



U.S. Geological Survey Science-Support Tools for Indiana's FEH-Mitigation Program

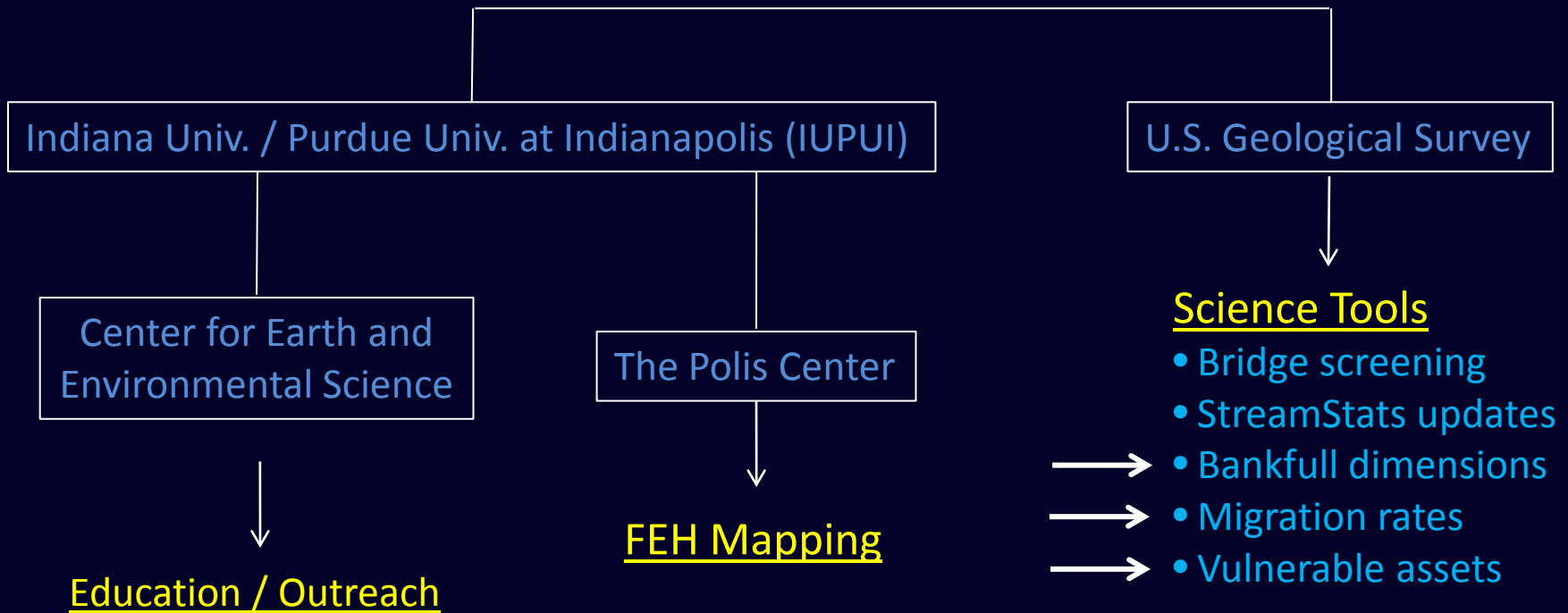
Bret A. Robinson, Ph.D.
U.S. Geological Survey
Indiana Water Science Center

In cooperation with
Indiana Office of Community and Rural Affairs

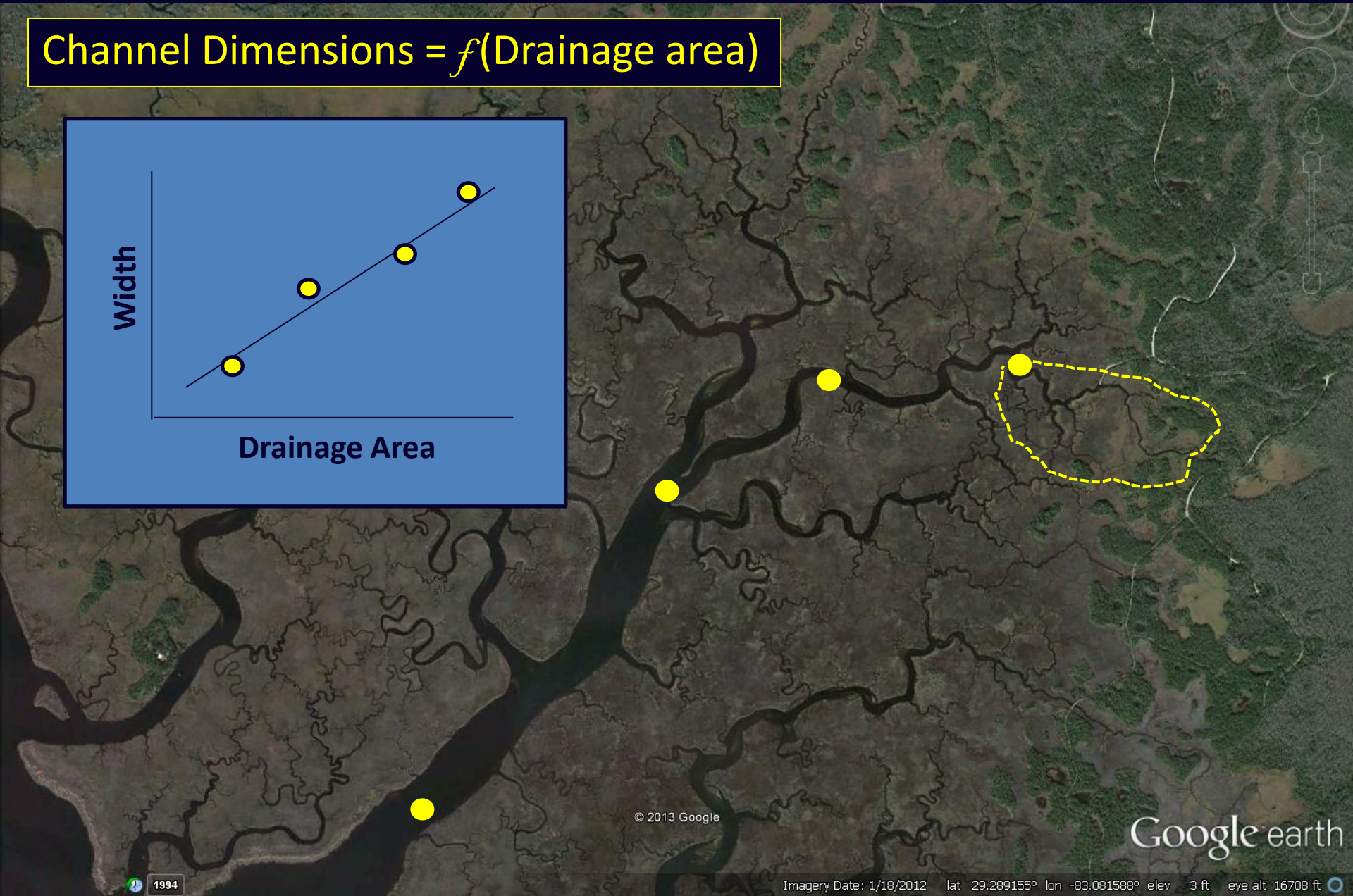
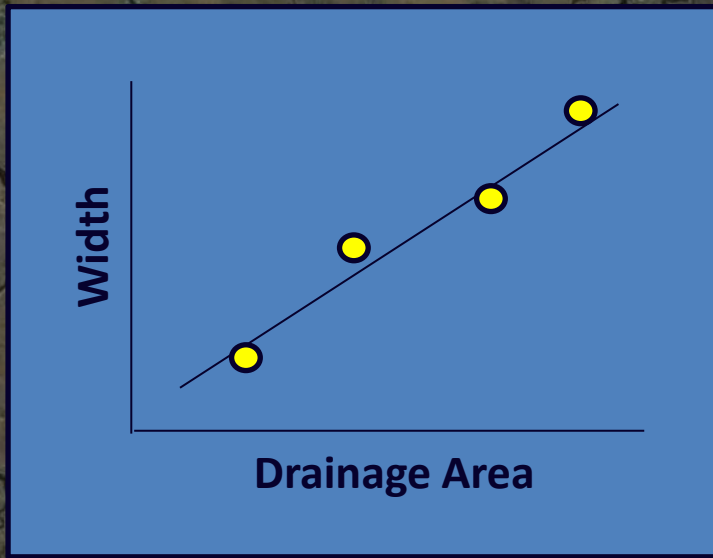
Indiana's FEH Program



