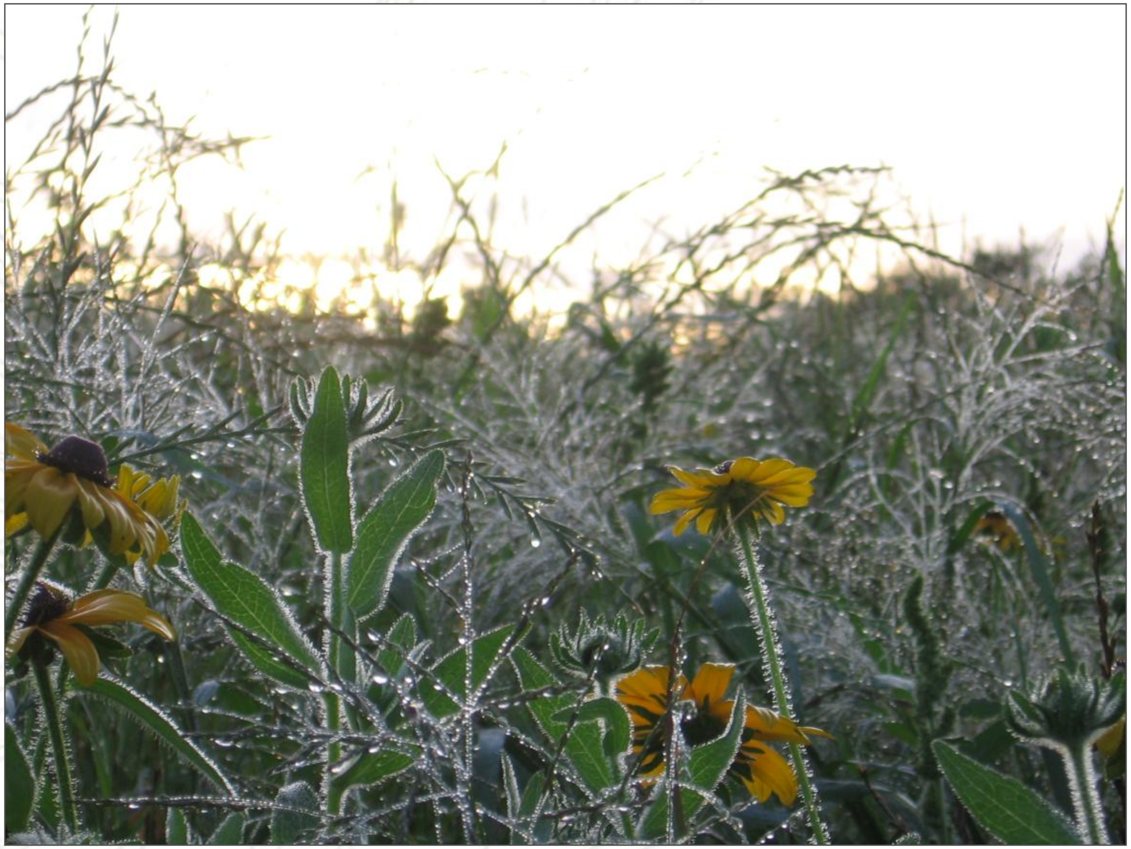
WETLAND RESTORATION



THE INTRODUCTION OF AGROECOLOGICAL LAND USE

ENGINEERING ANALYSIS OF WETLAND RESTORATION

Photo by Bill Hecht

Objectives

REDUCE PHOSPHORUS AND SEDIMENT LOADING

IMPROVE WATER QUALITY AND THE LOCAL ECONOMY

Current Situation

Current Situation

Current Situation

Current Situation

Current Situation

Current Situation

Current Situation

Current Situation

Process

Entrenchment is a four-phase cyclic process that starts with an over-steepened channel as the channel erodes upslope. The over-steepened channels permit higher flow volumes, which increasingly stay within the stream channel, rather than dissipating onto the stream's floodplain.

