Study Camp on Environment Technology

TONAMI Camp 2018

08/27 - 08/31

Target River: Brahmaputra River

Group A: BHP - WPSA

Group member:

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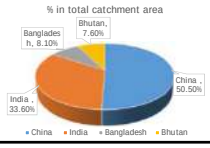
Introduction:The Brahmaputra river

- World's 4th largest river in terms of annual discharge (average discharge approximately 20000 m^3/s)
- Area of around 580000 km^2 covering four countries (China, India, Bangladesh and Bhutan)
- Main channel transverses through China, India and Bangladesh
- Travels a total distance of 2880 km (1625 km in china, 918 Km in India and 337 km in Bangladesh) and finally discharge into the Bay of Bengal



34% in Assam and 16% in WB

41% in Bangladesh

9% in Tibet, Bhutan and north-east of India

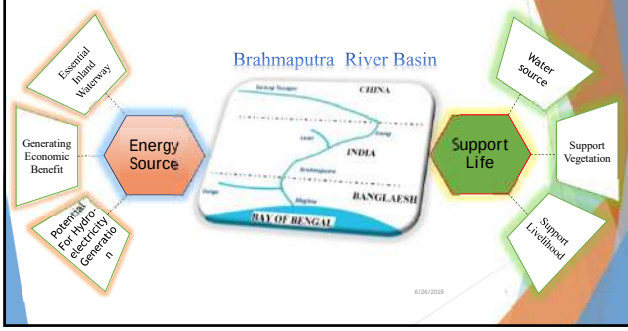
Total 83 million people living in the basin

Agriculture (81%), domestic uses (10%)

Fishing industries (16%), different industries (9%)

Local civil society, NGOs, academicians, researchers, media, donor agencies, bureaucrats, and politicians

Roles and functions of Brahmaputra river



Current Problems

Massive destruction to the villages and houses
Killing thousands of people, animals
Destroying farms and crops every year.

FLOODS

Reasons

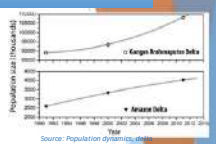
Climate change: snow melting in the Himalaya
Earthquake: the Indo-~~Burma~~ border area is disaster prone (earthquakes) Destroying dams
Dams: Poor maintenance of dams
lack or missing of collaboration of dams management among the countries
Solid Waste: Improper management
Heavy Metal: Industries discharge waste directly to the river without treatment, some of are toxic, contain heavy metals (Pb, Cr, Cd, Ni, etc.)
Wastewater: Domestic sewage also disposed to the river directly
Erosion of Soil: Floods and high speed flow in some parts Soil Erosion
Construction activities: Especially in the river upstream

WATER POLLUTION

Potential Problems

Population Growth

Increase Population → Increase Pollution → Increase Fresh Water Demand



Source: Population dynamics, delta vulnerability and environmental change: comparison of the Mekong, Ganges-Brahmaputra and Amazon delta regions

International Water Sharing Agreement

NO International Agreement → LEAD Tension Among Countries → LEAD Conflicts or War in future

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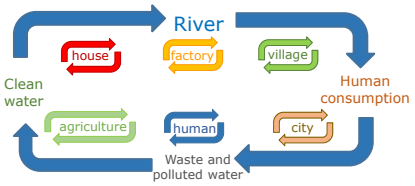
SLOGAN

Limited Resources, Unlimited Loops.



International joint commission | Improve Water Quality | Flood Protection

Integration among action

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Target 1-ROADMAP Flood BRAHMAPUTRA 2030

From 2020 onward
- Introduce about warning system
- Train to response during flood warning system occur
- Drill and campaigning before rainy season

Train and educate the local people

2018 | 2020 | 2026 | 2030

Installation of protecting facilities

Installation of warning facilities

- Identify the flood prone areas
- Establishment of warning center and communication system
- Construction of the

From 2026 onward
Construction: embankment
porous road
Plants vegetation
- Periodical maintenance

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Time period	Targets	Measurement	Responsible
2018-2025	**Installation of warning facilities** • Identify the flood prone areas • Establishment of warning center • Development of warning communication system by connecting mass media (Radio, TV, Newspaper, etc.) • Construction of the multipurpose used building	• Number of completed warning center • Completion of EIA	• Government support • Professional and technical support • Media • Volunteers NGOs
2020~onward	**Train the local people** • Introduce about warning system information • Educate the local people and train them to response during flood warning system occur • Drill and campaigning every year before rainy season	• Increasing number of participants and local people.	• Professionals and technical support • Local people • Volunteers (Student or NGOs)
2026~onward	**Installation of protecting facilities** • Construct embankment and water pathways • Construct porous road • Development of rain water harvesting facilities in cities and villages • Periodical maintenance of the facilities • Plants vegetation : • *Barringtamacea* family (strong roots, tolerant to flood)	• Number of completed embankments • Number of tanks provided	• Government support • Professional and technical support • Media • Local people • Volunteers (Student or NGOs)

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Target 2: Establishing a Joint Commission for Brahmaputra River

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Annual International Conference to Plan & Maintain → 2018

2020 — Deliver Recommendation to the Gov.