FEH Study Team



Channel Dimensions = $f(\text{Drainage area})$



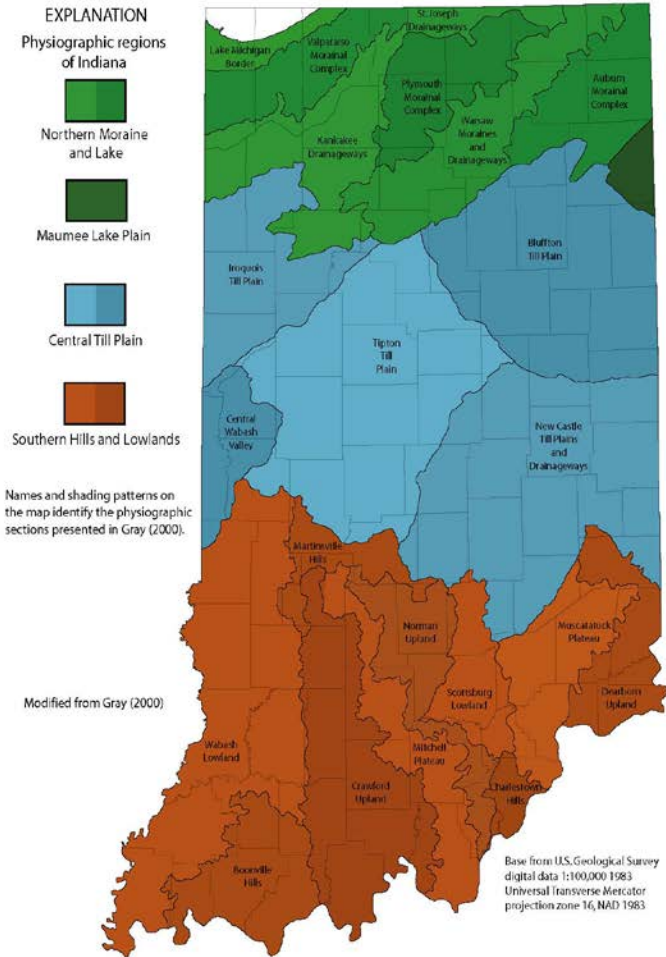
© 2013 Google

Google earth

1994

Imagery Date: 1/18/2012 lat 29.289155° lon -83.081588° elev 3 ft eye alt 16708 ft

Physiographic Divisions of Indiana



Henry Gray, 2000
 Indiana Geological Survey
 Special Report 61

Northern Indiana Streams



Southern Indiana Streams

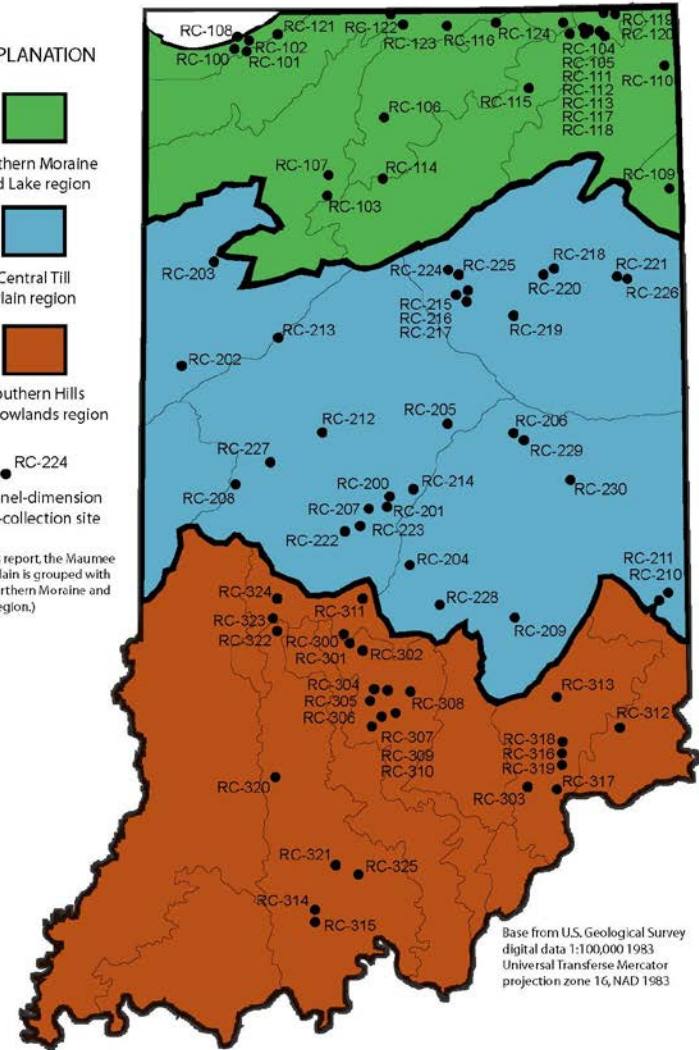
82 Data-collection sites



EXPLANATION

- Northern Moraine and Lake region
- Central Till Plain region
- Southern Hills and Lowlands region
- RC-224
- Channel-dimension data-collection site

(In this report, the Maume Lake Plain is grouped with the Northern Moraine and Lake region.)



(25)

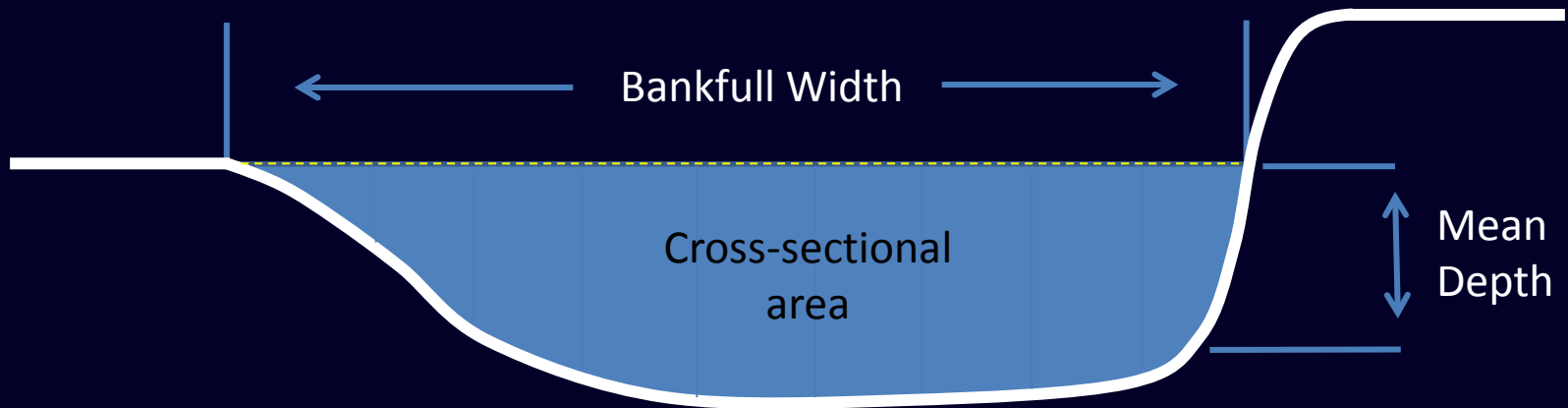
(31)

