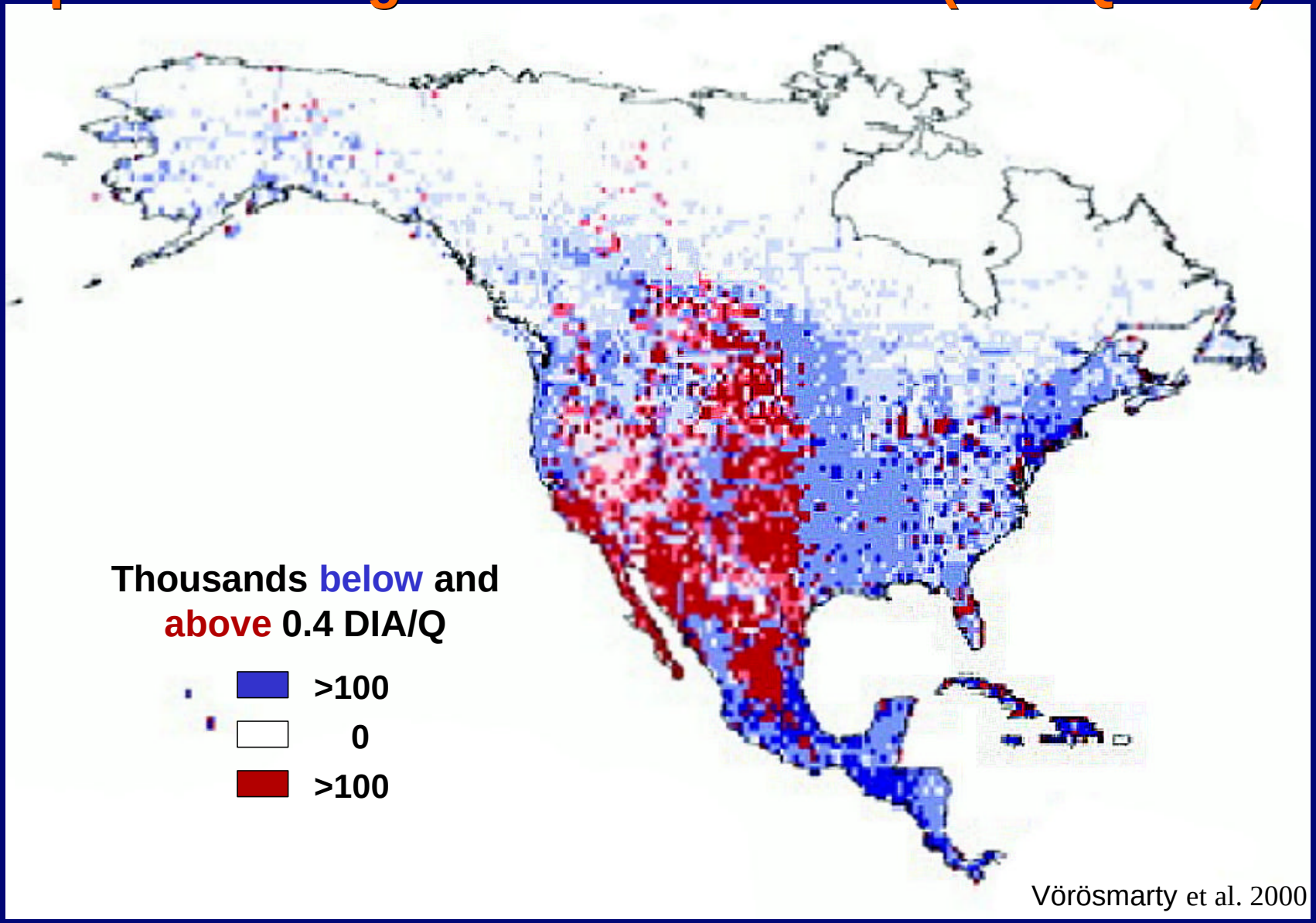
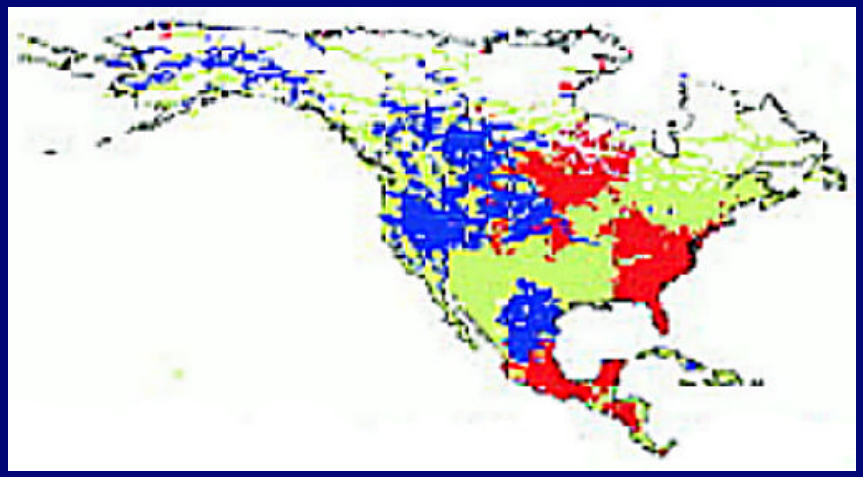
Contemporary Population Relative to Demand per Discharge Stress Threshold (DIA/Q =0.4)

