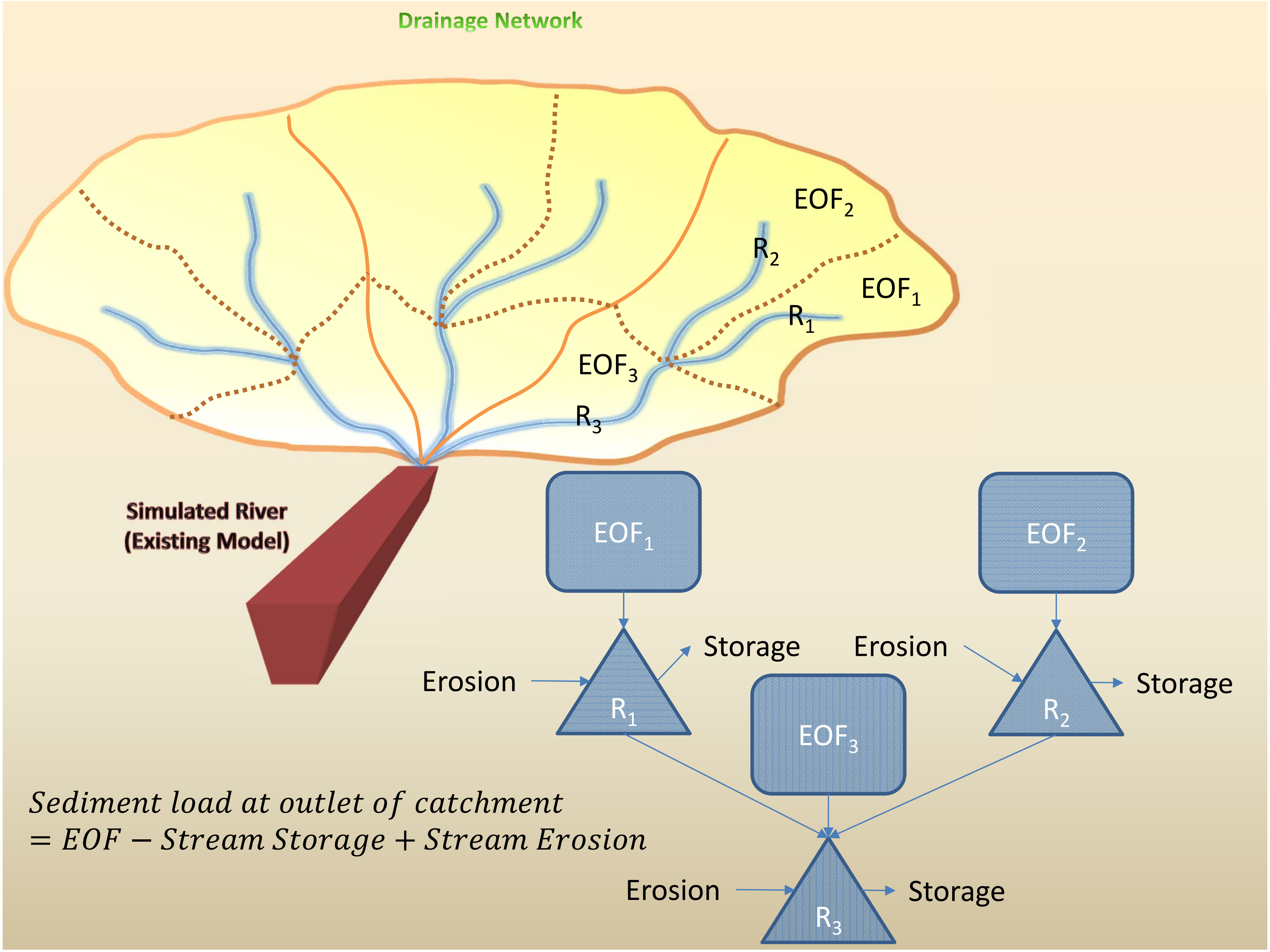
Estimating Sediment Source Ratios (SSRs) for Urban Streams

