

Modeling Stream Peak Flow in Island Branch Watershed Using the Curve Number Method

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Overview and Methods

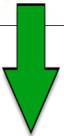
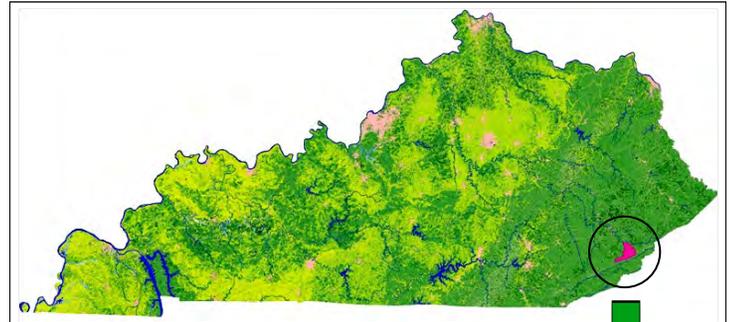
Island Branch is a first-order watershed in eastern Kentucky that has been mined and recently reclaimed. The stream shows signs of erosion related to increased peak flows. Like the majority of small streams, there is no gauging station available to measure flow. In the southern Appalachian forest region, where hydrology can be dramatically altered by coal mining, it is imperative to develop a reliable and accurate model to estimate peak flow and its relationship to land use change.

In this study, the Natural Resources Conservation Service (NRCS) curve number method is used to estimate runoff in Island Branch. Curve number values are carefully chosen for each of the following land classifications: undisturbed forest, actively mined, reclaimed grassland, and two years after reclamation. After determining runoff, peak flow will be acquired using basic hydrologic equations.

Modeled Watershed

Island Branch is located in Letcher County, Kentucky. This watershed has an area of 2.23 km² and a slope of 4.1%. Digital orthophotos from the Natural Agricultural Imagery Project were analyzed in a GIS to determine that 6.3% of the watershed is disturbed by mining. The Island Branch site shows erosion from the following mechanisms: scouring, slumping, and undercutting.

Island Branch Watershed



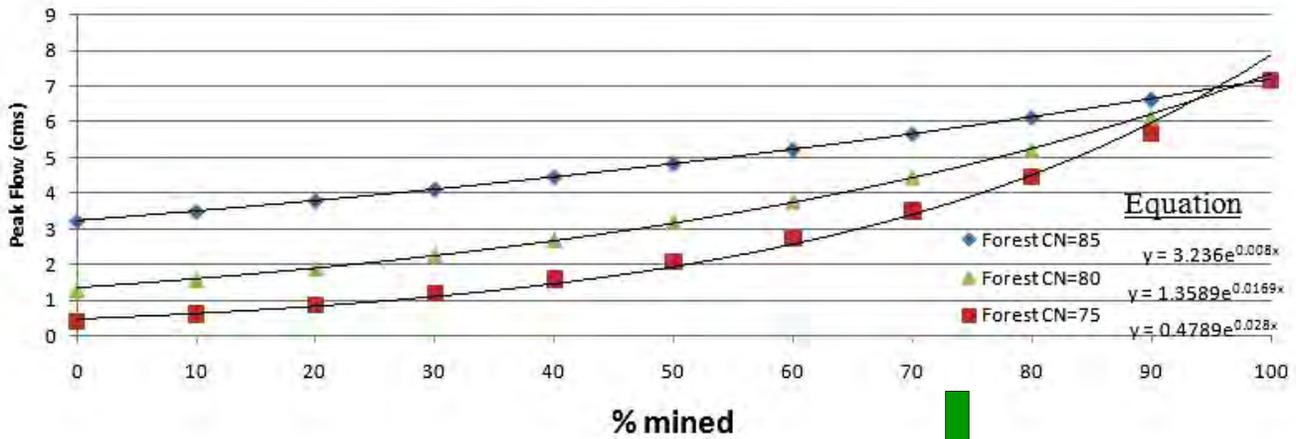
Slumping stream bank

Scouring/undercutting

Curve Numbers Used

LU	Forest	Mining	Rel	Rel+2 yrs
CN	75-85	90	89	80-90
# Srcs	5	1	3	1

Peak Flow in Island Branch



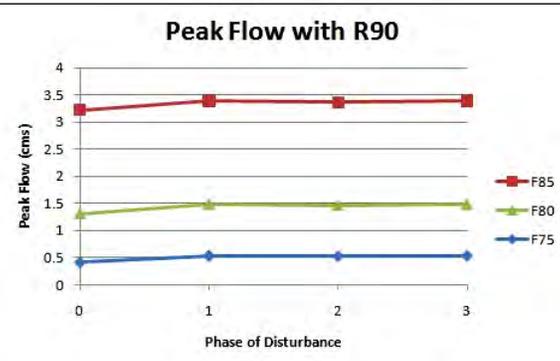
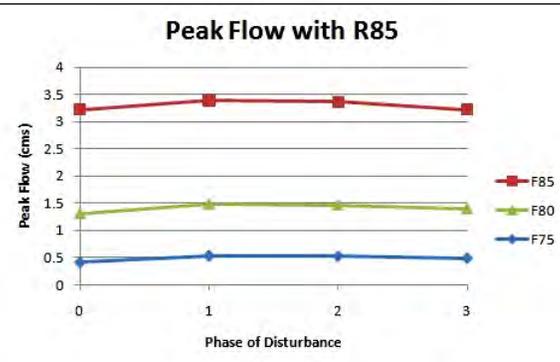
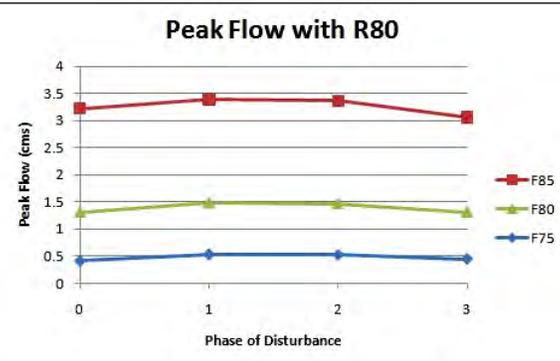
Constant	Mining Increases by Area				
	0-20%	20-40%	40-60%	60-80%	80-100%
Flow Increase (F=75)	110%	84%	71%	64%	61%
Flow Increase (F=80)	46%	42%	40%	38%	37%
Flow Increase (F=85)	18%	18%	17%	17%	17%

Conclusions

Island Branch shows signs of increased peak flow, presumed to be a result of mining in the area. Peak flow increased by 30%, 13%, and 5% when using forest curve numbers 75, 80, and 85, respectively. Exponential growth was found when calculating the relationship between percentage of watershed mined and peak flow. These increases cause streams to erode and widen in an attempt to regain equilibrium with their flows. If reliable curve numbers are found for the diverse sub-regions and soil types, the curve number method has potential to model watershed flow in the southern Appalachian forest region.

Areas of Further Research

In order to further develop the NRCS curve number model for predicting runoff in the southern Appalachian forest region, more accurate curve numbers must be determined. By measuring peak flow during rainfall events, curve numbers can be evaluated for specific sub-regions and soil types.



Constant	R = 90	
	F75 → F80	F75 → F85
Flow Increase due to mining disturbance	180%	540%

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