Process

In the second phase, the stream flow's greater velocity results in greater pressure and shear on the streambed. This contributes to accelerated deepening of the streambed until equilibrium is attained between the erosive force of the confined flows, the channel gradient, and the resistance of the streambed.

Process

When stream flow, channel gradient, and streambed resistance equilibrium have been reached, the streambed widens at the new base flow elevation. In this third phase, the channel widening is the result of the increased stress on unvegetated streambanks that occurs at the same time as the increased sediment supply from eroding streambanks is deposited downstream. The increased streambank stress and sediment supply tend to focus the erosive forces at the streambank toe. Erosion of the streambank is compounded by groundwater flows through its sides.

Process

The fourth phase is the re-establishment of a functional channel and floodplain within the entrenched waterway. During period of favorable flow, significant recovery may be observed. Major flooding can completely re-arrange the channel, removing vegetation and destroying habitat, as well as further widening the entrenched stream.

Result

One result of the above-described responses by the primary Inlet into a Finger Lake is a substantial decrease in its access to its former floodplains. The inability to access its floodplains results in a decrease in filtration of sediment from the inflows into the Lake, which contributes to a decline in water quality.

Pencil to Paper

This analysis is intended to allow a comparison between different restoration scenarios, and is not intended to provide a completely accurate quantification of the effectiveness of the scenarios.

It is likely that the benefits would occur at a different time than the costs.

Analysis

In the case of restoring the functions of Inlet Wetlands, citizens will experience a cessation lag, a time difference between reduction in exposure and a reduction in observed health risks. In this study, surrogates will represent the assumed health risks. *Decreased input of phosphorus into a Finger Lake via its primary Inlet will be equated with an increase in the Lake's water quality, a decrease in potable water treatment costs and increase of the economic benefit of the Lake to the citizens that reside in or are provided services from the natural resources within the Lake watershed.*

Analysis

The time span of an economic analysis should be sufficient to capture major welfare effects from policy alternatives, so that the benefit-cost analysis reflects the welfare of those affected by the policy. The time horizon should be long enough that the net benefits for all future years beyond the time horizon are expected to be negligible when discounted to the present.

Analysis

Restoration Scenario	Benefits	Costs
East Side Diversion	Nutrient Management; Sediment Capture; Habitat Restoration; Streambank Stabilization	Land Acquisition; Stream Bypass; Earthwork; Stabilization; Maintenance

Analysis

Restoration Scenario	Watershed Area (mi^2)	Linear Feet	Bankfull Width (feet)	Buffer Width, Each Side (feet)	Project Width (feet)	Added Land Cost ($$)
East Diversion	0.5	1500	100	100	300	$18,000

Analysis

Bankfull Width calculated per “Regionalized Equations for Bankfull Discharge and Channel Characteristics of Streams in New York State: Hydrologic Region 6 in the Southern Tier of New York, U.S. Geological Survey Scientific Investigations Report 2005-5100.

Bankfull Width = 16.9 (drainage area in square miles) $^{0.419}$.

Bankfull Cross-Sectional Area calculated per “Regionalized Equations for Bankfull Discharge and Channel Characteristics of Streams in New York State: Hydrologic Region 6 in the Southern Tier of New York, U.S. Geological Survey Scientific Investigations Report 2005-5100.

Bankfull Area = 17.6 (drainage area in square miles) $^{0.662}$.

Analysis

Restoration Scenario	Linear Feet	Adjusted Cost per LF	Added Land Cost	Scenario Cost
East Diversion	1500	$ 700	$18,000	$1,068,000

Analysis

Restoration Scenario	Watershed Area (mi^2)	Linear Feet	Bankfull Cross-Section Area (ft^2): $17.6(DA)^{0.662}$
East Diversion	0.5	1500	11

Analysis

Restoration Scenario	Water Treatment Volume (ft^3)	Bankfull and Floodplain Water Treatment Volume (gal)	Restoration Cross-Section Treatment Volume as % of primary Inlet Volume
East Diversion	16,680	124,800	0.2%