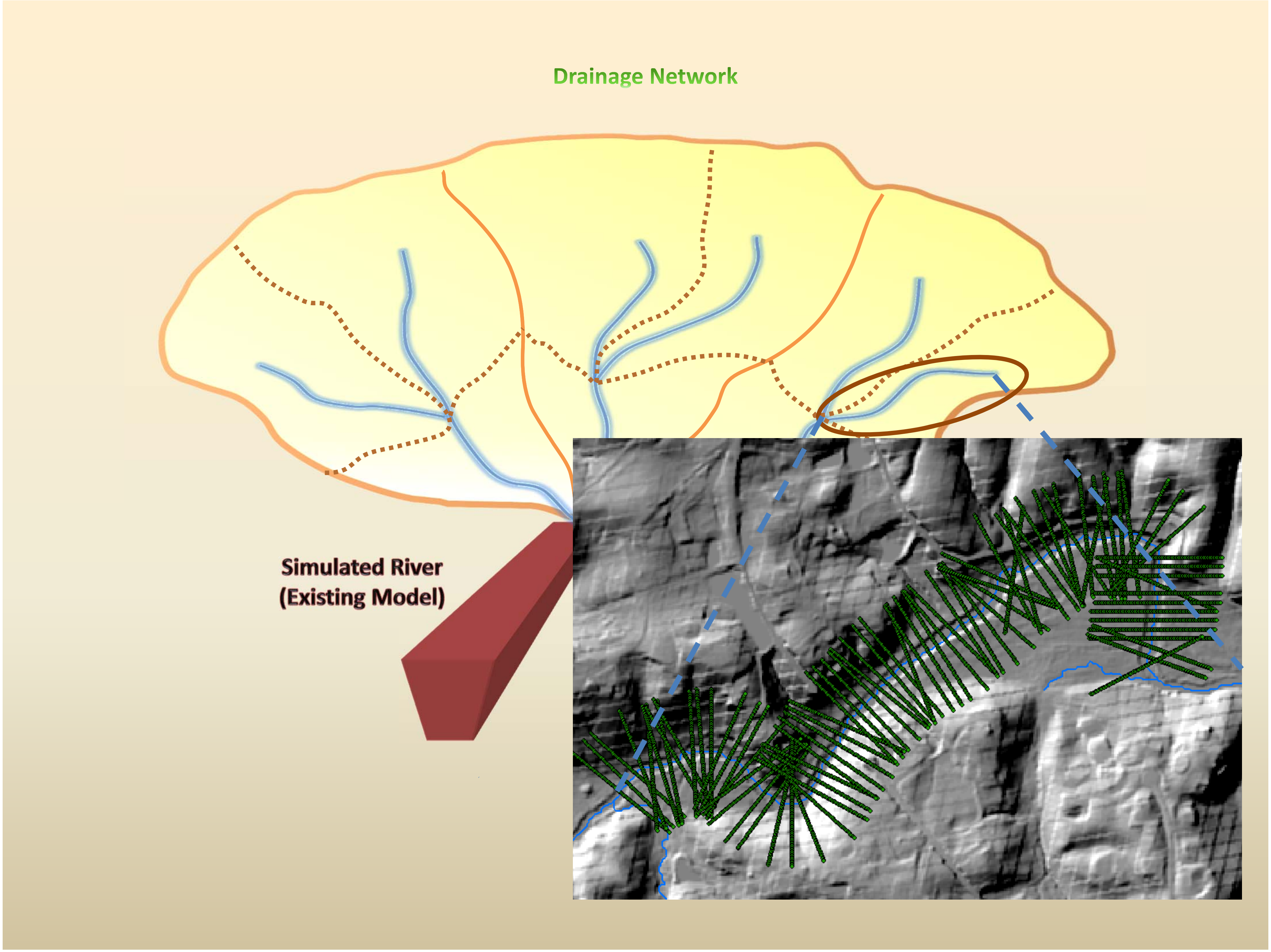
SSR =
ratio of sediment originating from bank/bed erosion to total sediment budget

- Develop a database of outfall and in-stream sediment monitoring data.
  - Use stormwater outfall and in-stream monitoring data
- Develop database of watershed and stream corridor characteristics
  - Use high-resolution digital elevation models (e.g., LiDAR) and high-resolution land cover
- Perform stepwise multiple regression to predict SSRs from watershed and stream corridor characteristics
- Apply relationship to all urban stream corridors.

