



## 淡水生态系统健康指数（FHI）应用-澜沧江西双版纳段案例

Application of the Freshwater Health Index  
-Case Study of Lancang River in Xishuangbanna



Lancang-Mekong Environmental Cooperation Center

CONSERVATION  
INTERNATIONAL





# Lancang-Mekong Environment Cooperation

Lancang River in Xishuangbanna



## 澜湄环境合作 Lancang-Mekong Environmental Cooperation

On 23 March, 2016, Premier Li Keqiang put forward at the First Lancang-Mekong Cooperation Leaders' Meeting the initiative of establishing Lancang-Mekong Environmental Cooperation Center.



## 澜湄环境合作战略、绿色澜湄计划

### Lancang-Mekong Environmental Cooperation Strategy、Green Lancang-Mekong Initiative

January 2018, the First Lancang-Mekong Cooperation Leaders' Meeting , <Lancang-Mekong Cooperation Five Year Action Plan> Green Lancang-Mekong Initiative was proposed on the Second Lancang-Mekong Cooperation Foreign Ministers' Meeting on 23 December, 2016. The project is one of the major components of the Green Lancang-Mekong Initiative.

December 2018, the forth Lancang-Mekong Cooperation Foreign Ministers' Meeting



## 澜湄环境合作中心 Lancang-Mekong Environmental Cooperation Center

Lancang-Mekong Environmental Cooperation Center was officially launched on 28 November, 2017. The project is conducted by the Lancang-Mekong Environmental Cooperation Center.

# Freshwater Health Index Application

澜湄：水资源、生态资源和生物多样性丰富

快速工业化、城镇化进程导致生态环境凸显；可持续发展与生态系统可持续利用是共同面临的挑战

## Songtao reservoir in Hainan

海南松涛水库

2018年

地缘相近、人文相亲

气候条件相似

## Erhai Lake

云南大理洱海

2018年

高原湖泊

澜湄水系

## Lancang River in Xishuangbanna

澜沧江西双版纳

2017年

澜沧江主干流

# Freshwater Health Index

Lancang River in Xishuangbanna

## Background

背景  
Lancang-Mekong  
Environmental  
Cooperation  
Green Lancang-Mekong  
Initiatives

## Ecosystem Vitality

生态系统生命力  
Water quantity  
Water quality  
Basin Condition  
Biodiversity

## Ecosystem Services

生态系统服务  
Provisioning  
Regulation & support  
Culture

## Governance & Stakeholders

管理与利益相关方  
Enabling environment  
Stakeholder engagement  
Effectiveness  
Vision & adaptive  
governance

