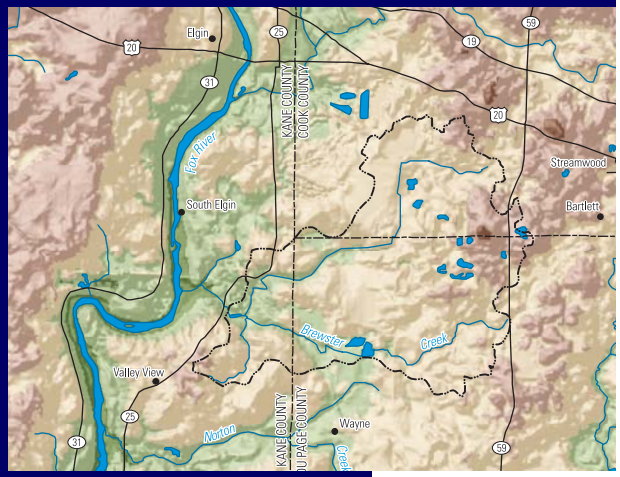
Stepwise Small Dam Removal

Brewster Creek Dam near St. Charles, Illinois

1. Stream Channel Evolution
2. Sediment Release
3. Knickpoint Migration

Willow Lake and Brewster Dam



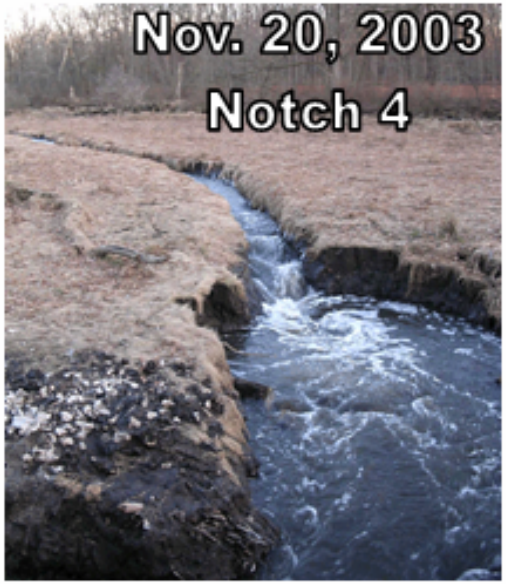
Dam: 8 ft high and 30 ft wide

Lake: 3.96 acre surface area
1 ft water depth

Deposited Sediment: 14.47 acre-ft volume
3.7 ft thick (average)
67–99 percent silts & clays

Stream Channel Evolution

Stream Channel Evolution



Stream Channel Evolution

(channel substrate: coarse material and intermittent stiff clay)

Sediment Release Downstream of Brewster Creek Dam

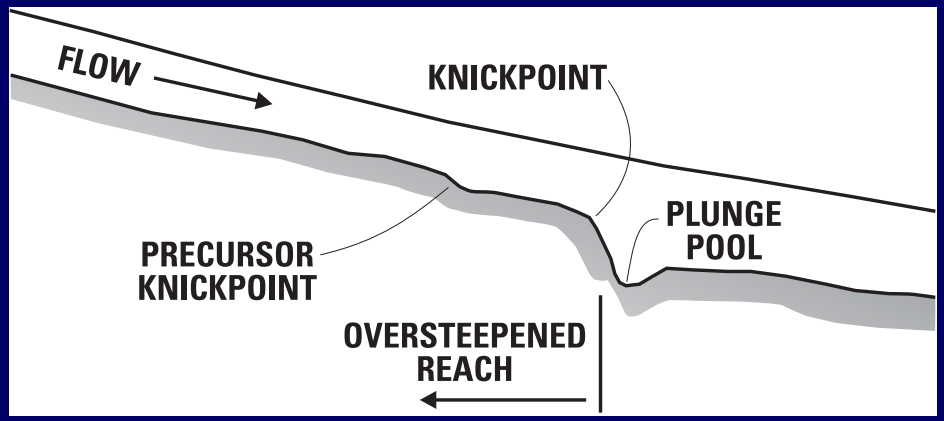
	Pre-Notching 2003 6/15/2002-6/14/03	Notching+Post 2004 6/15/2004 - 09/30/2004	Post-notching 2005 10/01/2004 - 9/30/2005
Downstream Gage	12 months	15 months	12 Months
Total Sediment Yield (tons)	397	2,146	487
Sediment Yield tons/mi^2-yr	28	122	35