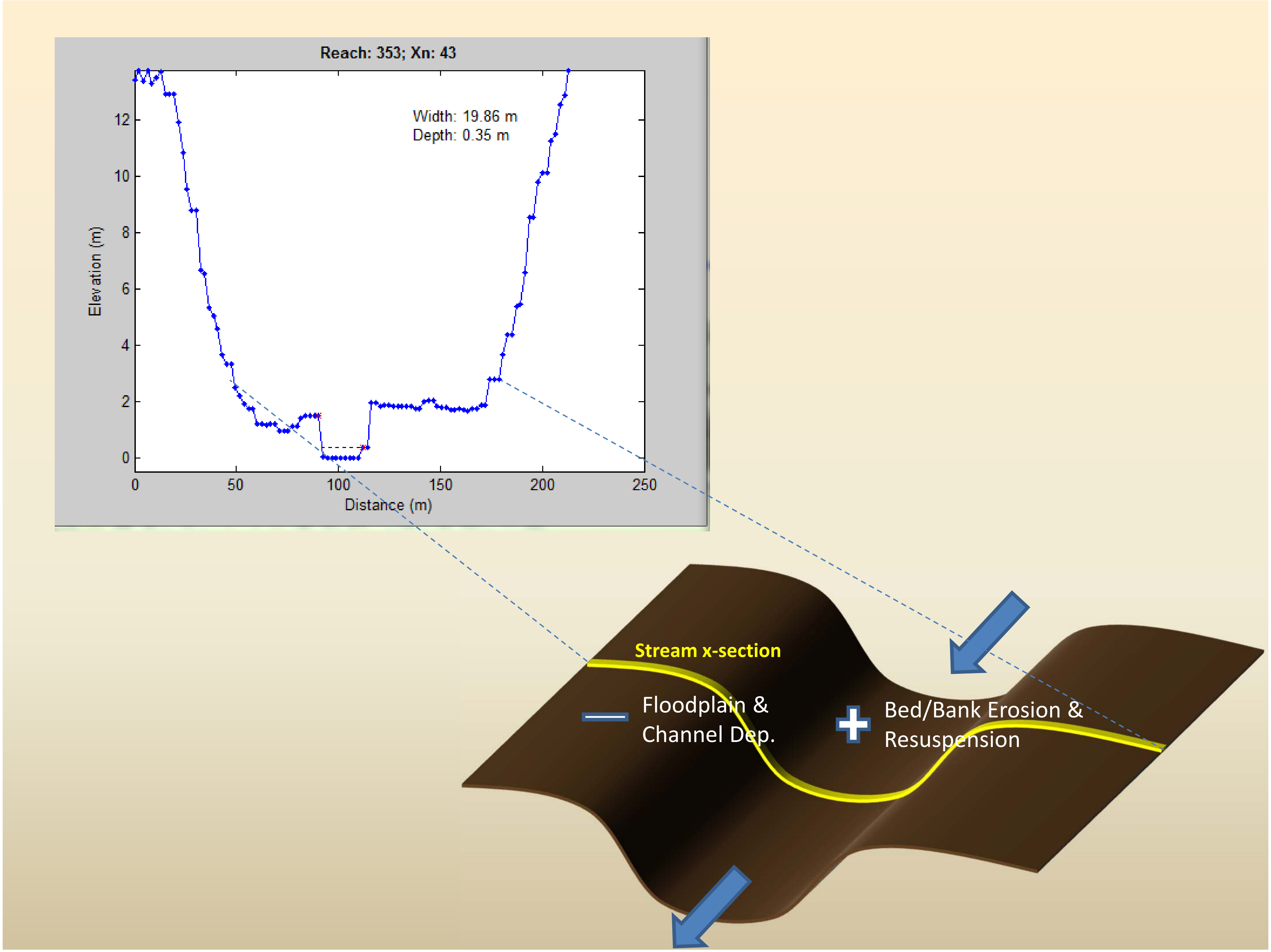
Potential stepwise regression parameters for SSR

Catchment data – variables affecting sediment budget	
Parameter	Data Source
Impervious cover	Local data – planimetric; NLCD
Storm drainage density	Local/ MS4 data; connectivity indicator
Density of outfalls	Local/ MS4 data
Forest Cover (watershed)	Anderson Level II (from State e.g. MDP)
Riparian land cover/buffers	Local data
Soil type	SSURGO
BMP implementation	Local/MS4 data; % IC treated or other
Stream density	Connectivity indicator
Stream corridor – variables affecting sediment budget	
Sinuosity	Derived
Floodplain width	USGS
Bank height	USGS
Channel slope	Derived
Source/sink	USGS-Schenk method