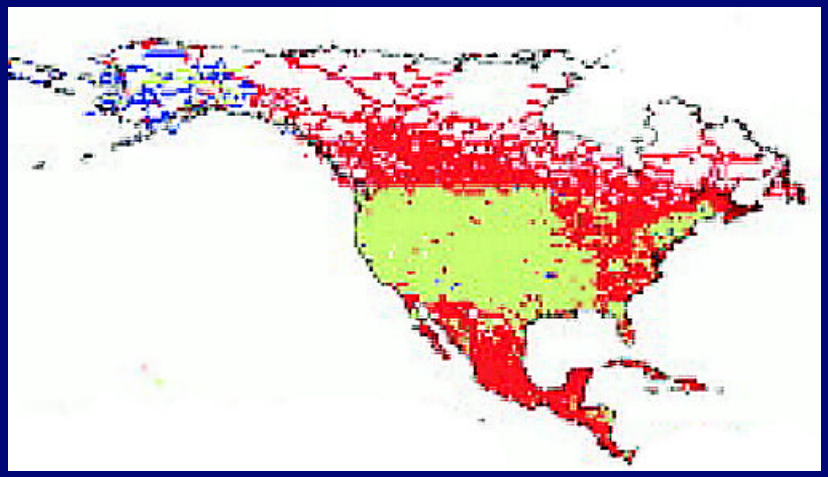


Vörösmarty et al. 2000

Relative Change in Demand per Discharge



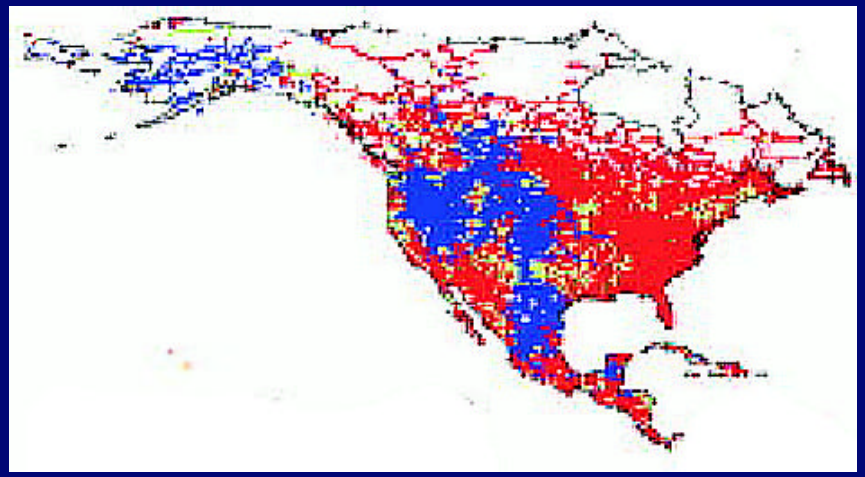
Climate Change Only



Population Change Only

$$\frac{\Sigma\ DIA/Q_{scenario}}{\Sigma\ DIA/Q_{base}}$$

	<0.8
	0.8-1.2
	>1.2



Climate and Population Change

Vörösmarty et al. 2000

Longitudinal Distribution of Mesohabitats in the North Fork Shenandoah River, Virginia

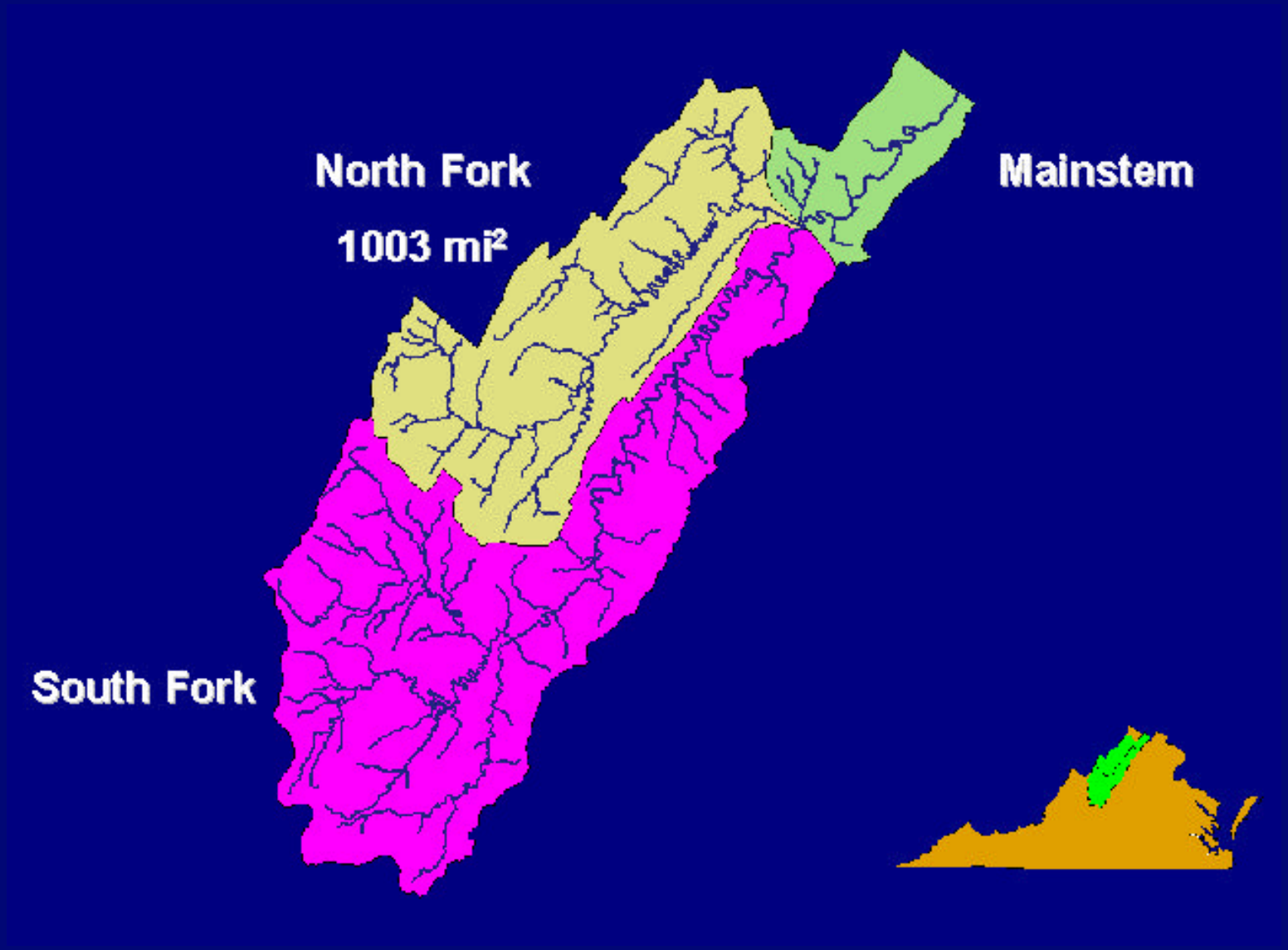
Adrienne Weimer, Peter M. Ruhl*, Donald C. Hayes*, Donald J. Orth, and Tammy J. Newcomb