average annual sediment yield .. for NE Illinois streams: 100-191 tons/mi^2-yr

average annual sediment yield for western Illinois streams: 1,000 – 2,000 tons/mi^2-yr

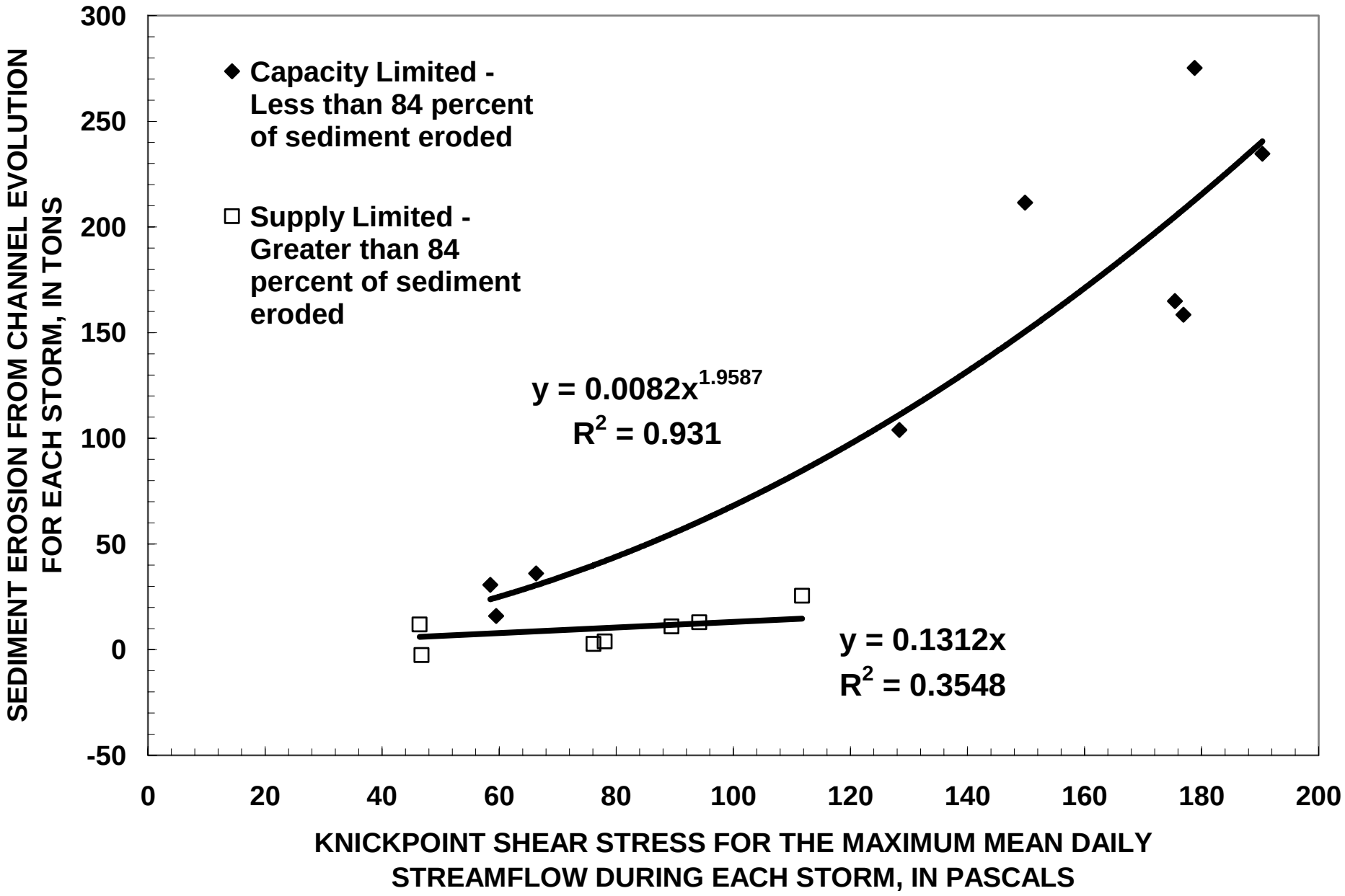
2005 Aerial Photo

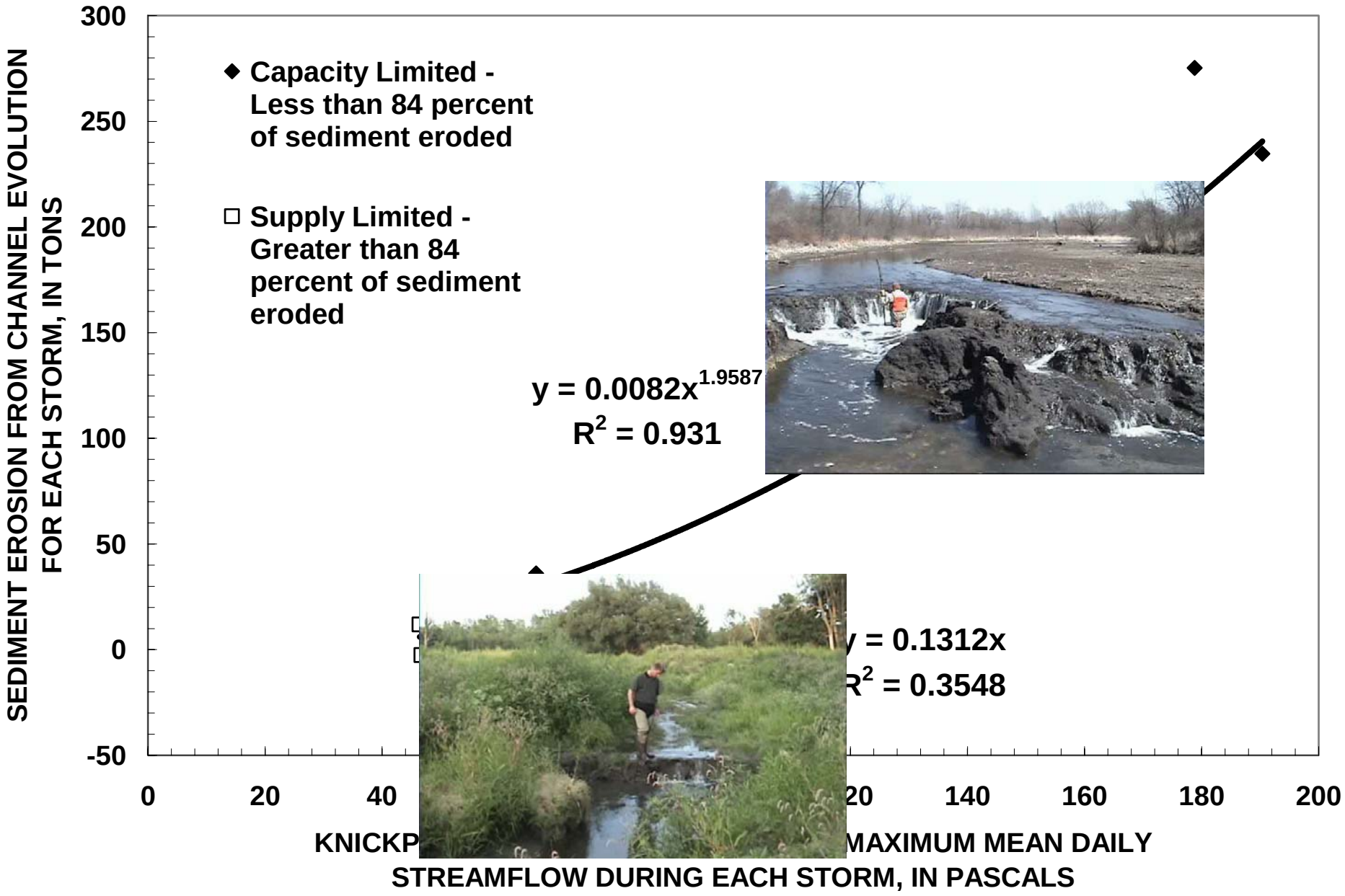
Knickpoint Migration



(modified from Schumm, Harvey, and Watson, 1984)