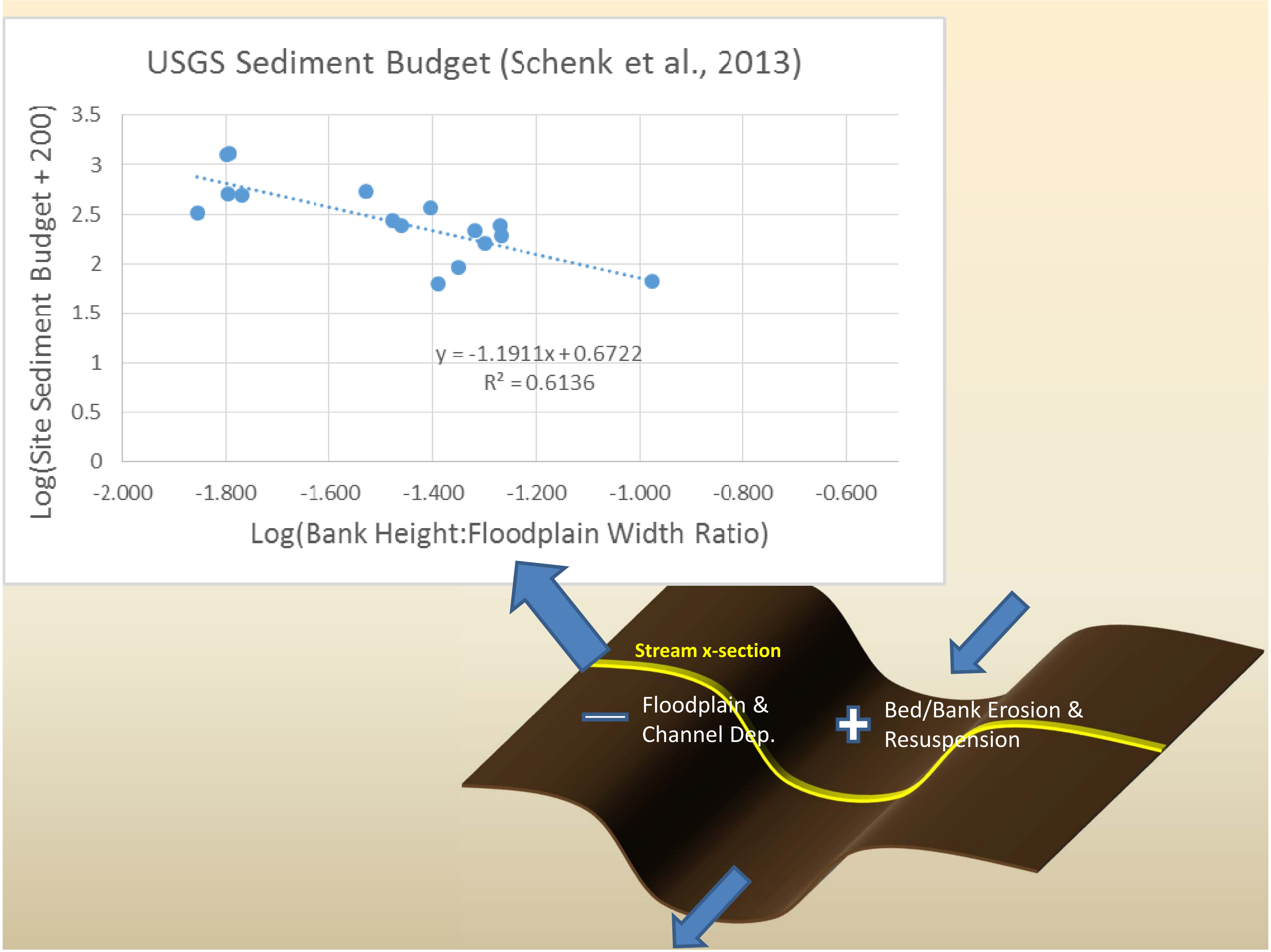

Drainage Network
EOF2
R2
EOF1
R1
EOF3
R3
Simulated River
(Existing Model)
EOF1
EOF2
Storage
Erosion
Erosion
R1
EOF3
R2
Storage
Sediment load at outlet of catchment
= EOF − Stream Storage + Stream Erosion
Erosion
Storage
R3



