Research on Ecosystem Services Of Chishui River Basin Based On Invest Model

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1. Introduction

Backgrounds

✓ “Tributary protection as an alternative for hydropower development in the mainstream river” is an important environmental protection principle during hydropower development in China.

✓ Notice on strengthening environmental protection during hydropower development (China EPA, [2012] No. 4)

✓ The 13th Five-Year Hydropower Development Plan of China (in the period of 2016-2020) approved by National Energy Administration (China NEA)

✓ Chinese government needs an easy tool to assessment environmental protection effect at a national scale

✓ Our research group is working on the national guidelines for sustainable hydropower
1. Introduction

- Four hydropower plants built on the upstream of the Yangtze River: Wudongde, Baihetan, Xiluodu, and Xiangjiaba
- Chishui River is an important tributary of the upper Yangtze river
- Chishui River is an alternative habitat relative to hydropower development in the mainstream of Yangtze River

In operation:
Wudongde: 10200 MW
Baihetan: 16000 MW

Under construction:
Xiangjiaba: 6400MW
Xiluodu: 13860 MW

Total: 46460 MW, two times of Three Gorges hydropower station
Objectives

✓ Developing useful tools about how to measure benefits both in a project scale and a watershed scale

✓ Quantifying the economic, social and ecological value of Chishui River conservation as an alternative habitat

✓ Balancing costs and benefits between Chishui River protection and four hydropower plants in the mainstream of Yangtze River
2. Framework

An integrated framework
2. Framework

**Economic internal rate of return (EIRR)**

\[ \sum_{t=1}^{n} (B - C)_t (1 + EIRR)^{-t} = 0 \]

**Net economic value**

\[ ENPV = \sum_{t=1}^{n} (B - C)_t (1 + i_s)^{-t} \]

**Cost and benefit ratio**

\[ R_{BC} = \frac{\sum_{t=1}^{n} B_t (1 + i_s)^{-t}}{\sum_{t=1}^{n} C_t (1 + i_s)^{-t}} \]

- Summarizing benefits (goods and services) in the tributary and mainstream
- Defining costs of hydropower stations construction and operation, and tributary protection (economic cost)
- Balancing costs and benefits
2. Framework

INVEST (Integrated Valuation of Ecosystem Services and Trade-offs) was developed by Stanford University, World Wide Fund, The Nature Conservancy.

A. Providing scientific information for policy makers to weigh the benefits and impacts of human activities among different scenarios.

B. Providing distribution of benefits of ecosystem goods and services.

✓ Integrating the value of ecosystem services into decision-making and operational management of hydropower stations.
2. Framework

Geographical overview and drainage in the Chishui River Catchment

Habitat Quality Map (2015)

Average Soil Erosion Modulus of Different Cities from 1980 to 2015
3. Investigation

The index of biological integrity (IBI):

✓ An indicator aquatic ecosystem health to assess biology assemblages
✓ Overcome the limitations of chemical and physical parameters in the assessment of aquatic ecosystem health
✓ A sensitive indicator in the assessment of aquatic ecosystem health degradation associated with cascading dams
✓ Capture aquatic trophic status and identify variations in aquatic ecosystem health and degradation
## 3. Investigation

### Selection of field investigation points

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<th>No.</th>
<th>Survey Section</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Channel Segment</th>
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Distribution of field investigation points
3. Investigation

Investigation on site
Thanks for your attention!