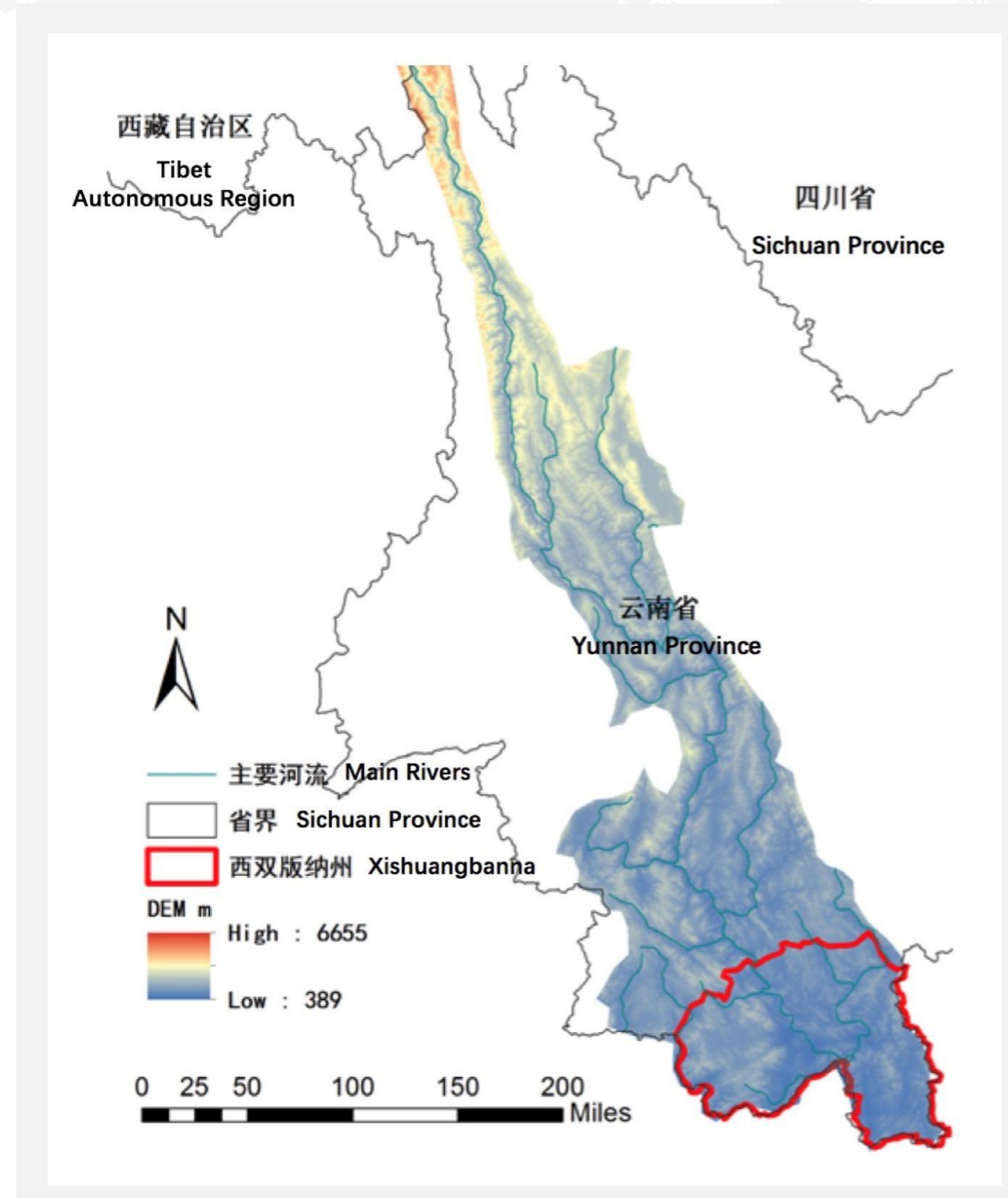
## Conclusions

结论  
Ecosystem Vitality  
Ecosystem Services  
Governance &  
Stakeholders



# Background

Lancang River in Xishuangbanna



## Lancang River in China

Lancang River originates from Qinghai Province in China, flows through Qinghai, Tibet and Yunnan, departs in Mengla County of Xishuangbanna as a border river between Laos and Myanmar

Length: 2139/ 4909km

Study Area: marked in red

# Background

Lancang River in Xishuangbanna



## 调研 Investigations

February 13-17, Xishuangbanna

September 4-8, Xishuangbanna



## 讨论会 Forums

February 13, Kunming

February 14, Jinghong

May 24, Beijing

September 5, Jinghong

September 8, Jinghong



## 采访 Interviews

Local governments

Enterprises

Research institutes

Communities

NGOs

# Background

Lancang River in Xishuangbanna



**Water quantity**  
水量

Deviation from natural flow; Groundwater storage

**Water quality**  
水质

TN; TP; Permanganate index; Anionic surface active agent

**Basin condition**  
流域情况

Channel modification; Natural land cover

**Biodiversity**  
生物多样性

Species of concern ; Invasive & nuisance species

**Provisioning**  
供给

water stress; Water supply reliability; Biomass for consumption

**Regulation & support**  
调节与支持

Sediment regulation; Water filtration; Flood mitigation; Disease regulation

**Culture**  
文化

Conservation areas; Water-related recreation

**Enabling environment**  
政策环境

Water resource management; Rights to resource use; Incentives and regulations; Financial capacity; Technical capacity

**Stakeholder engagement**  
利益相关方参与度

Information access; Engagement in decision-making process

**Vision & adaptive governance**  
愿景和适应性管理

Strategic planning and adaptive governance; Monitoring and learning mechanism

**Effectiveness**  
有效性

Enforcement and compliance; Distribution of benefits ; Water-related conflicts



# Background

Lancang River in Xishuangbanna

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## Data resources of Ecosystem Vitality and Ecosystem Services