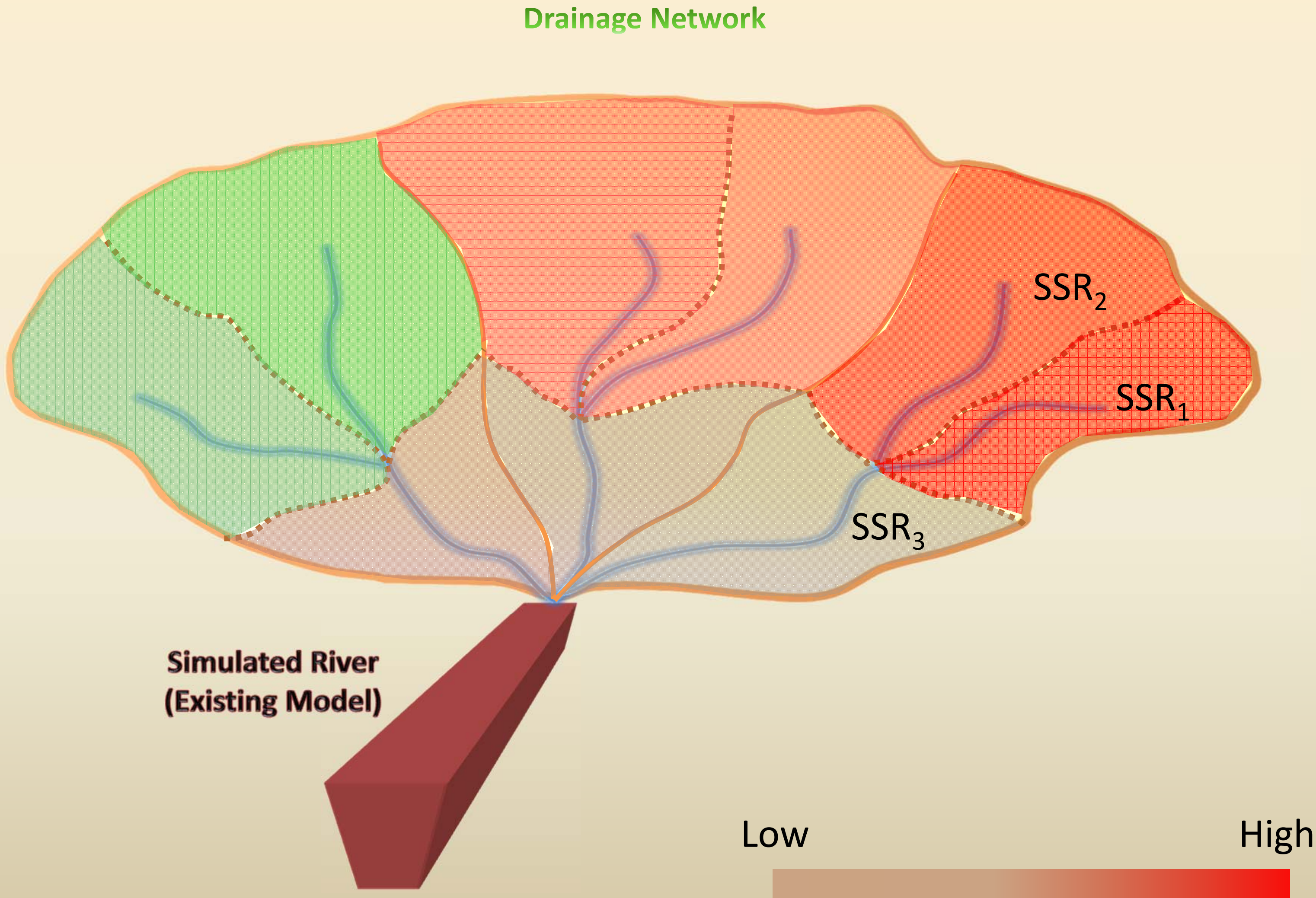
Drainage Network
Simulated River
(Existing Model)



Reach: 353; Xn: 43
Width: 19.86 m
Depth: 0.35 m
Elevation (m)
Distance (m)
0
2
4
6
8
10
12
0
50
100
150
200
250
Stream x-section
Floodplain &
Channel Dep.
Bed/Bank Erosion &
Resuspension


USGS Sediment Budget (Schenk et al., 2013)
Log(Site Sediment Budget + 200)
3.5
3
2.5
2
1.5
1
0.5
0
-2.000
-1.800
-1.600
-1.400
-1.200
-1.000
-0.800
-0.600
Log(Bank Height:Floodplain Width Ratio)
y = -1.1911x + 0.6722
R² = 0.6136
Stream x-section
Floodplain &
Channel Dep.
Bed/Bank Erosion &
Resuspension

SSR Result


Drainage Network
SSR$_2$
SSR$_1$
SSR$_3$
Simulated River
(Existing Model)
Low
High

SDF Result

$$SDF = \frac{Sediment\ Delivered}{Sediment\ Generated}$$