Primary Knickpoint Locations


SEDIMENT EROSION FROM CHANNEL EVOLUTION FOR EACH STORM, IN TONS
300
250
200
150
100
50
0
-50
0
20
40
60
80
100
120
140
160
180
200
Capacity Limited - Less than 84 percent of sediment eroded
Supply Limited - Greater than 84 percent of sediment eroded
y = 0.0082x^1.9587
R^2 = 0.931
y = 0.1312x
R^2 = 0.3548
KNICKPOINT SHEAR STRESS FOR THE MAXIMUM MEAN DAILY STREAMFLOW DURING EACH STORM, IN PASCALS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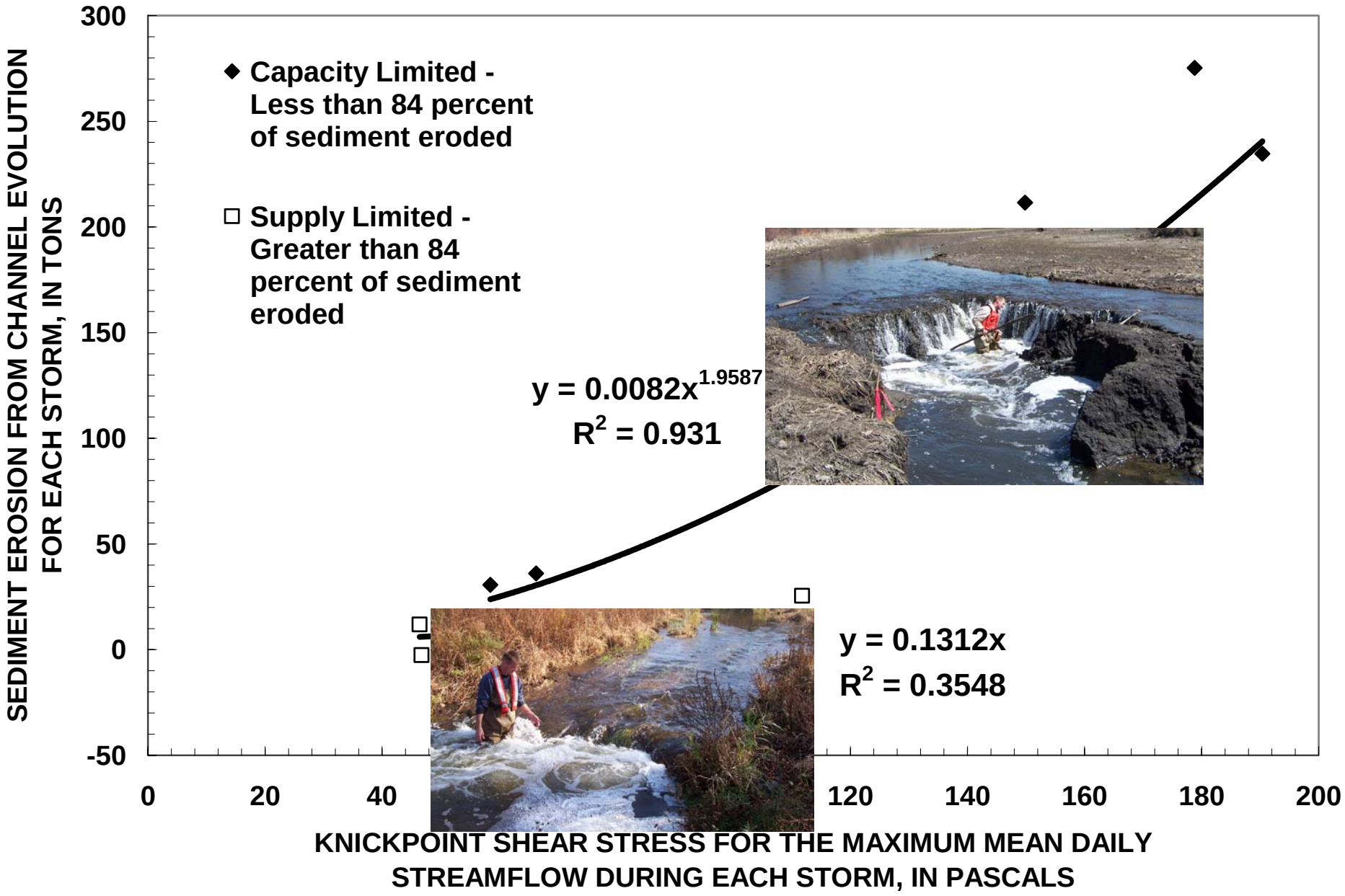
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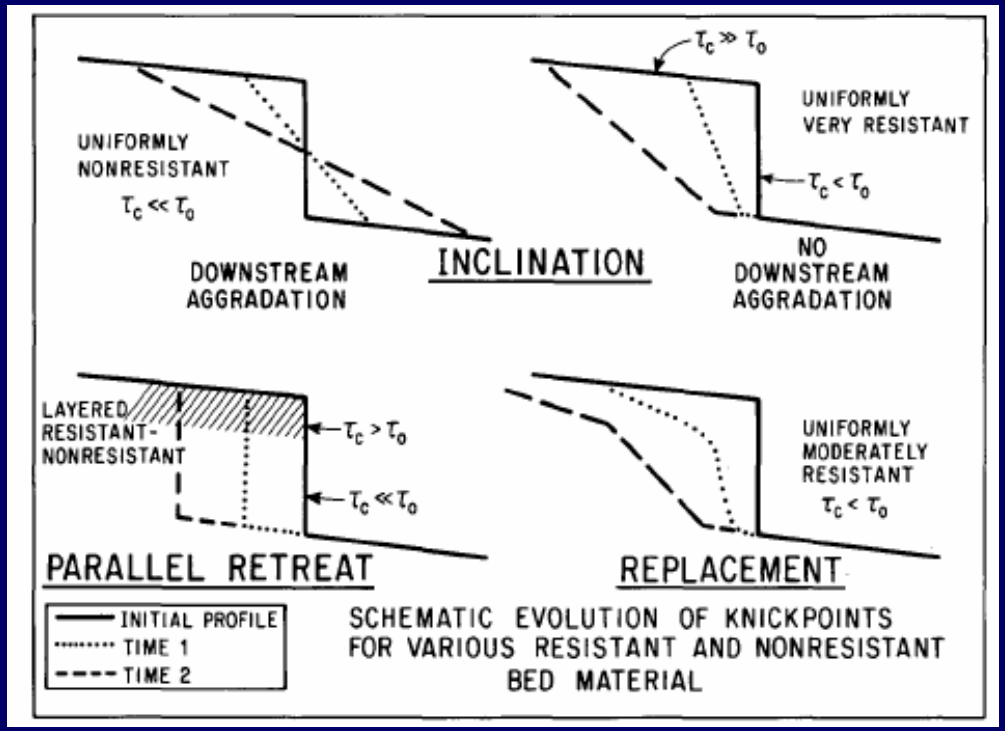
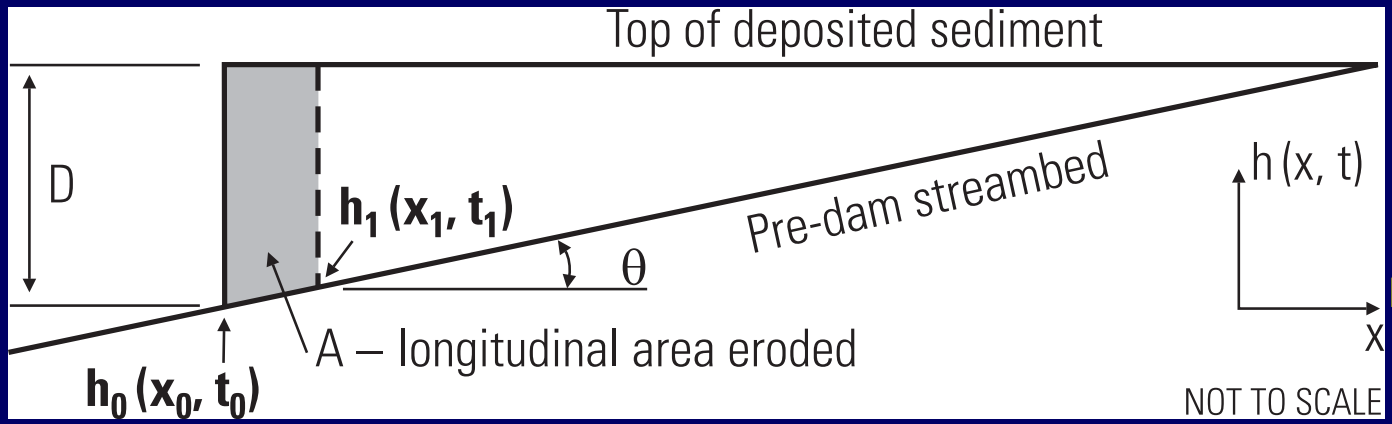
Knickpoint Migration Research