(26)

Base from U.S. Geological Survey
digital data 1:100,000 1983
Universal Transverse Mercator
projection zone 16, NAD 1983



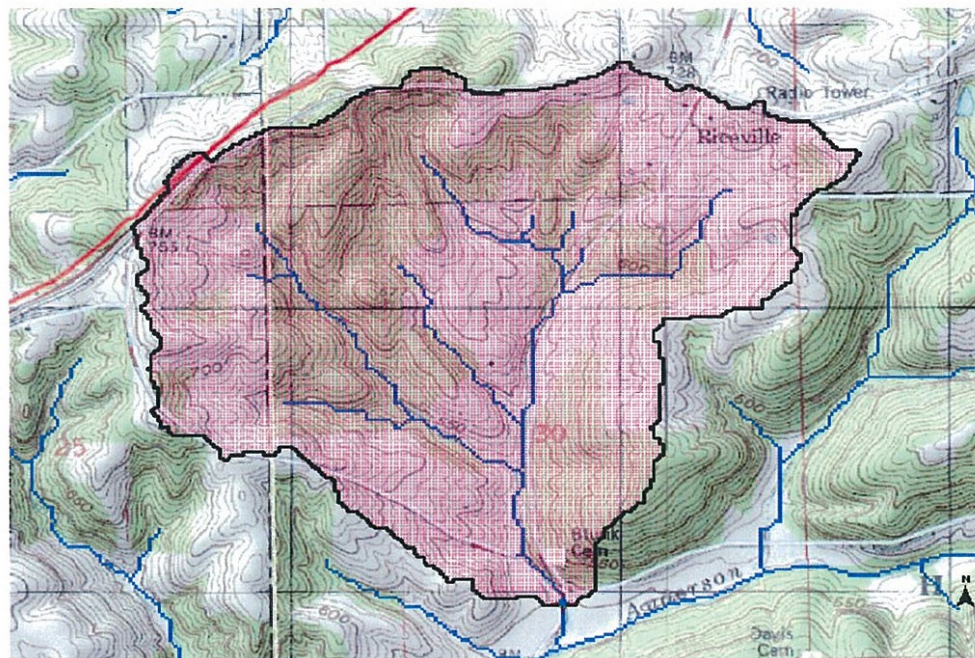
Data Elements



RC-314 Unnamed tributary to Anderson River



StreamStats Print Page



Basin Characteristics Report

Date: Mon Jul 15 2013 06:35:15 Mountain Daylight Time
NAD27 Latitude: 38.3091 (38 18 33)
NAD27 Longitude: -86.6703 (-86 40 13)
NAD83 Latitude: 38.3091 (38 18 33)
NAD83 Longitude: -86.6703 (-86 40 13)

Parameter	Value
Total drainage area in square miles	1.007

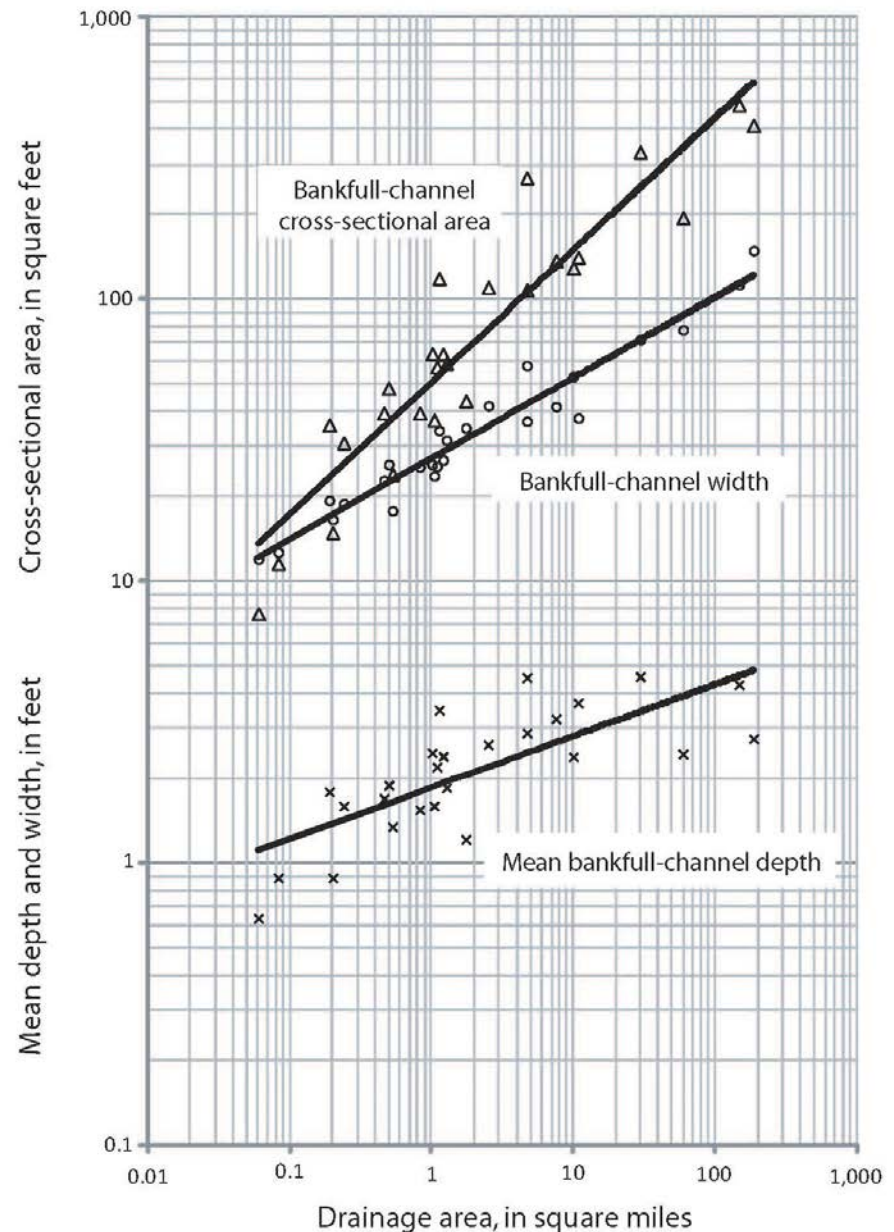
Regional Curves

Plots \longrightarrow
 Regression equations
 \downarrow

Table 5. Regression equations for estimating bankfull-channel dimensions of non-urban wadeable streams in Indiana.