Analysis

Restoration Scenario	P Input from primary Inlet (lb/yr)	Treatment Volume / Inlet Volume	P Removal Rate	P Removed lb/yr
East Diversion	7722	0.2%	.50	8

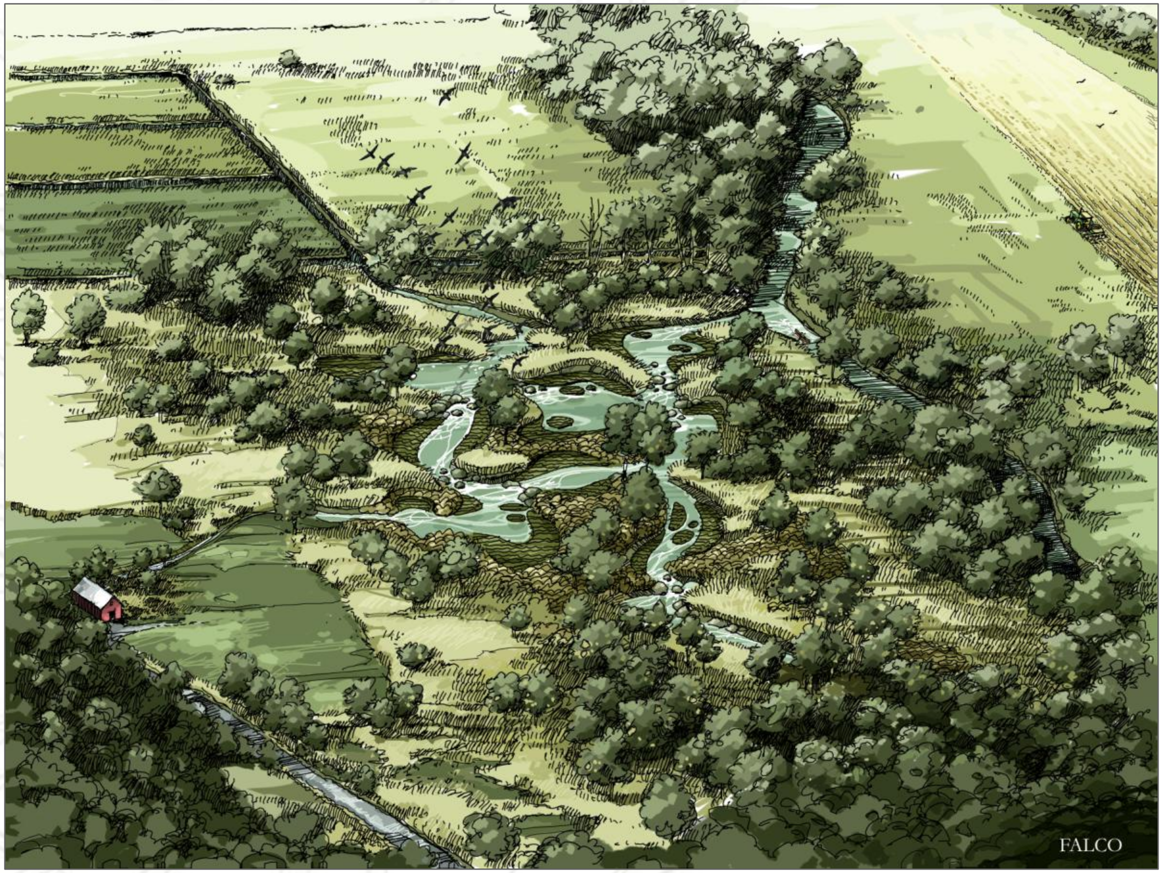
Analysis

Restoration Scenario	Scenario Cost	P Removed lb/yr	Cost per Pound of Phosphorus Removed
East Diversion	$1,068,000	8	$133,500

Analysis

Restoration Scenario	Estimated Life Cycle (years)	Cost per Pound of Phosphorus Removed	Cost/Pound of Phosphorus Removed per Year
East Diversion	15	$133,500	$8,900

East Diversion



East Diversion