

**DAM DECOMMISSIONING WORKSHOP:
OPTIONS, OPPORTUNITIES AND CHALLENGES**

Northwestern Michigan College - Great Lakes Campus, Hagerty Center
Traverse City, Michigan

April 24-25, 2006

Socio-Economic Aspects of Dam Decommissioning

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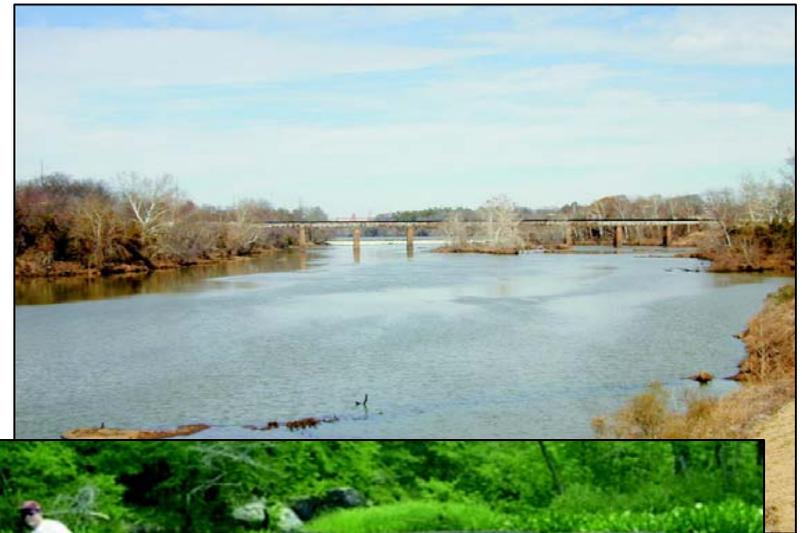
**US Army Corps
of Engineers.**

Funding Provided by:
Water Operations Technical Support (WOTS)
Mr. Robert Gunkel, Program Manager
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Socio-Economic Overview

- **Least-researched aspect of dam decommissioning**
- **Often highly site-specific**
 - Land ownership/property rights
 - Water rights
 - Aesthetics
 - Cultural resources
 - Archeological and historical resources
 - Funding opportunities
- **Perception plays a major role**
 - Appearance
 - Values—equity and opinion
 - Access
- **Level of understanding**
 - Public education
 - Open communication



Perceptions and Social Values

- **Change is threatening**
 - **Sense of powerlessness**
 - Will outside professionals value public opinion?
 - What is the decision-making process?
 - Who are decision-makers?
 - How can I express my opinion?
 - **How will this affect real estate values?**



Perceptions and Social Values

- **Public safety issues**
 - Floods
 - Health
 - Recreation (boating, swimming, and fishing)
- **Loss of privacy or increased access?**
- **What are the long-term costs?**
 - Maintenance?
 - Liability?
 - Opportunity costs?
 - Ecosystem services?
- **How will this impact recreation?**



Socioeconomics—Survey Results

Survey reported by Born et al. (1998)

Pro:

- Impoundment recreation will be missed
- Many appreciate the impoundment's aesthetics
- Fish and wildlife values will be lost

Con:

- It's safer without the dam
- Fish and wildlife values will improve
- Maintenance and liability costs need to be eliminated
- Removal is cheaper



Cost/Benefit, Decision Support Analyses

- **Standard Cost-Benefit Analysis**
 - Cost/benefit analysis of real or inferred cash flows with net present value estimates
 - Multiple criteria decision model with subjective and objective measures
 - Rights and obligations create red light/green light conditions
- **Data are integrated to rank alternatives (e.g., economic concepts from W. Price, n.d.)**
- **Incremental analyses (e.g., Corps IWRPlan)**
- **Multiobjective Analyses (e.g., Kuby et al 2005)**
 - Does not generate a single policy recommendation
 - No attempt is made to impose any particular values or weights on economic vs. ecological goals
 - Decisionmakers and stakeholders can evaluate and discuss the solutions on the tradeoff curve using their expert knowledge



Multiojective Analyses

- Maximize unobstructed drainage area
- Minimize economic losses

$$\text{Maximize: } Z_1 = \sum_i D_i X_i \quad (1)$$

$$\text{Minimize: } Z_2 = \sum_i E_i X_i \quad (2)$$

Subject to:

$$X_i \leq X_j \quad \text{for all } i, j \text{ such that } i \text{ is directly upstream of } j \quad (3)$$

$$X_i \in \{0, 1\} \quad \text{for all } i \quad (4)$$

where:

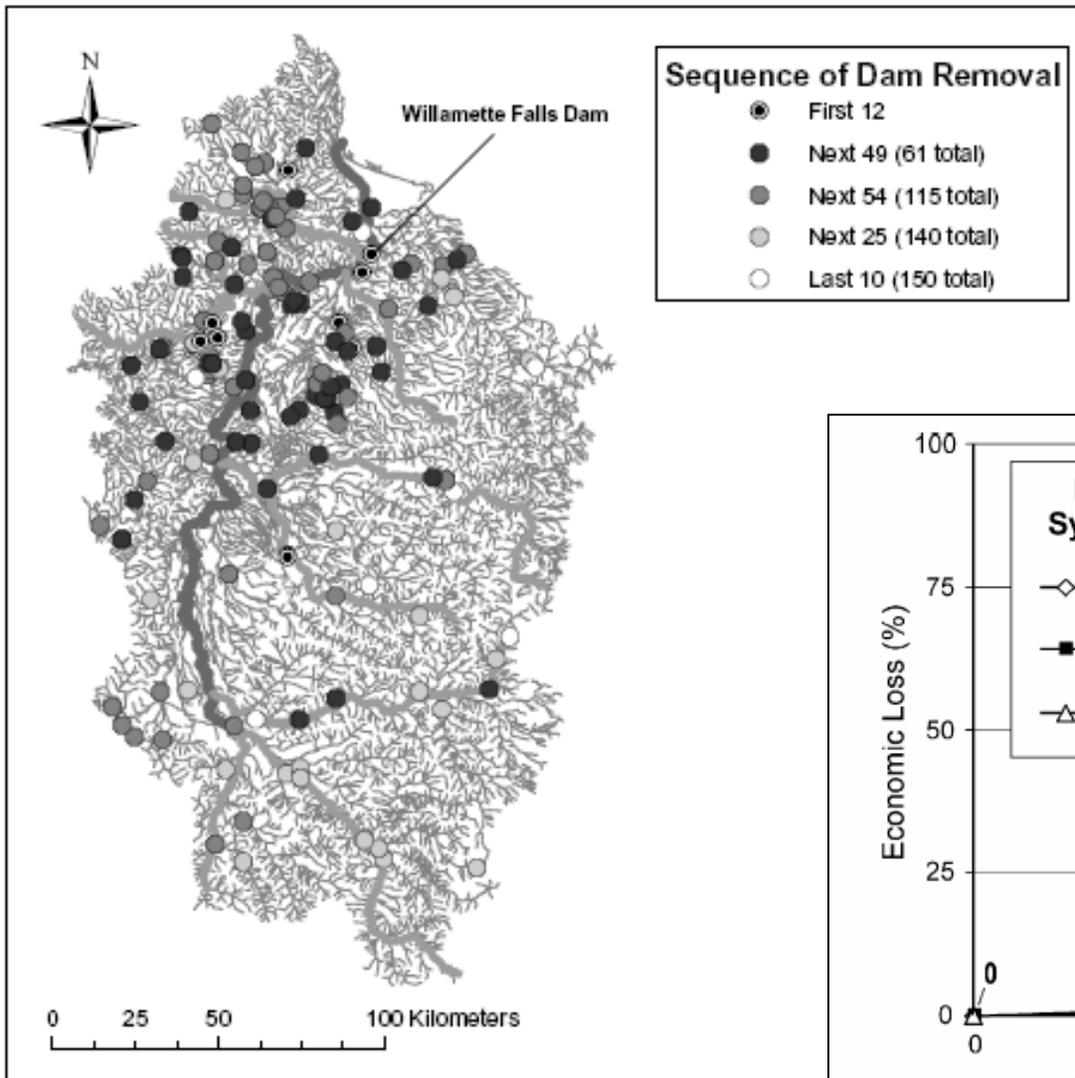
D_i = the drainage area of streams between dam i and any dams upstream of i (in km^2).

E_i = the economic loss of removing dam i (in percent).