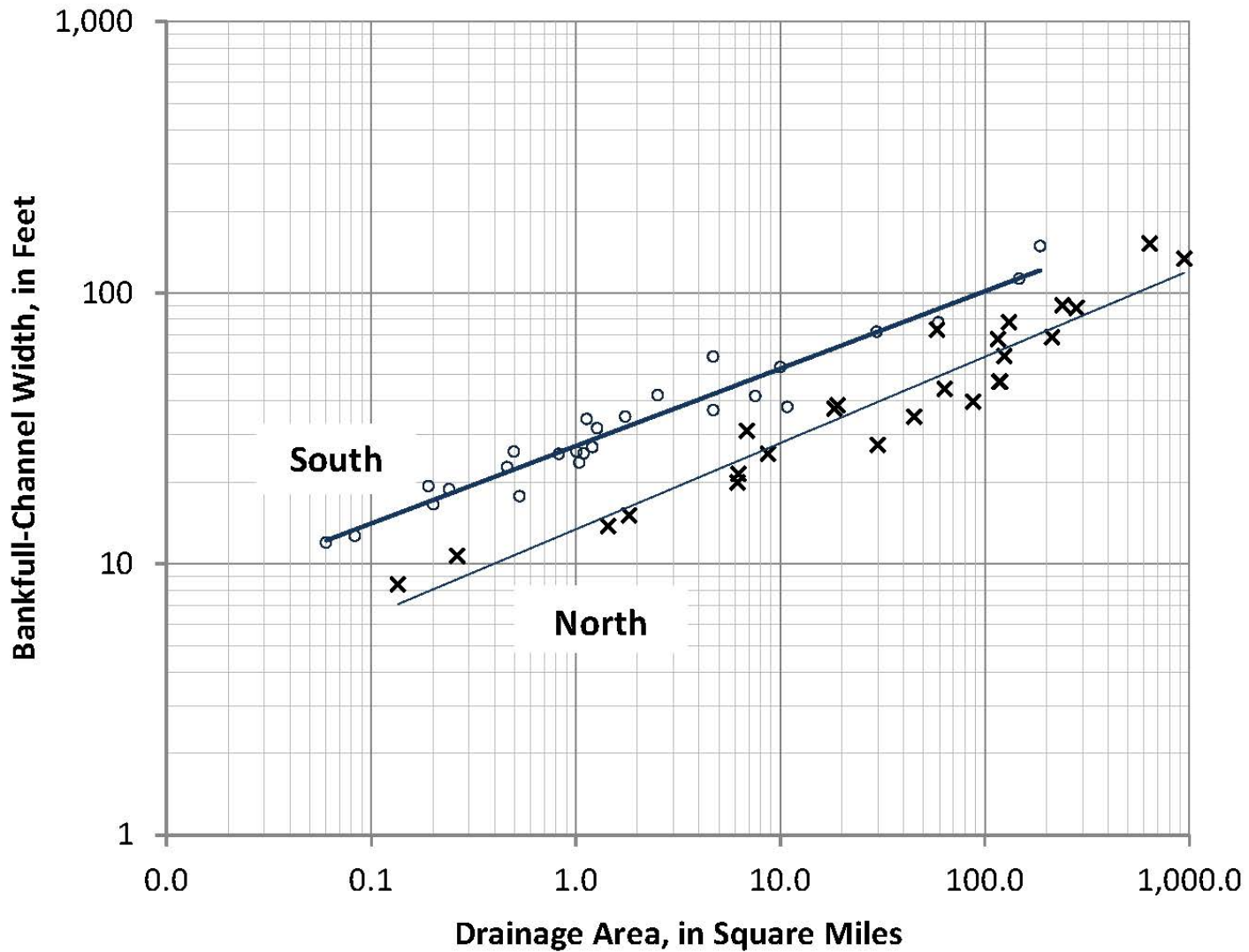
[WBF, bankfull width, in feet; DBF, mean bankfull depth, in feet; ABF, bankfull cross-sectional area, in square feet; DA, drainage area, in square miles]

Equation number	Equation	Coefficient of determination (r-squared)
Northern Moraine and Lake region		
1	$WBF_n = 13.4 DA^{0.318}$	0.92
2	$DBF_n = 1.3 DA^{0.176}$	0.75
3	$ABF_n = 17.0 DA^{0.495}$	0.92
Central Till Plain region		
4	$WBF_c = 18.2 DA^{0.327}$	0.94
5	$DBF_c = 1.6 DA^{0.159}$	0.56
6	$ABF_c = 28.8 DA^{0.487}$	0.88
Southern Hills and Lowlands region		
7	$WBF_s = 27.2 DA^{0.286}$	0.94
8	$DBF_s = 1.9 DA^{0.183}$	0.58
9	$ABF_s = 50.9 DA^{0.468}$	0.87



South

Bankfull-Channel Width



Prepared in cooperation with the Indiana Office of Community and Rural Affairs

Regional Bankfull-Channel Dimensions of Non-Urban Wadeable Streams in Indiana

By Bret A. Robinson



Pleasant Run Creek at Greenwood, Indiana. (Photograph by Bret A. Robinson, U.S. Geological Survey, taken January 24, 2013)

Scientific Investigations Report 2013—5078

U.S. Department of the Interior
U.S. Geological Survey

To view this report, visit:
<http://pubs.usgs.gov/sir/2013/5078/>

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USGS

Publications Warehouse

Results available in

StreamStats

Indiana Streams...

Actively Migrating....

- Raw and failing cutbanks
- Non-vegetated point bars



Recently Stationary....