Literature and yearbooks, environmental monitoring datasets, remote sensing images, field visits, questionnaire surveys, and model simulations (Soil and Water Assessment Tool, SWAT, by Beijing Normal University)

文献与年鉴、收集环境监测数据、解读遥感图像、实地走访、问卷调研、模型模拟 (SWAT模型)

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## Data resources of Governance & Stakeholders

Governance & stakeholders questionnaire fulfilled by Local governments, enterprises, research institutes, communities, and NGOs

组织利益相关方填写调查问卷分析

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## Weighted values of indicators

Indicators are weighted using the Analytic Hierarchy Process (AHP) based on values assigned by experts

指标权重赋值，并运用层次分析法 (AHP) 分析得出了最终的各指标权重，计算FHI值





# Ecosystem Vitality

Lancang River in Xishuangbanna



**Water quantity**  
水量

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## Deviation from natural flow 与天然径流的差异

The water flows in the Lancang River Basin : mainly rainfall , also replenished by groundwater and snowmelt. 径流以降水为主，地下水和融雪补给为辅。

In Xishuangbanna, in the subtropical and tropical climate zones, rainfall is abundant under the impact of monsoon, contributing to more than 60% of annual runoff. 处于亚热带和热带气候区，受季风影响，降水丰沛，降水占年径流量的60%以上。

研究表明现有径流量与天然径流存在少量差距，但总体比较贴合自然状况

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## Depletion of groundwater storage 地下水储量改变

Surface water resources are rich地下水资源丰富，利用率很低，可利用空间大。

Groundwater extraction is limited and mainly used for barrel and bottled mineral water.

地下水开采较少，主要用于桶装、瓶装的矿泉水。

# Ecosystem Vitality

Lancang River in Xishuangbanna

**total nitrogen, total phosphorus, permanganate index and anionic surface active agent**  
总氮、总磷、高锰酸盐指数、阴离子表面活性剂



**Water quality**  
水质

The primary and tertiary industries dominate Xishuangbanna's economy

Pesticides and fertilizers are hardly utilized in cash crops to meet the market demand for green food.

The secondary industry accounts for small proportion: 2-3 cement plants, 5 sugar mills, and around 50 rubber plants. In general, the water bodies are free from chemical pollutants. A small number of degradable organic substances are discharged from rubber plants, but can be largely diluted in rainy season.

以中国《地表水环境质量标准》的III类水体污染物浓度限值为标准，应用WQI法计算所得

以第一和第三产业为主，基于市场对绿色食品的需求，目前经济作物基本不使用农药、化肥；茶地、樟脑树等多用生物防治无化学污染物，存在少量可降解的有机物质；橡胶厂生产期一般为汛期，对水中有机物浓度有较强的稀释作用