*

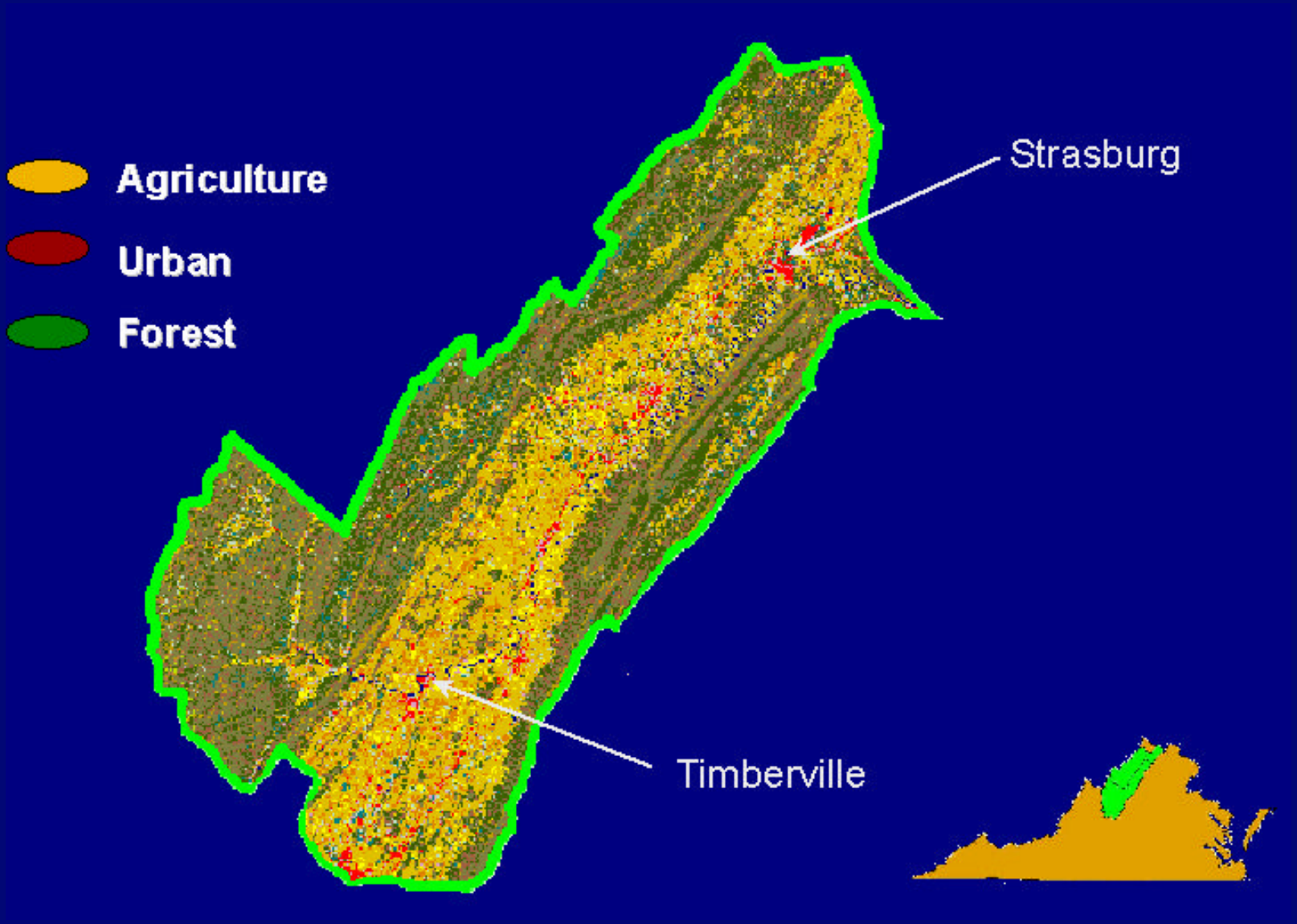
Objectives

- North Fork Shenandoah River
- Mesohabitat inventory study
- Instream flow study