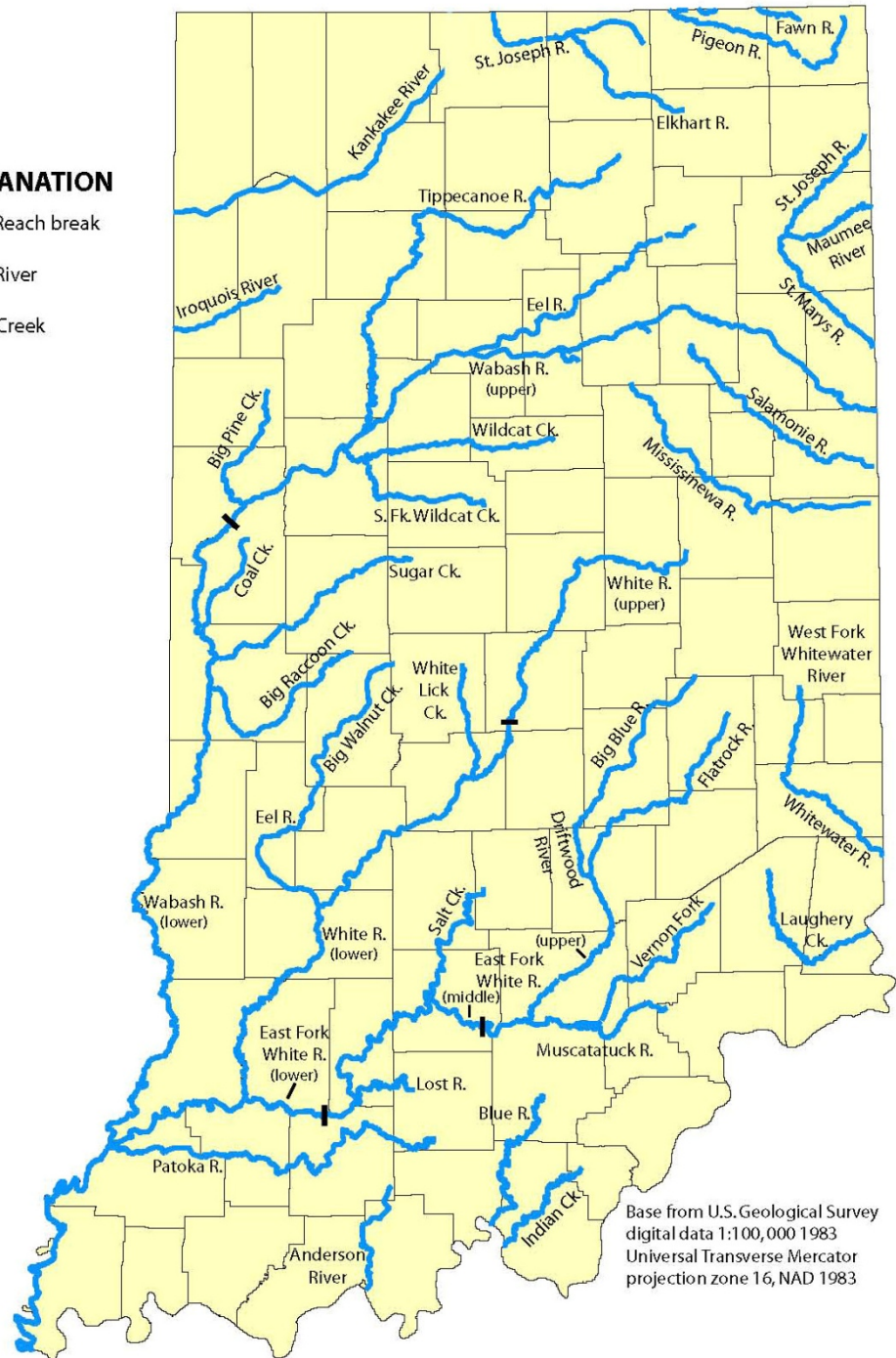
- Both banks stable
- With mature trees



Channel-migration rates?

EXPLANATION

- Reach break
- R. River
- Ck. Creek



Coal Creek

from
Mouth to Veedersburg

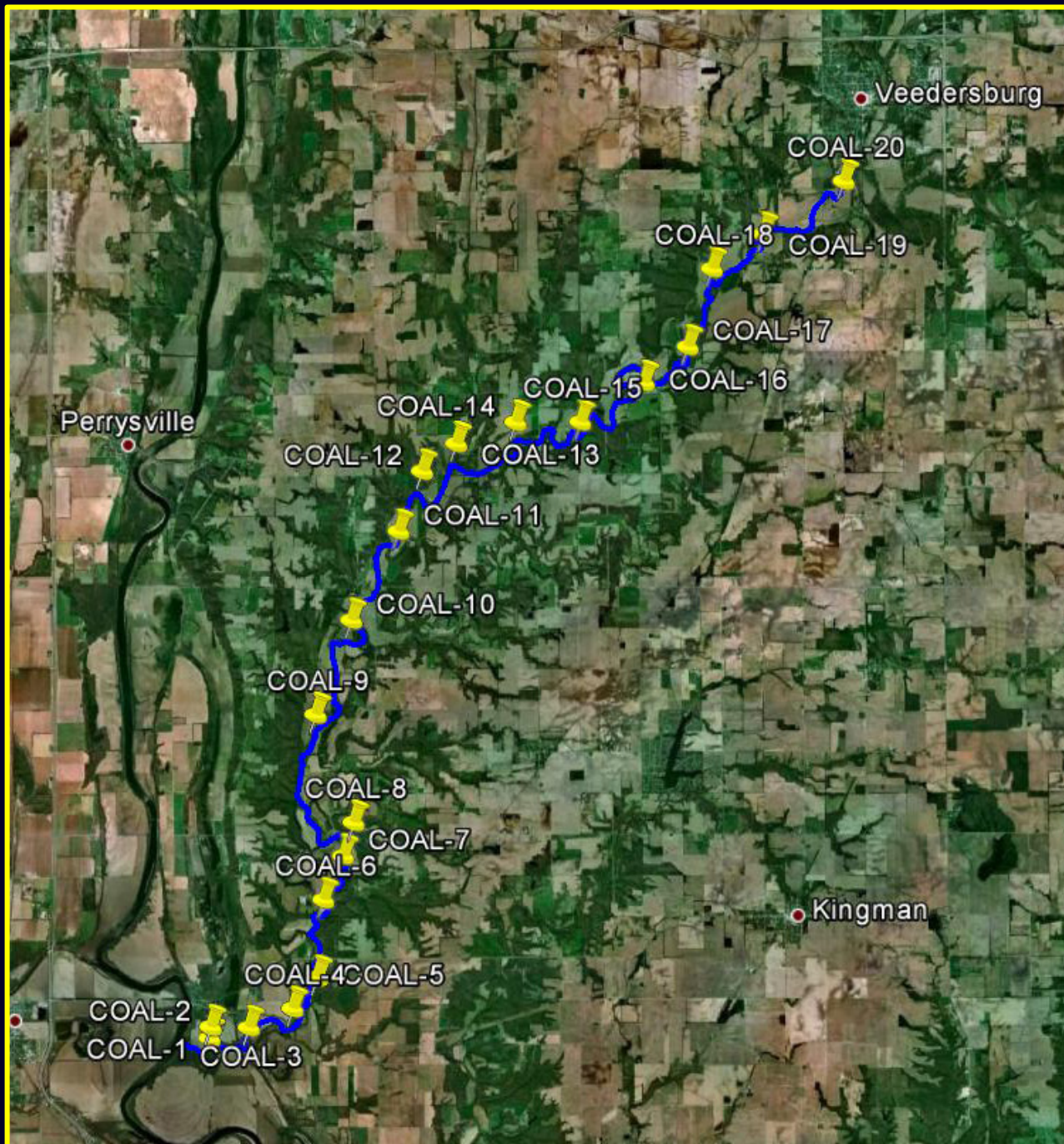
Coal-1

Coal-2

Coal-3



Coal-20



At each selected meander....

White Lick Creek at Mooresville, Ind. (WHITELICK-17)