# Ecosystem Vitality

Lancang River in Xishuangbanna



Research team investigating eco-agriculture



Research team visiting rubber plant

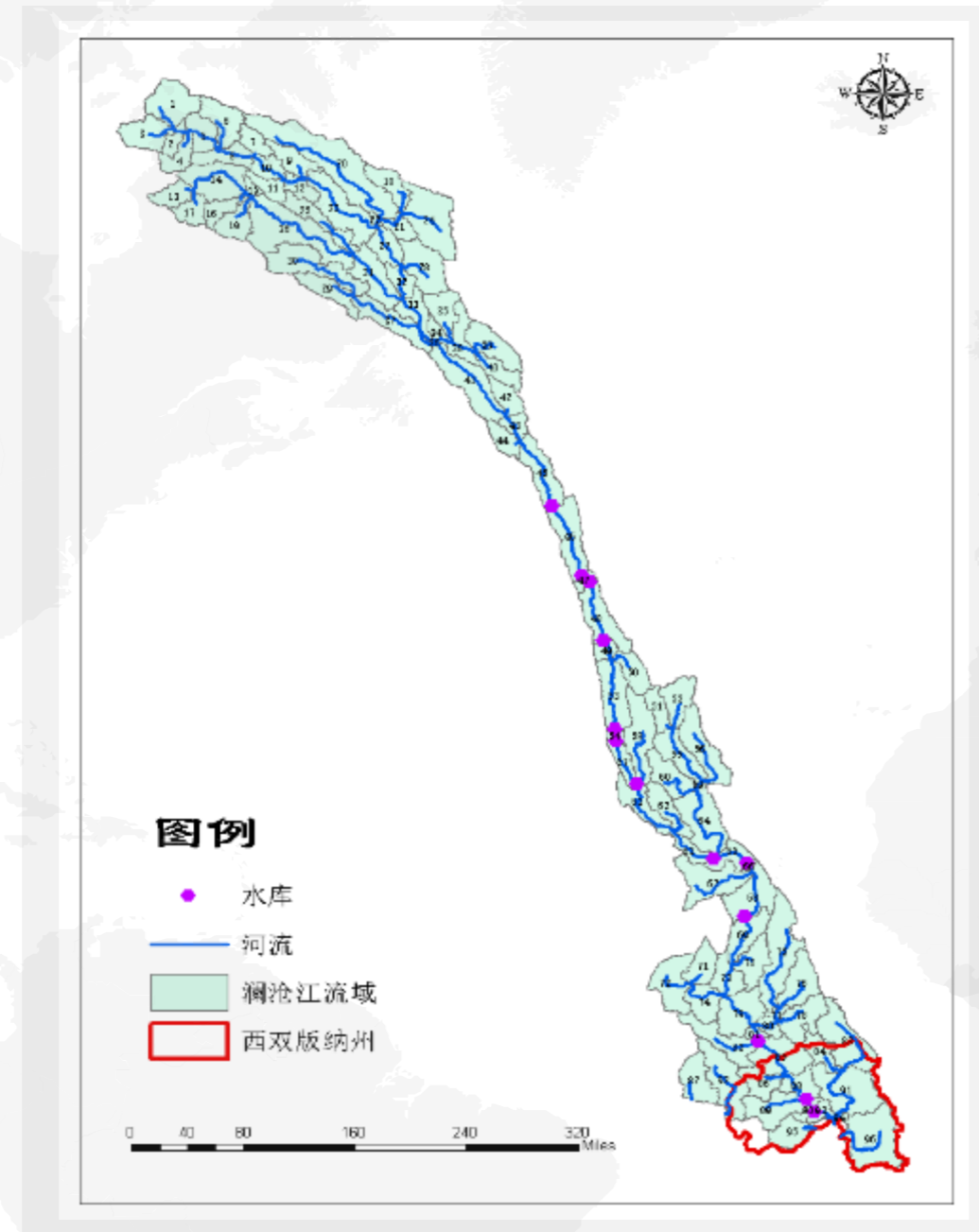


# Ecosystem Vitality

Lancang River in Xishuangbanna

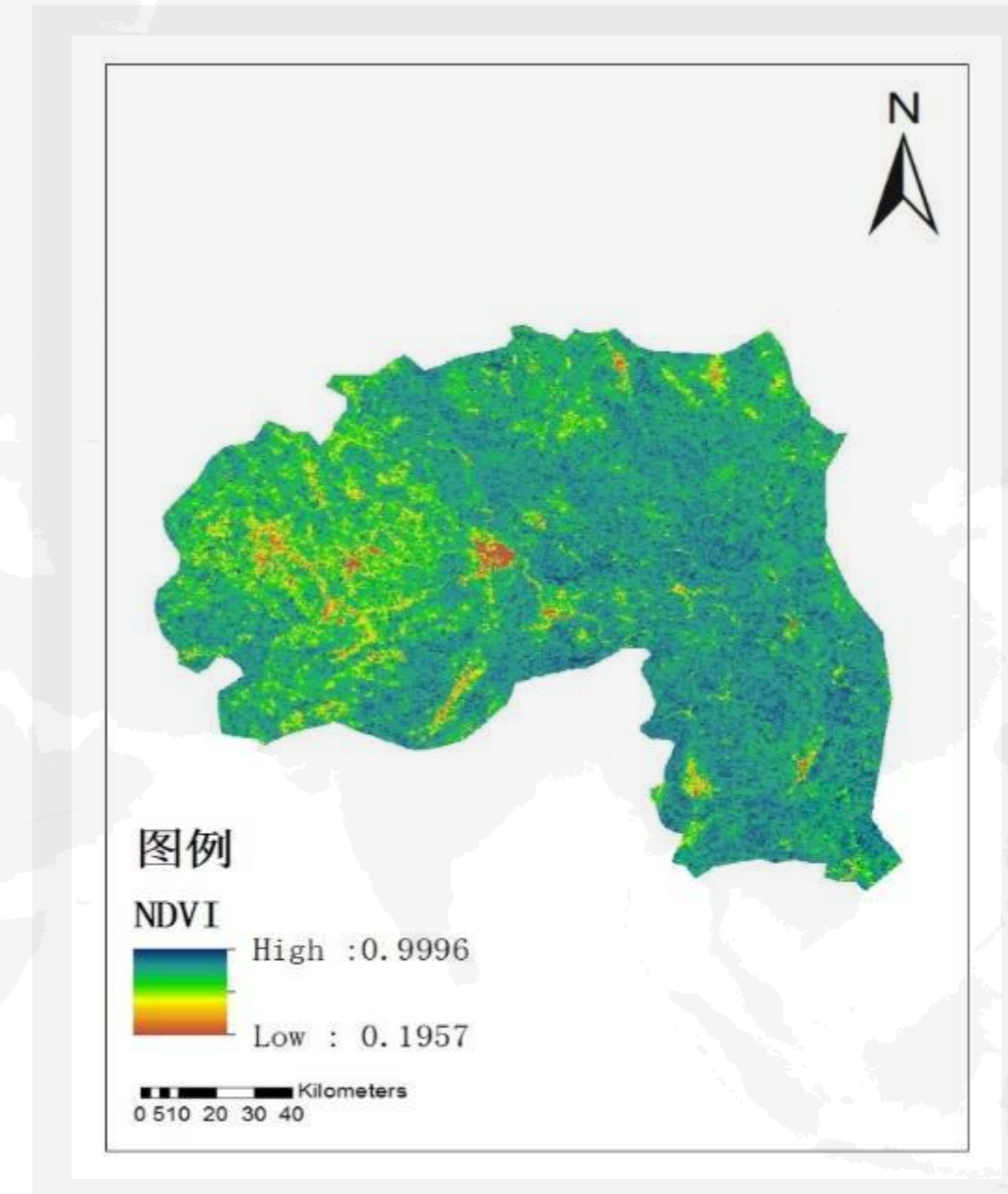


**Basin condition**  
流域情况



**channel modification河道改变程度**

主干流:景洪电站, 支流上有200多座小二型水库, 导致了一定程度的河道破碎化  
据环评报告, 电站建设时设计了鱼类洄游通道, 对洄游鱼类影响很小。



**natural land cover天然地表覆盖变化**

一部分天然植被已被香蕉林和橡胶林所替代, 香蕉林和橡胶林相对于天然植被具有较弱的保水固土功能, 且耗水量大。



# Ecosystem Vitality

Lancang River in Xishuangbanna



**Biodiversity**  
生物多样性



**"Kingdom of Animals" and "Kingdom of Plants"**

abundant in flora and fauna because of warm and humid climate and rich light and heat resources. 气候温暖湿润，丰富的光热资源，动植物物种丰富，素称“动物王国”“植物王国”

It gives top priority to biodiversity conservation and achieves desired results. 生多保护是工作重中之重，生多保存较好

took multiple measures to effectively control alien species

对入侵物种采取人工/机械铲除、替代控制、生物防治、开发利用等措施，外来物种得到了有效控制。

近几年来由于农业发展河流中天然渔业资源量有所减少，但农业局针对该问题及时、按期采取增殖放流措施，保证了河流中的生物多样性。



# Ecosystem Services

Lancang River in Xishuangbanna

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## Annual water use 年均用水压力

per capita water resources reach 6000-10000 cubic meters, but only 5.7% of them are utilized 人均水资源量为6000-10000方，但使用率仅为5.7%，其中农业用水为80%，水资源储量较大。研究年份出现干旱的频率较高，但采取措施比较及时，未产生过较为严重的影响

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## Water supply reliability 供水可靠性

The rainy season spans from May to October and the dry season from November to next April, but there is no seasonal water shortage owing to water supply works, like reserviors. 西双版纳雨季为5至10月，旱季为11月至次年4月，由于蓄水工程的供水，无季节性缺水现象。