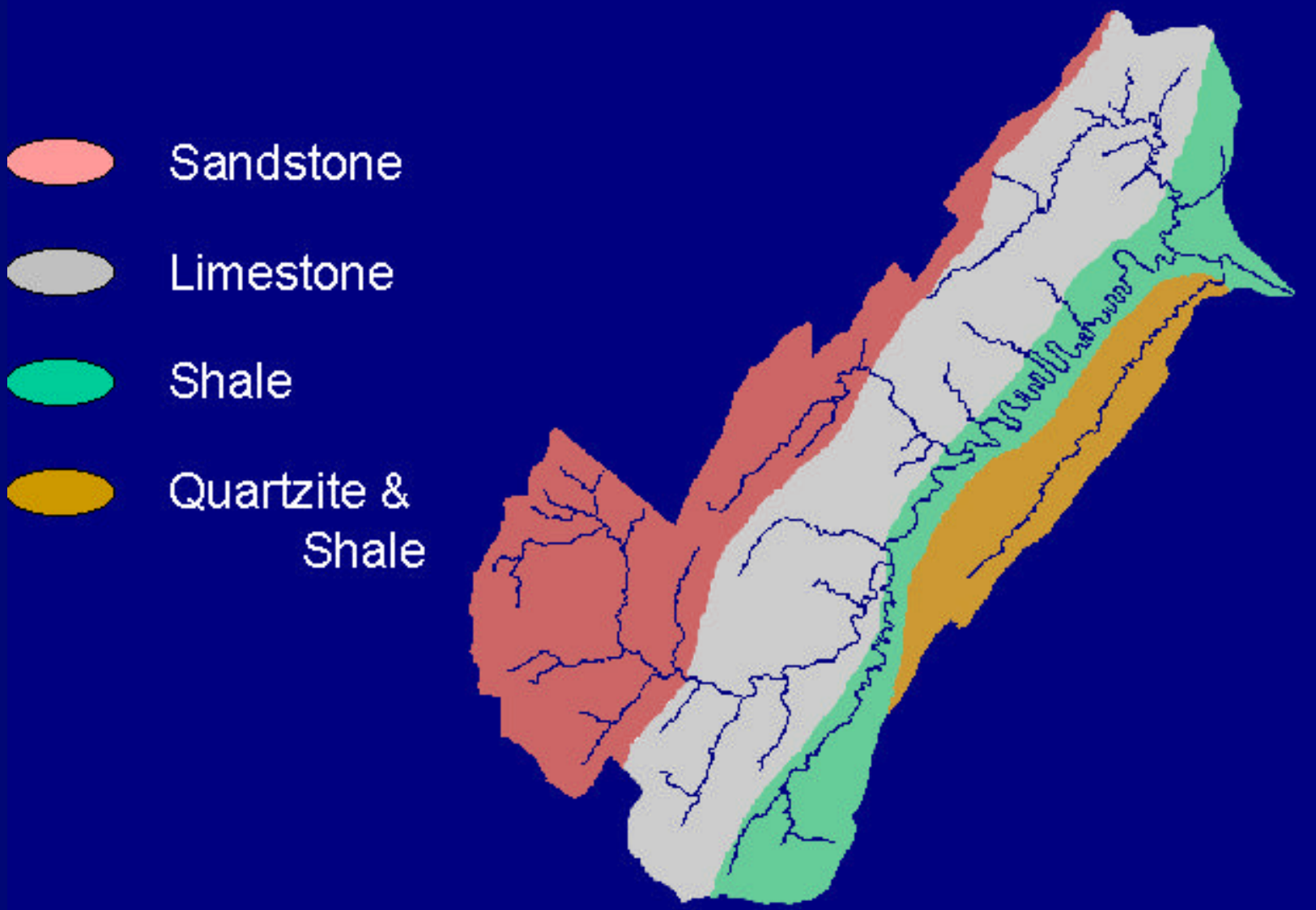
The Shenandoah River Basin



Land Use in the North Fork Basin

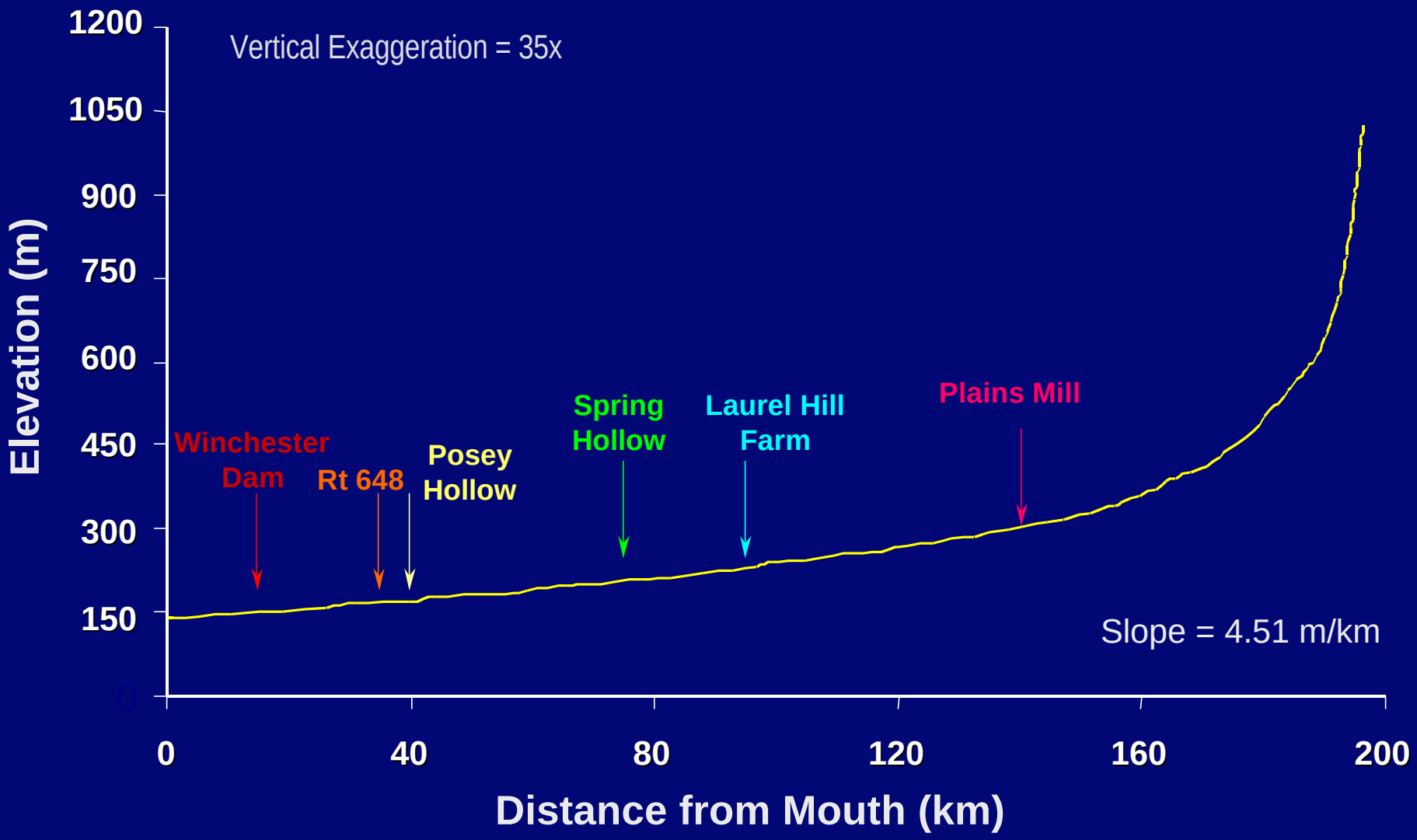


Geology of the North Fork Basin



Adapted from Hack 1965

Longitudinal Profile



The North Fork Shenandoah River

- 20% of mainstem discharge
- 60% of Shenandoah basin population growth
- Benefits: economic, recreational, biological
- Frequent droughts related to reduced water quality & fish kills
- Growing concern over water allocation issues

North Fork Instream Flow Study:

Using analytical tools for water management decisions

- Cooperative, multi-agency study
  - USGS, VDGIF, DEQ, Va. Tech
- Water Quality Investigation
  - Chan et. al 1999
- Mesohabitat Assessment
- Stream Habitat Modeling
  - PHABSIM
- Temperature Modeling

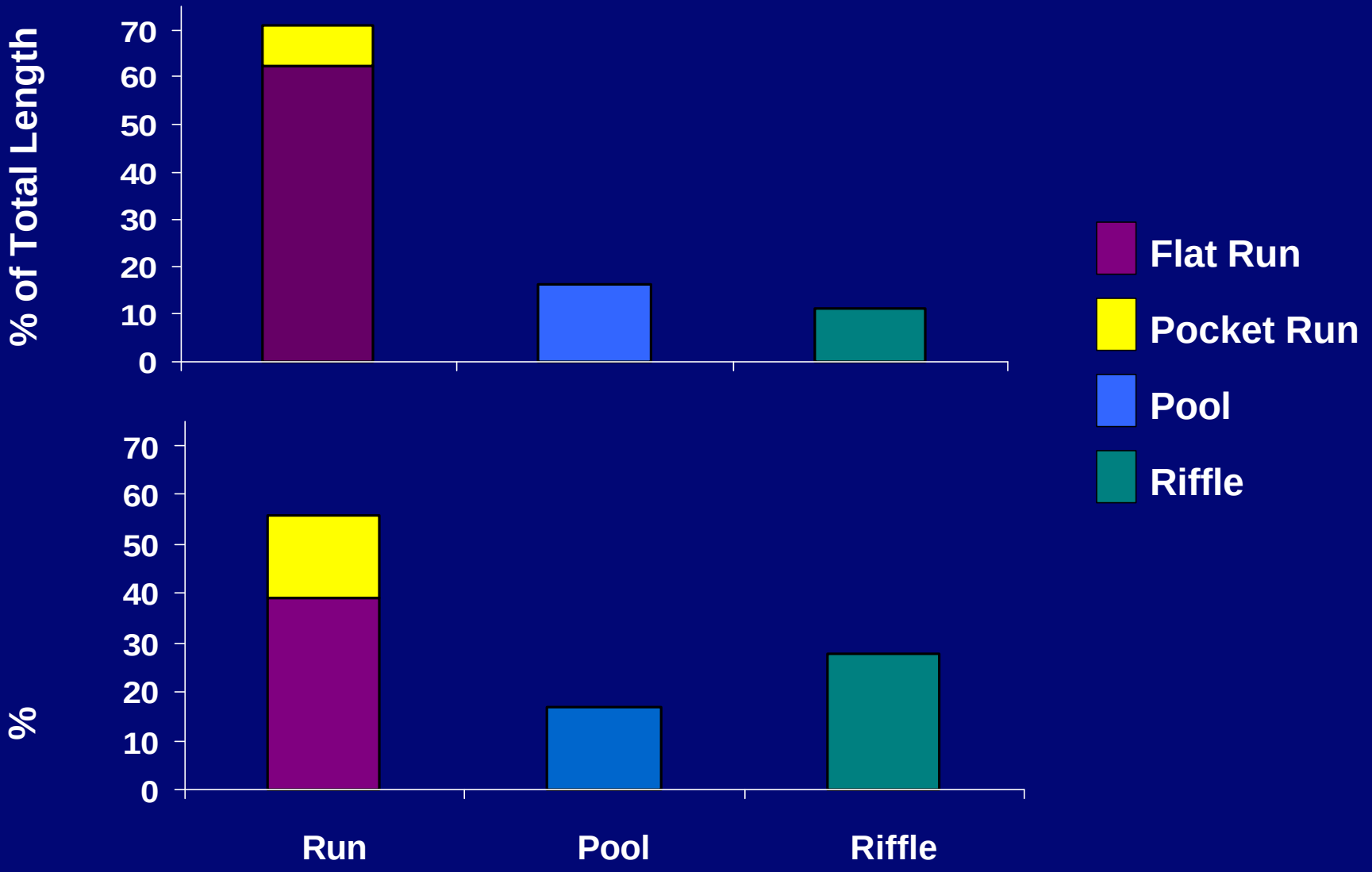
Mesohabitat Inventory

- By Peter Ruhl and Don Hayes , USGS
- Canoed from Stony Creek to Passage Creek
- 3 trips during low-flow conditions
  - September, October 1998; May 1999
- Mesohabitat lengths calculated via:
  - Latitude-longitude coordinates (>300 ft)
  - Infrared rangefinder (50-300 ft)
  - Direct measure (<50 ft)
- Depth, width, and substrate also measured