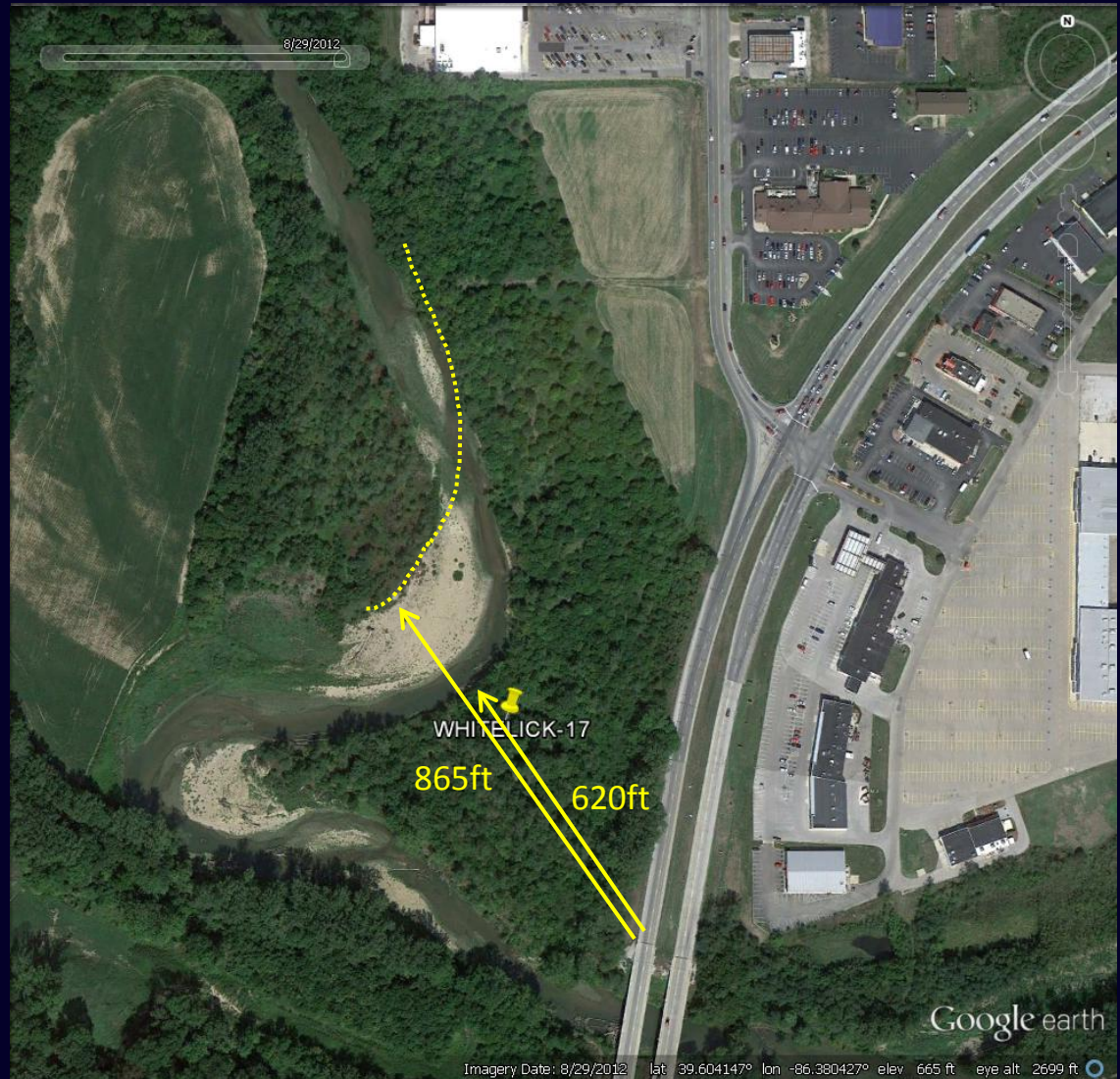
Historical imagery: 1998 to 2012

$$12 \left(\frac{865 \text{ ft} - 620 \text{ ft}}{172 \text{ months}} \right) = 17 \text{ ft/yr}$$

(...over the past 14 yrs)

April, 1998

Aug, 2012

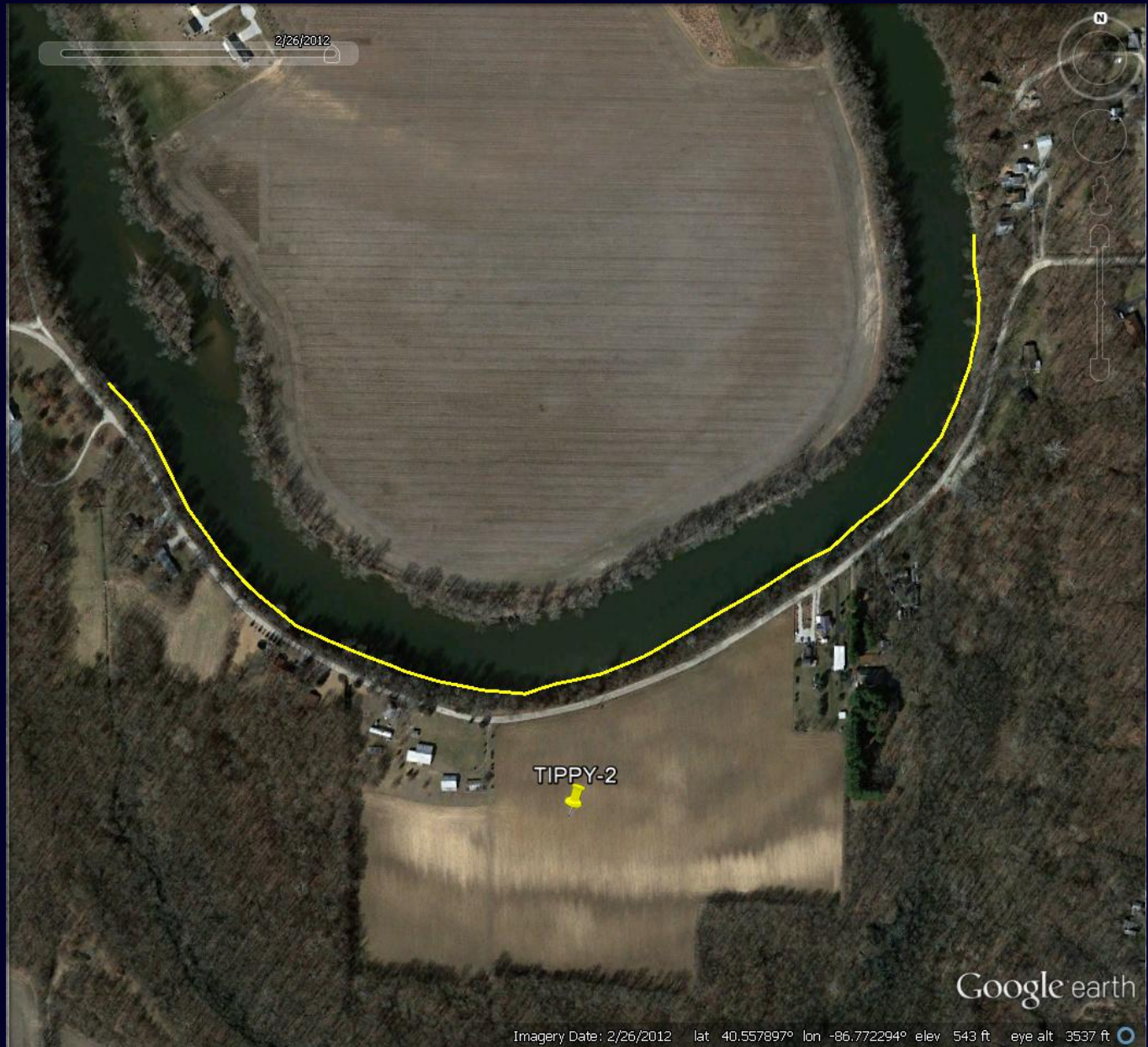


Some meanders are relatively stationary...

Tippecanoe River
(TIPPY-2)