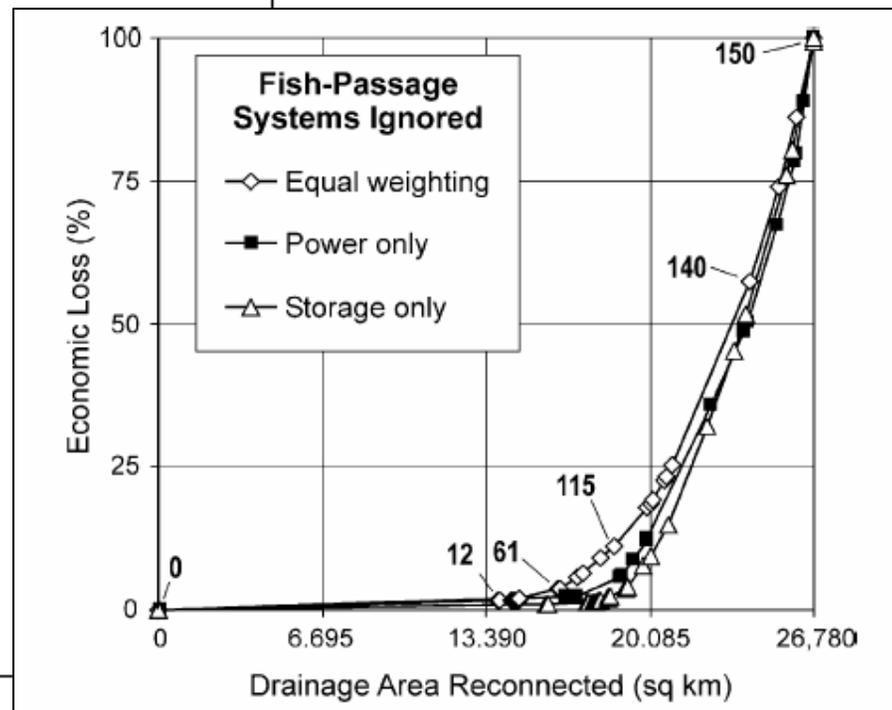
X_i = 1 'if dam i is removed' and 0 'otherwise'.



Multiobjective Analyses



- First 12 dams removed allow reconnection of 52% of upstream drainage and only 1.6% of hydropower and water storage is lost



Classic Cost/Benefit Analyses

- “Financial rationality”--
?????
- Any decision’s impact on finances of owners (known) and other stakeholders (imputed)
- Uncertainty, value ranges ignored
- Even a simple model is complex



C/B Variables

Benefits of decommissioning

- **Cost reduction of operations and maintenance**
- **Cost reduction of ownership overhead, insurance, and liability (other costs of potential failure?)**
- **Cost elimination of fish passage requirements**
- **Revenues of materials recycling**
- **Recreation revenues (real) with naturalized river**
- **Recreation benefits (implied)**
- **Natural resource benefits (real and implied)**
- **Potential increases in property values**



C/B Variables

Costs of decommissioning

- **Cost of deconstruction (diversion, removal, staging, management, overhead)**
- **Costs of sediment management (including contaminant disposal) and other environmental mitigation burdens**
- **Loss of power, water, recreation revenues**
- **Increase in flood damage (?)**
- **Potential decrease in property values--settlements to damaged parties?**
- **Risk to infrastructure, including municipal and private wells**
- **Corollary channel restoration costs**



Outcomes

- **Multiple decision criteria approach (all “hard” and “soft” costs and benefits weighted 1-100 and ranked by scenario) seen as arbitrary**
- **C/B analysis will nearly always come out in favor of dam presence unless condition is a factor**
- **Absence of “imagineering” (identified by NASA as a factor in the Apollo 1 fire) is a problem.**



Lessons From C/B Analyses

- **Scientific and stakeholder communities must improve their skills to more clearly articulate**
 - **Functions**
 - **Core processes**
 - **Values or “services” of the naturalized system**
 - **Long-term or large-scale processes that characterize the system**



ANALYSES LEVEL

Big Dam - High Impact - High Controversy

RUN! (or call)



Elwha, Glines Canyon and Snake River Dams

Small Dam - High Impact - No Controversy

Big Analyses



Cuddebackville Dam

Big Dam - Low Impact - Some Controversy

Moderate Analyses



Edwards Dam

Small Dam - Low Impact - No Controversy

Small Analyses



Naugatuck River Dams

Small Dam - No Impact - No Controversy

Minimal Analyses



Pizzini Dam

Conclusions

- **Projects can be contentious, long, and expensive; prioritization and effective planning, communications, and implementation are sorely needed**
- **Many costs, benefits, rates, and processes and perceptions don't readily quantify**
- **Net present value estimates undervalue long-term responses that are of central interest and significance**
- **Better models and case study documentation are needed**