Mesohabitat Definitions

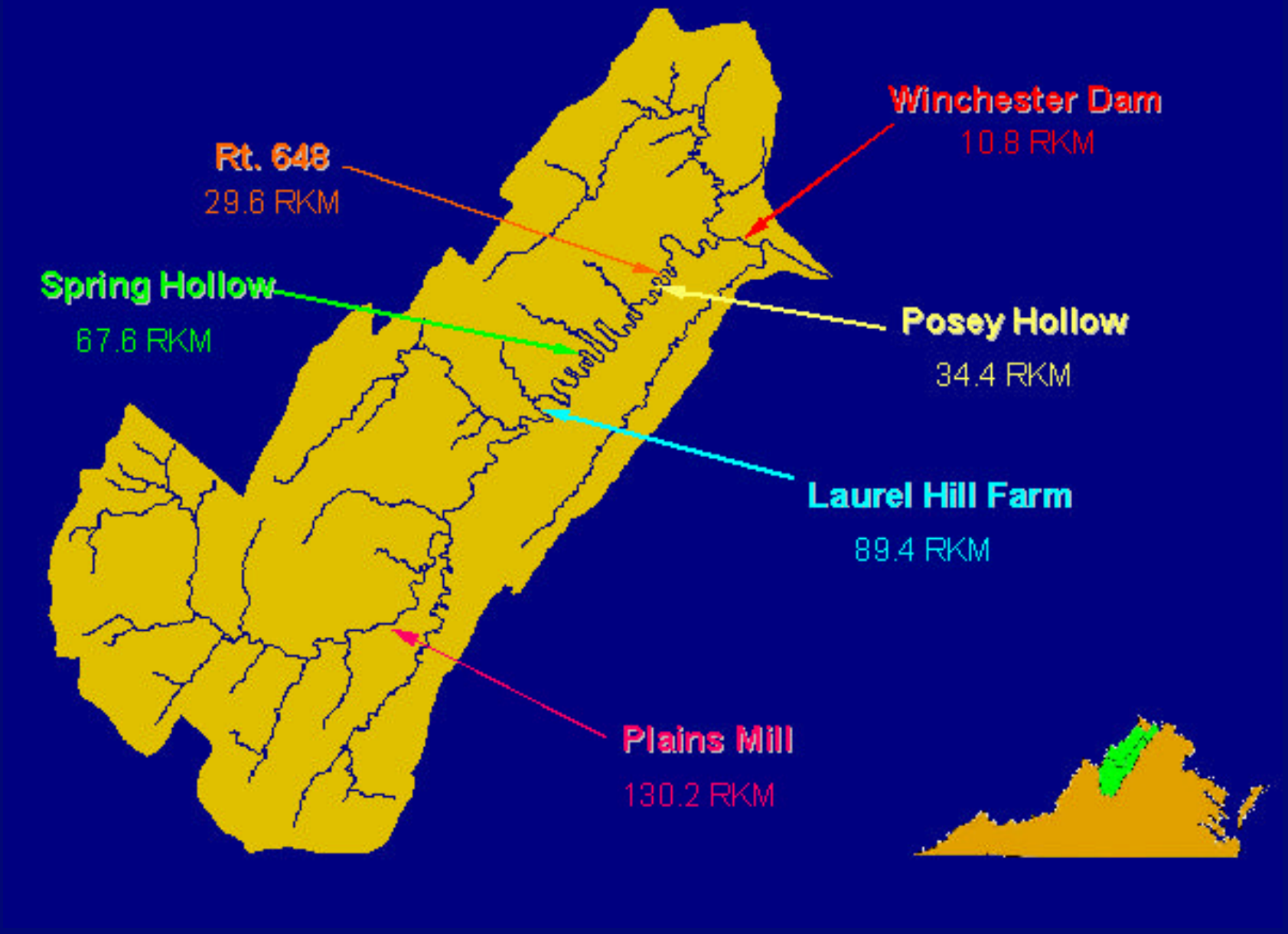
- Pool – concave bed; reduced surface velocity
- Run – flat bed; slightly turbulent flow; surface is not broken by the bed substrate
- Riffle – convex bed; turbulent surface created by substrate that is wholly or partly submerged
- Pocket Run – shallow areas of bedrock interspersed with deeper holes