Rate <1 ft/yr

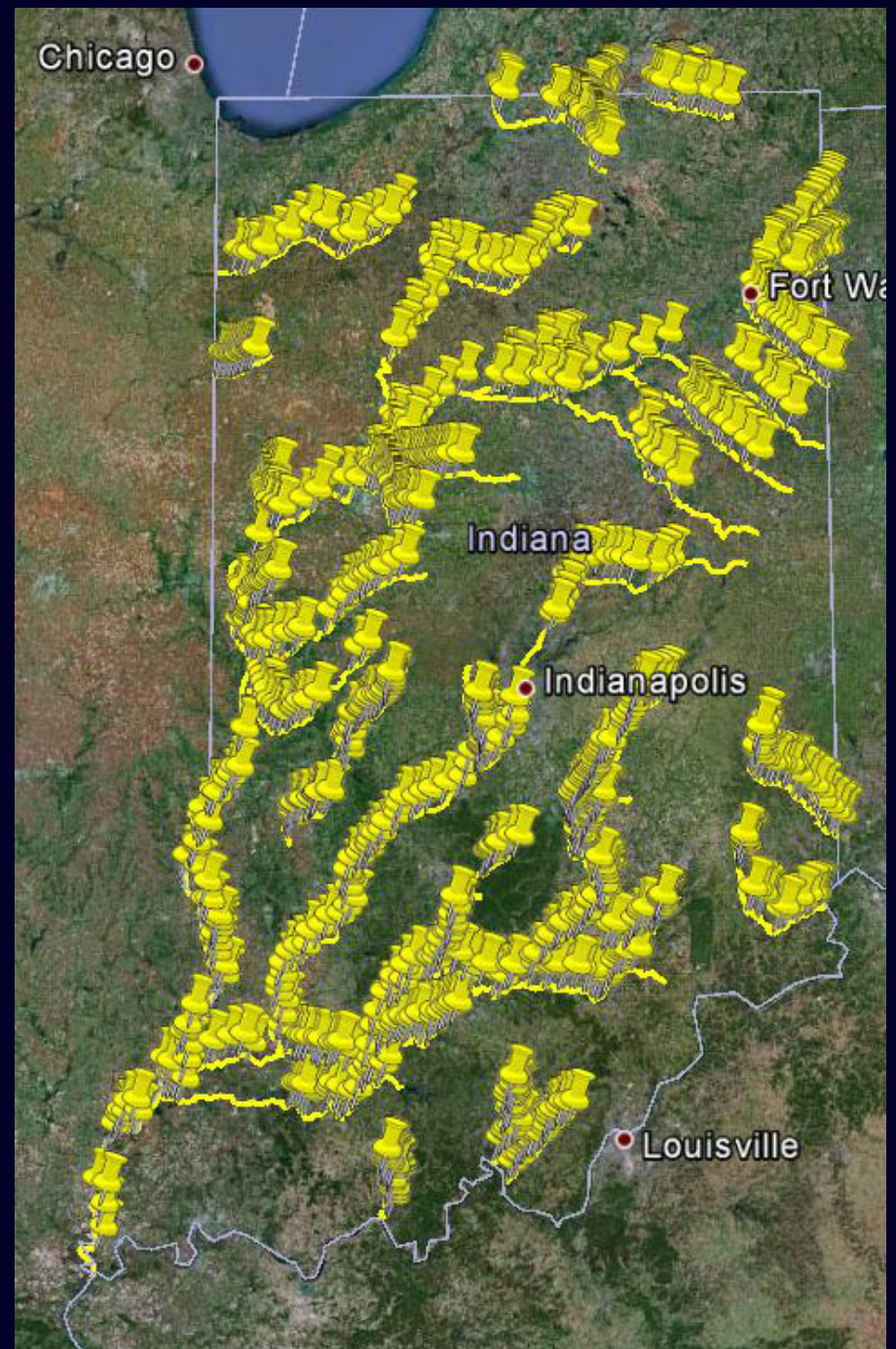
March, 1992
Feb, 2012
(...20 yrs)



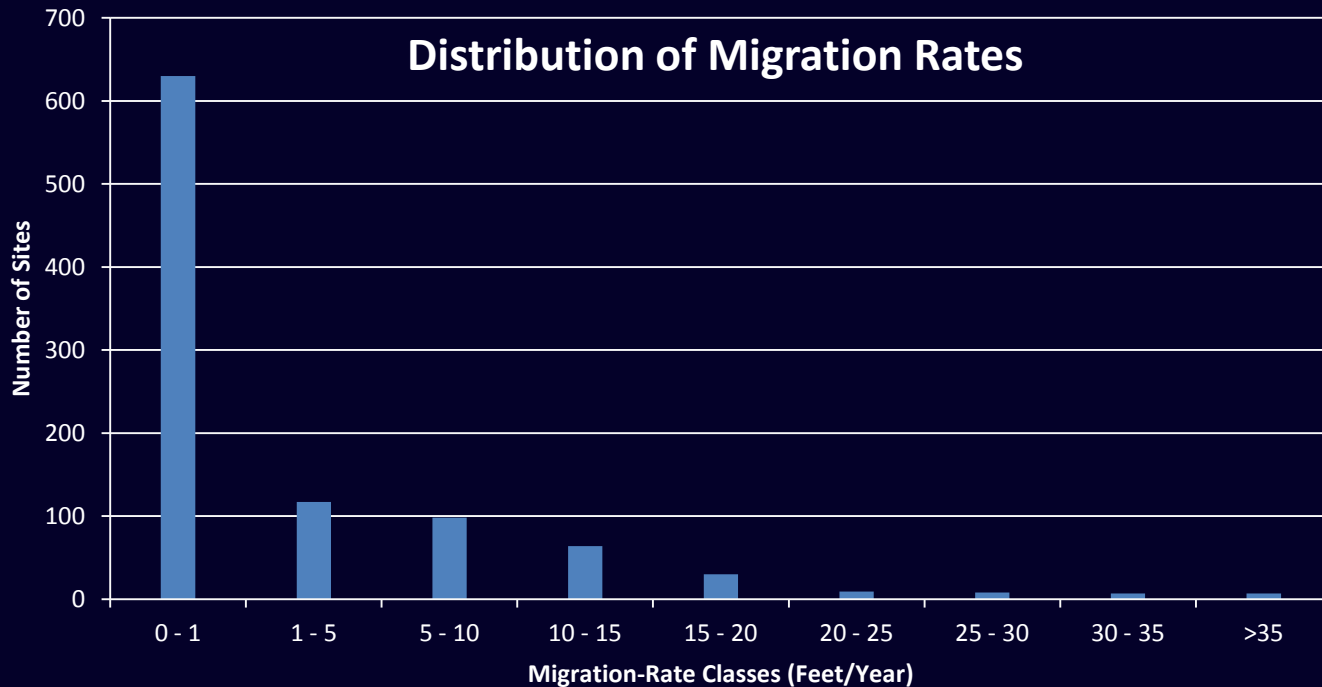
Within Indiana

Investigating 38 largest streams

970 meanders measured



Summary Statistics



- 65% of measured sites are stationary
- 3% of measured sites migrating >20 ft/yr