(Gardner, 1983)

$$\left.\frac{D_n}{h_n}\right|_C = 1.5\left(\frac{F^2+0.4}{F}\right)^2$$

(Stein and Julien, 1993)



(Straub, 2007)

Cohesive Knickpoint Parallel Retreat (CKPR)

Analytical Techniques for Dam Removal Assessment

- Measure amount and properties of deposited sediment and pre-dam stream substrate.
- Model channel evolution and final stability.
- Monitor sediment transport before and after dam removal.

Brewster Creek - 8/27/2005

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Stream Fishery Surveys – Steve Pescitelli, IDNR

Common Name	Downstream Control		Upstream Control	
	2002	2004	2002	2004
Central mudminnow	0	0	0	1
Grass pickerel	1	1	0	4
Carp	2	0	0	0
Golden shiner	0	9	0	0
Creek chub	2	7	11	6
Hornyhead chub	55	34	0	0
Striped shiner	0	3	0	0
Spotfin shiner	43	68	0	0
Bluntnose minnow	73	64	28	0
White sucker	2	0	3	0
Channel catfish	1	0	0	0
Yellow bullhead	3	8	3	7
Stonecat	17	29	0	0
Largemouth bass	2	3	2	1
Smallmouth bass	4	4	0	0
Green sunfish	92	57	23	19
Sunfish hybrid	3	9	0	0
Bluegill	122	36	6	0
Pumpkinseed	2	5	0	0
Johnny darter	0	3	0	0
Fantail darter	0	0	5	10
Total fish	424	340	81	48
Total species	15	15	8	7
IBI	27	32	20	22

The IBI increased in August of 2004 when sediment yield was greatest

Lesson – Temporary sediment increases do not destroy fisheries

Normalized Sediment Yields

in tons/(year-mi^2-cfs)