Mesohabitat Distribution

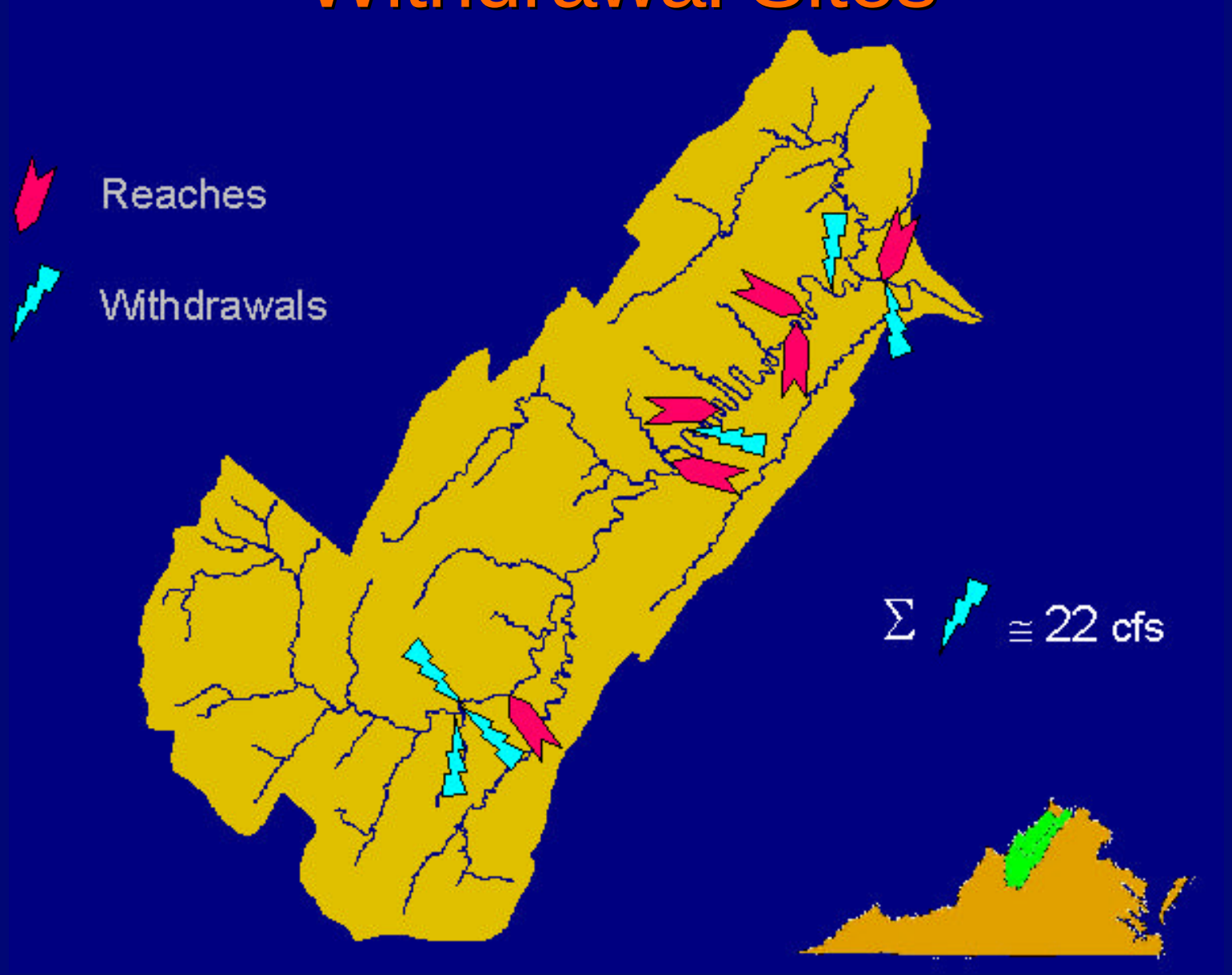


Longitudinal Distribution of Mesohabitat

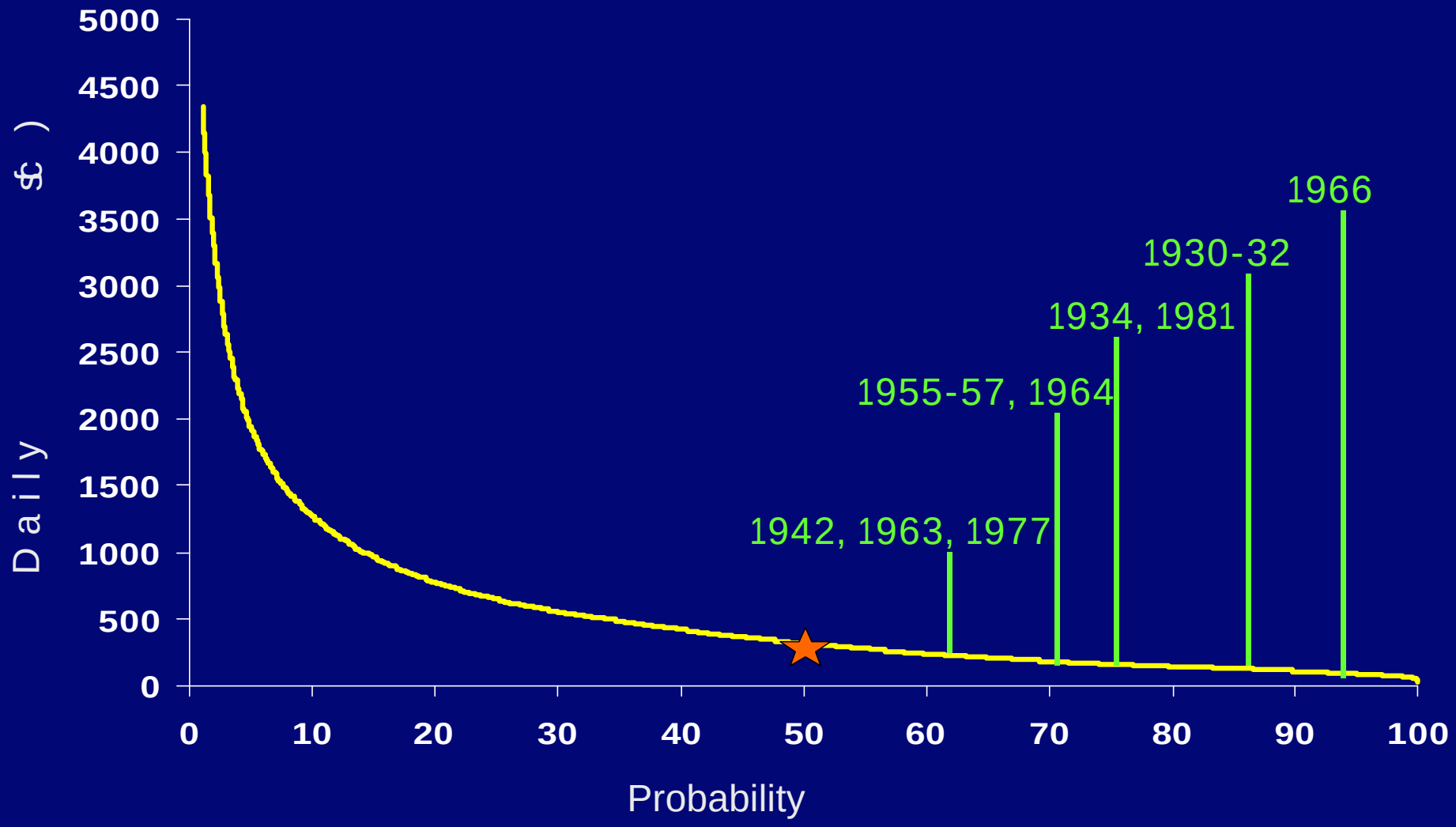
Instream Flow Study Reaches



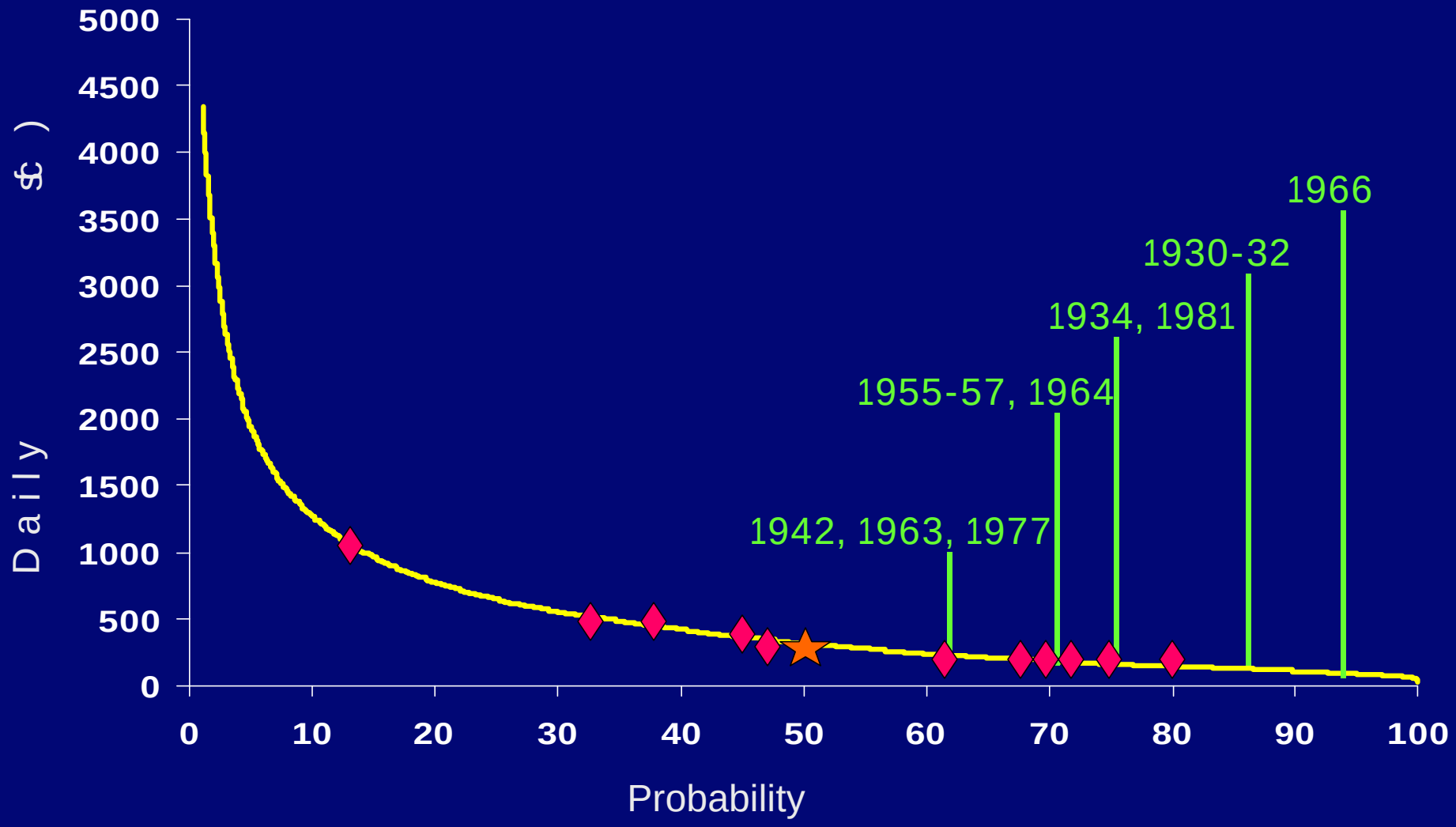
Withdrawal Sites

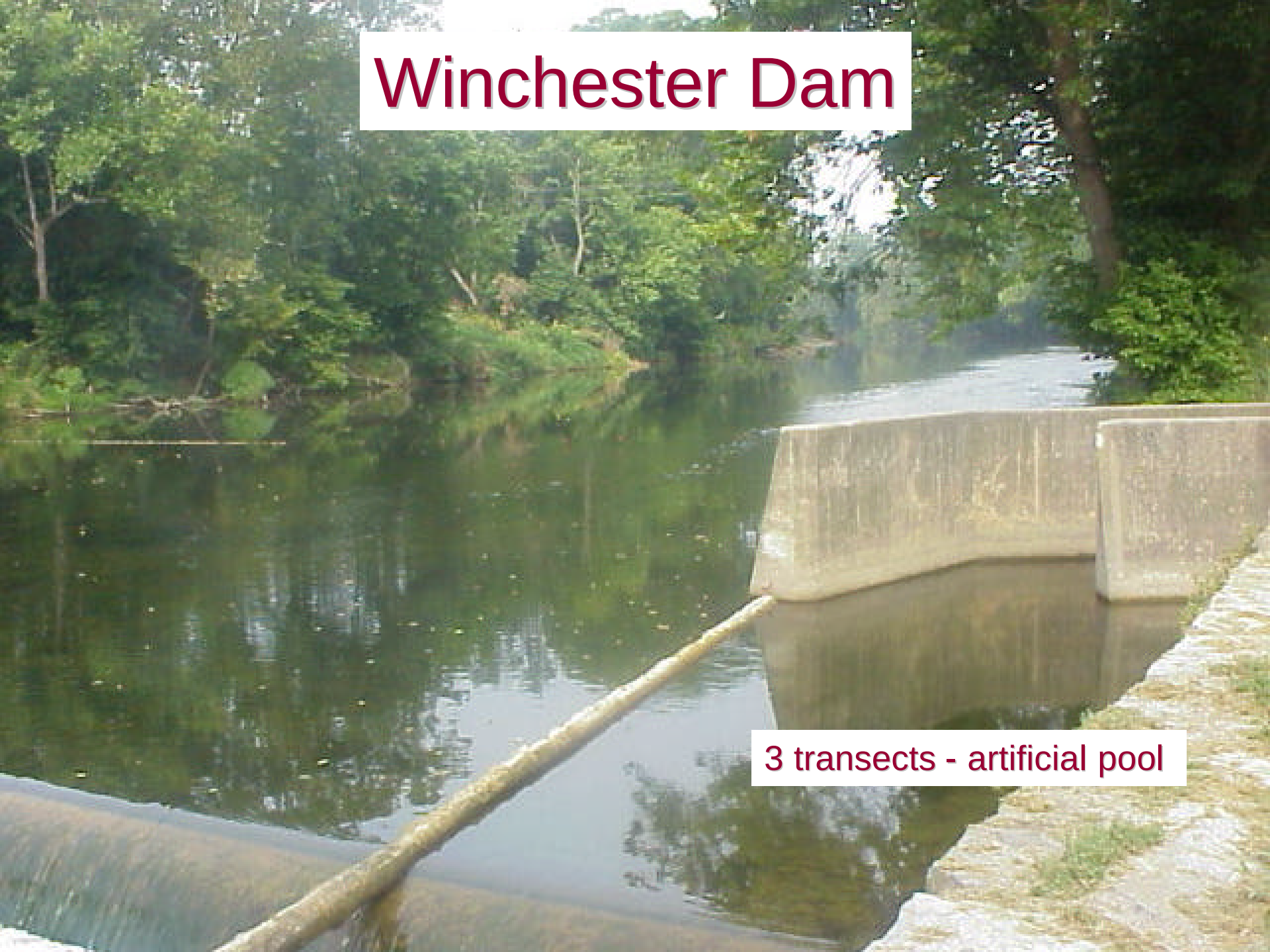


N. F. Shenandoah, Strasburg (VA) Gauge, Flow Exceedance Curve (1925-1998)



N. F. Shenandoah, Strasburg (VA) Gauge, Flow Exceedance Curve (1925-1998)




Winchester Dam
3 transects - artificial pool

Route 648

8 transects – run (3)

riffle (1)