Determine 75th Percentile

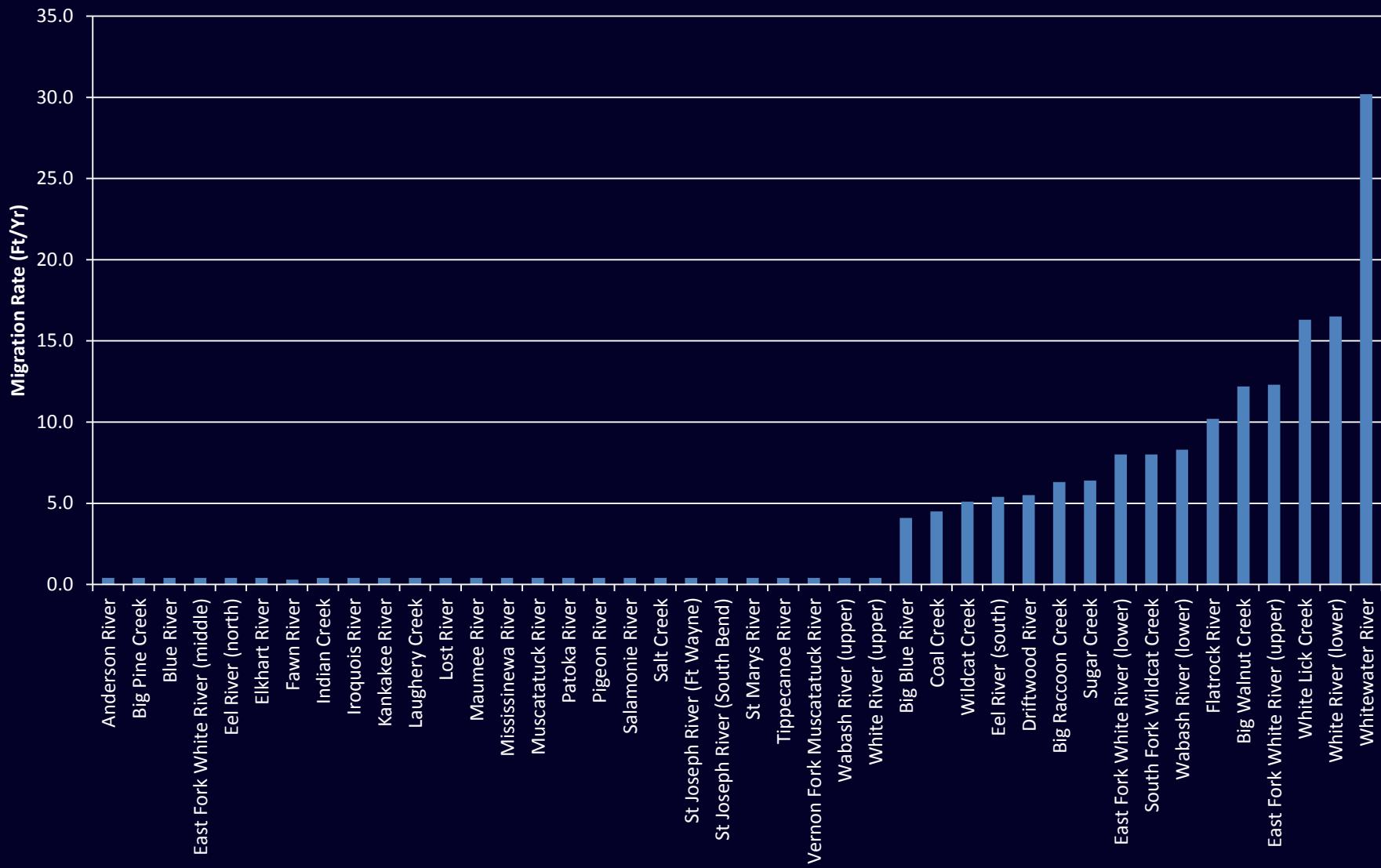
Site	Rate (ft/yr)
COAL-7	7.7
COAL-19	7.6
COAL-1	6.1
COAL-15	5.3
COAL-17	4.7
COAL-8	4.4
COAL-18	4.4
COAL-3	4.2
COAL-6	4.1
COAL-11	3.8
COAL-9	3.4
COAL-10	3.1
COAL-5	3.1
COAL-2	1.9
COAL-20	1.7
COAL-4	1.2
COAL-12	<1.0
COAL-13	<1.0
COAL-14	<1.0
COAL-16	<1.0

(25% are greater than...)

Coal Creek = 4.6 ft/yr

75% are less than...

75th Percentile Channel-Migration Rates



Distribution of stationary and actively-migrating streams

EXPLANATION

- Recently stationary stream reach
- Actively migrating stream reach

Only the actively migrating streams are shown with names.



Base from U.S. Geological Survey digital data 1:100,000 1983 Universal Transverse Mercator projection zone 16, NAD 1983

Prepared in cooperation with the Indiana Office of Community and Rural Affairs

Recent (circa 1998 to 2011) Channel-Migration Rates of Selected Streams in Indiana

By Bret A. Robinson



Google Earth™ images of White River near Centerton Ind., 2005 and 2012. The position of the channel relative to local landscape features allows for the recognition of recent channel migration.

Scientific Investigations Report 2013—5168

U.S. Department of the Interior
U.S. Geological Survey

To view this report, visit:
<http://pubs.usgs.gov/sir/2013/5168/>

White River near Centerton, Ind.

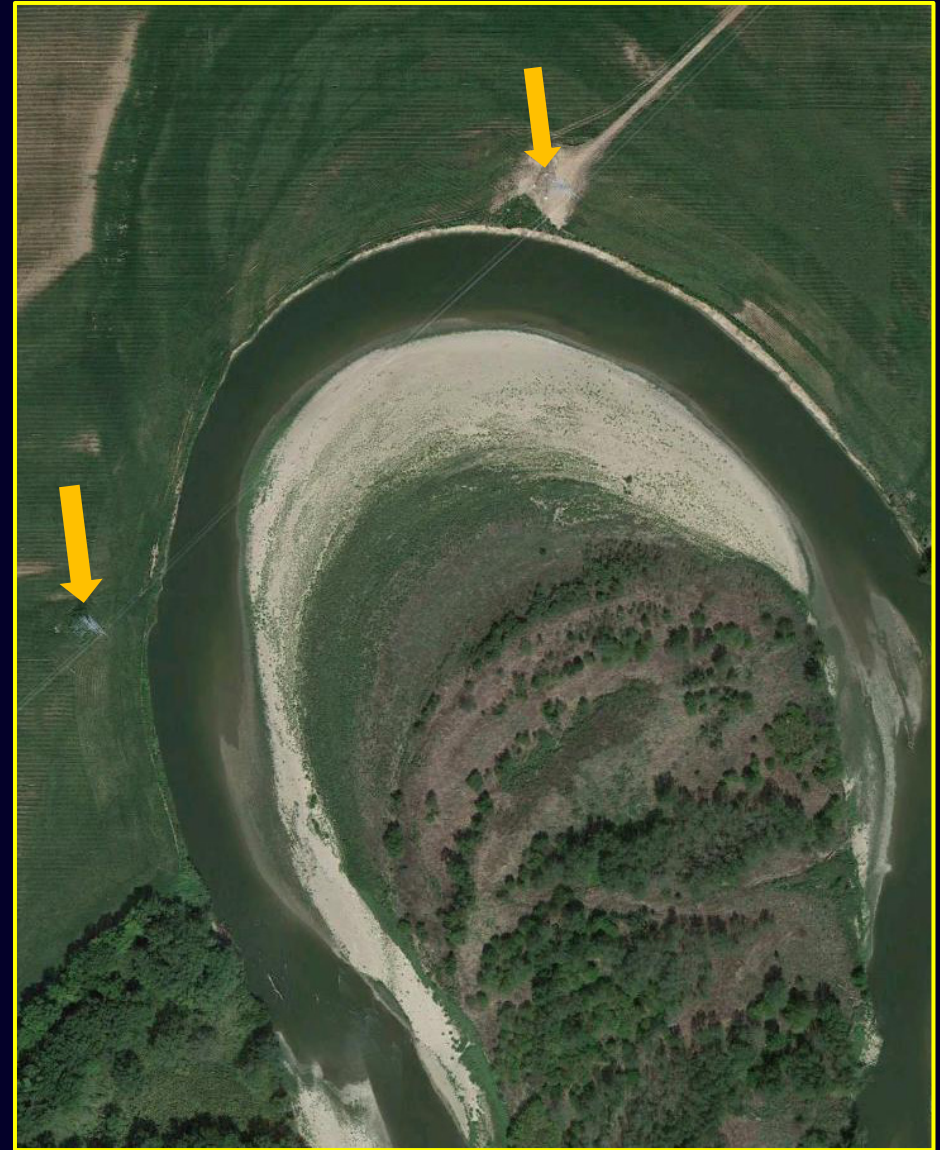
Identification of Meander-Vulnerable Assets

Transportation Assets

- Bridges
- Roads
- Railroads
- Railroad Bridges

Utility Assets

- Power Lines
- Pipelines
- Dams
- Water-treatment Plants



Google Earth™

Questions?

- **Bankfull-Channel Dimensions**
- **Channel-Migration Rates**