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## Biomass for consumption 人类可获取的生物量

Bureau of Agriculture has timely reproduced and released fish to rivers, basically the biomass for consumption reaches the residents' demand. 由于农业局对渔业资源捕捞量统计数据较少，无法得到该流域的生物物质供应量。通过实地走访获悉，天然河道里鲤鱼、草鱼相对较多，同时，州农业局会定期实行增殖放流，保证了河流生物物质供应量。



Provisioning  
供给



# Ecosystem Services

Lancang River in Xishuangbanna



**Regulation & support**  
调节与支持

## sediment regulation 泥沙调控

SWAT modelling indicates satisfactory function of sediment regulation. 利用SWAT模型对泥沙沉积量变化趋势进行了分析，对泥沙变化明显的子流域进行统计，表明研究流域具有较好的泥沙调控功能。

## water filtration 水过滤功能

The water quality has been compared to national surface water standards or more specifically Grade III standards According to the criteria, water filtration is rated perfect. 在研究年份一直符合国家地表水标准，水质状况较好。

## flood mitigation 防洪减灾

Thanks to the construction of water conservancy facilities, water supply and disaster prevention and mitigation capacities have been greatly improved, basically ruling out the possibility of floods. 得益于水利设施的修建，西双版纳供水保障能力、水利防灾减灾能力有了极大提升，几乎无洪涝灾害发生

## disaster regulation 疾病调控

There is no water-related epidemics within the study period 逐步完善了疾病预防控制机构建设，传染病预防控制工作逐渐转入常态，硬件建设和应急能力得到加强，人员素质得到提高。

# Ecosystem Services

Lancang River in Xishuangbanna



Culture  
文化



National ecological civilization demonstration state, Conservation areas occupy 12.7% of total area currently. it is difficult to identify conservation areas designated for cultural importance  
2017年全国生态文明示范州，目前西双版纳自然保护区面积已占全州总面积的12.7%

water-related recreation, questionnaire is designed, most of the valid questionnaires are completed by students or officials from government.

涉水休闲业的调查主要通过问卷调查完成。因有效问卷填写者身份较为单一，而受访群体可能花费在涉水休闲业上的时间不多，该指标得分较低。代表性与客观性有待研究，但也反映了西双版纳在涉水休闲业方面具有较大的发展空间。



# Governance & stakeholders

Lancang River in Xishuangbanna



**Enabling environment**  
政策环境



**Stakeholder engagement**  
利益相关方参与度



**Vision & adaptive governance**  
愿景和适应性管理



**Effectiveness**  
有效性

local governments, enterprises, research institutions, and communities and villages

NGOs temporarily default, few well understand the local governance of freshwater ecosystems, while the current questionnaires are too complex to complete

研究河段利益相关方较为多元化，能否从宏观管理角度进行流域规划与政策制定、从微观管理角度执行有效的流域投资、建设、保护项目，并对利益相关方进行有力协调，对流域可持续发展至关重要，但相关工作异常复杂。

无法精确量化，主观性较强，因此问卷调查。该流域在管理与利益相关方参与方面仍然存在一定的挑战。



# Governance & stakeholders

Lancang River in Xishuangbanna



Interview



Interview



Interview



# Conclusions

Lancang River in Xishuangbanna



## Ecosystem Vitality 生态系统生命力

Eco-friendlier cash crops should be introduced to promote green transformation of local rural economy

### 天然地表覆盖率变化

引进生态环境友好型经济作物，促进该地区农村经济的绿色化转型



## Ecosystem Services 生态系统服务

Develop water-related recreational projects that combine natural capital and economic development

### 涉水休闲业

加强涉水休闲娱乐项目建设，将自然资本利用与经济发展有机结合



## Governance & Stakeholders 管理与利益相关方

Management strengthened and advanced by formulating appropriate water utilization and protection planning, improving water crisis emergency response, and enhancing stakeholder engagement.

### 管理与利益相关方参与

加强淡水生态系统管理力度，做好水资源使用及保护规划，增强利益相关方参与度，整体推进当地淡水生态系统管理工作。



**Thanks for your attention!**

Lancang-Mekong Environmental Cooperation Center