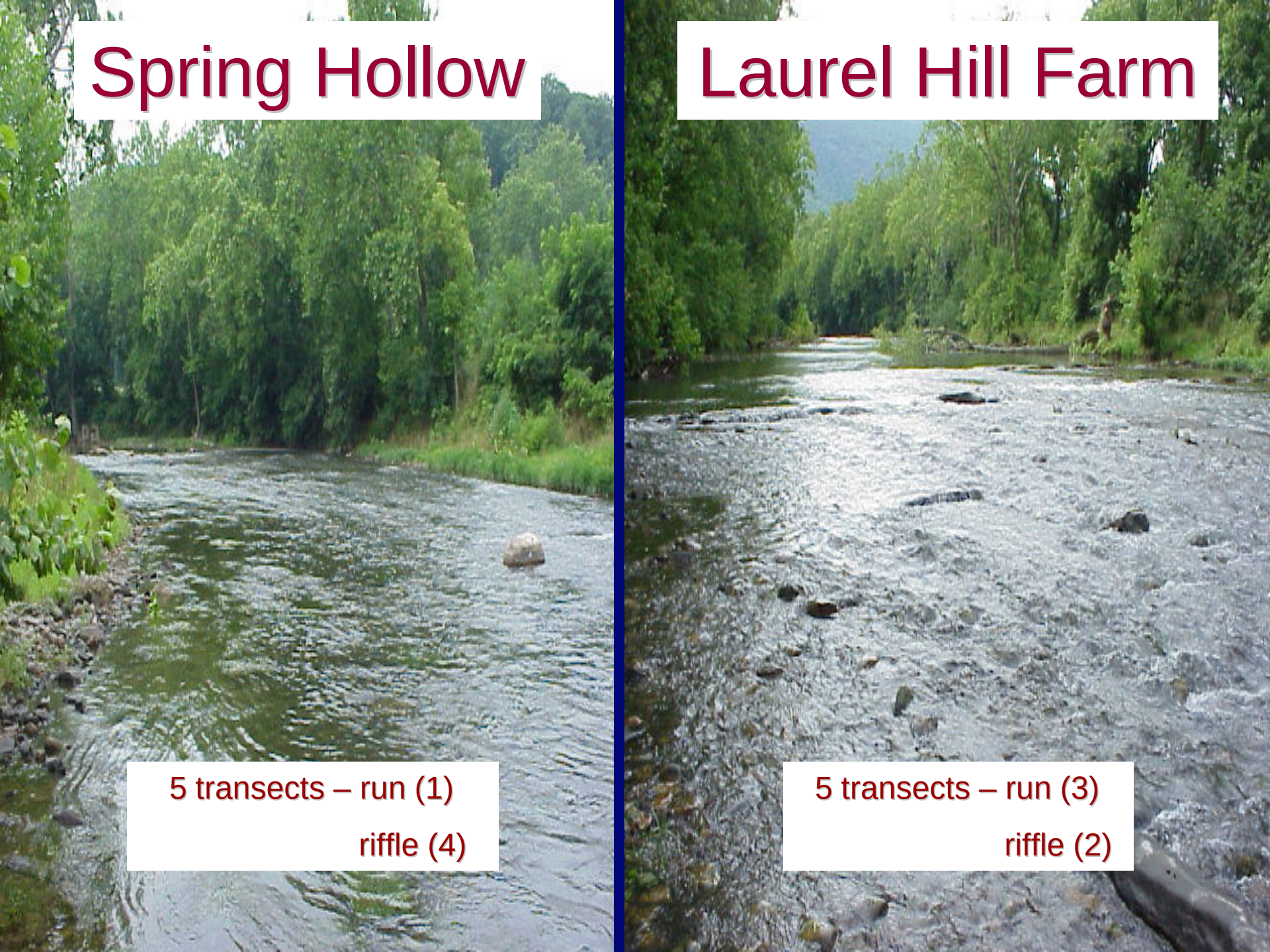
pocket run (4)

Posey Hollow

5 transects – run (2)

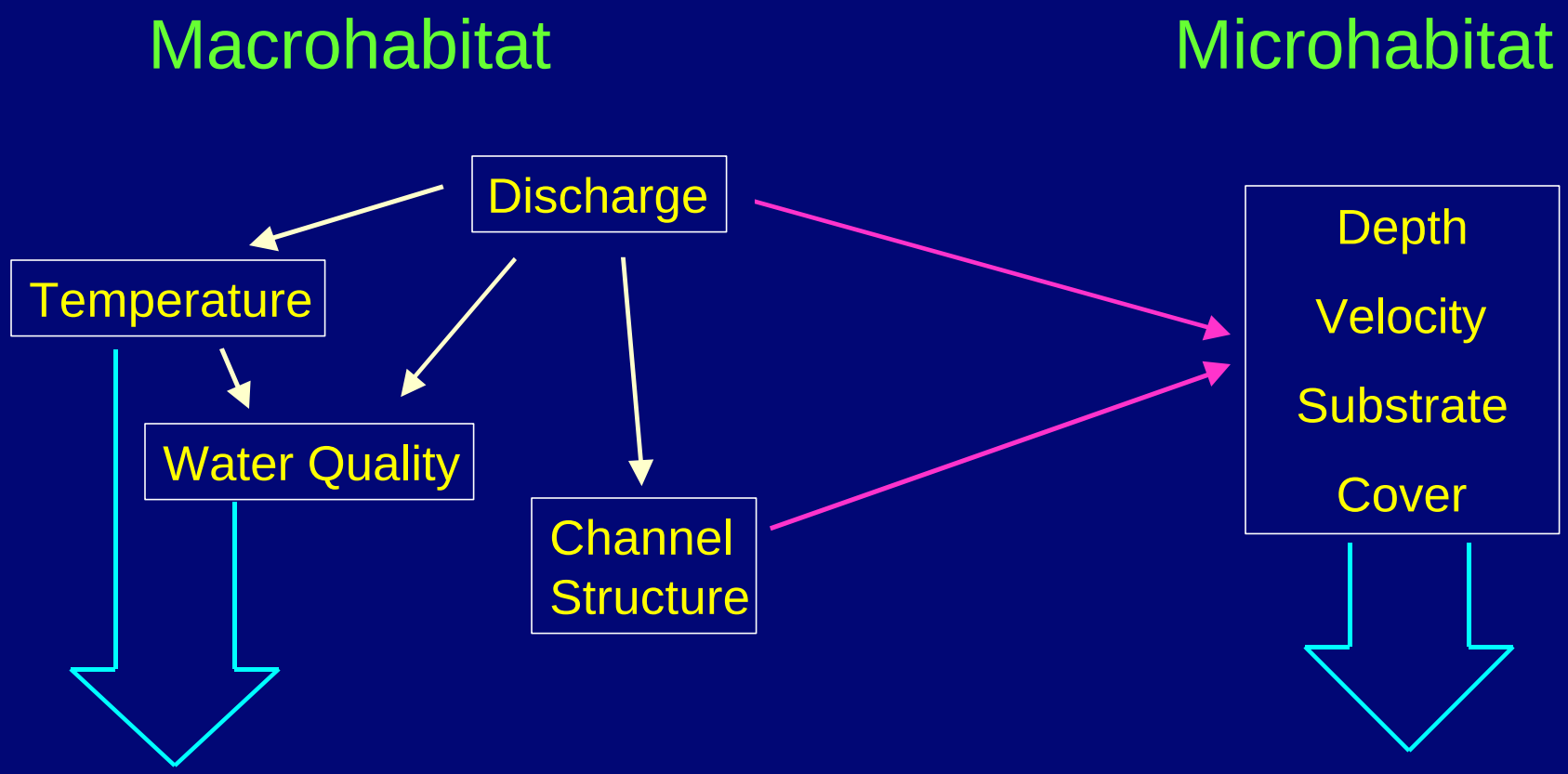
riffle (1)

pocket run (2)


Spring Hollow
Laurel Hill Farm
5 transects – run (1)
riffle (4)
5 transects – run (3)
riffle (2)


Plains Mill
10 transects – run (5)
natural pool (3)
riffle (2)

PHABSIM



= TOTAL HABITAT

Stalnaker et al 1995

Channel Geometry

- Cross section profiles
- Cell boundaries
- Substrate distribution
- Cover types

Hydraulic Characteristics

- WSL's
- Calibration discharges (3)
- Depth & velocity

Habitat Suitability Criteria (HSC)

- Guild approach
- HSC development
- Transferability testing

So, What Does it All Mean ?

"Obtain a representation of the physical stream, so the stream may be linked, through biological considerations, to the social, political, and economic world."

- Milhous et al 1989

Acknowledgments

- North Fork landowners
- Lord Fairfax Planning District Commission
- Funding by Virginia General Assembly
- Friends of the North Fork (Pat Maier)
- Rod Bodkin, DEQ
- VT associates: Matt Chan and Jason Persinger


Questions ?

James River Smallmouth Bass: flow recruitment curve