Sign International Agreement to Share the River Fairly → 2025

2030 — Successful Trans-boundary Policy to Share Water & Info & Prevent Pollution

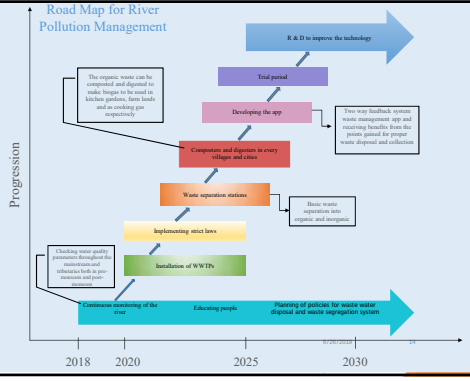
Continuous Observation & Collaboration

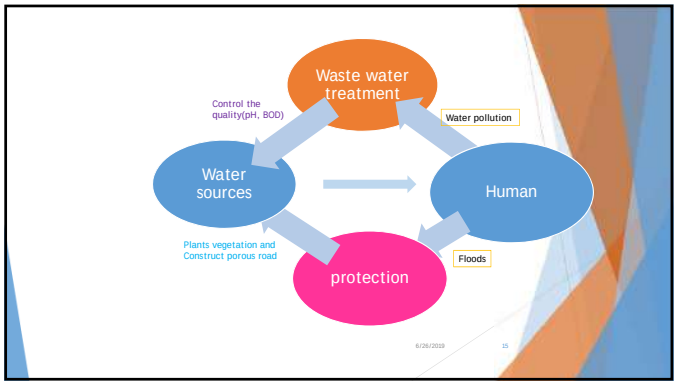
Period	Goals	Measurements	Responsible
2018 - 2020	- Annual international conference to set plans and maintain the river - Handing the outcomes to the governments & publish in public media	- Share & discuss the current data, policies, concerns and conflicts - Recommend scientific solutions to current & potential problems	Scientists, Researchers, NGOs, and Gov. agencies
2021 - 2025	- Creating a public opinion to push the governments - Reaching an official agreement among the concerned countries	**Examples:** - Socio-Ecological Impacts of one sided actions - Proper location & management for dams - Involve locals and stakeholders - Establish specialized institution to train engineers & researchers	Newspapers, TV advertisements - Politicians on Highest levels
2026 - 2030	- Starting practical actions Achieving a successful trans-boundary policy guaranty fair sharing of water, info & prevent pollution		The joint commission

Target 3-Engineering and policy measures for BHP river water pollution

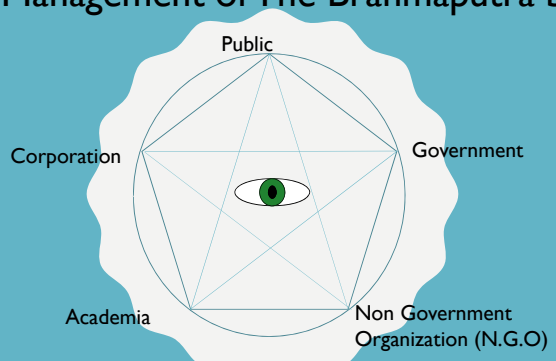
Time period	Target 1		Measures	Responsible
	Waste water	Solid waste		
2018-contd.	• Continuous monitoring of the mainstream as well as its tributaries • Educating people to separate municipal wastes • Making policies for industrial waste water discharge • Planning of WWTP & pipelines	• Educate and encourage people to separate for organic and inorganic waste segregation • Proper waste collection systems (e.g. municipal committees)	• Checking water quality parameters (turbidity, TSS, BOD, COD, pH, heavy metals, Total coliform bacteria) for the river • Proper record of pre-monsoon and post-monsoon data	• Public health engineering departments, State water boards, • Volunteers • Researchers • Municipal corporations
2020-2025	• Building WWTP (domestic waste) • Implementing strict laws on effluent discharge (pay compensation for violation of regulations)	• Supplying equipment (composter and digester in the villages and cities) • Building waste separation stations • Replacing chemical fertilizers to organic • Developing SMS (solid waste management system) app	• Continuous inspection of the industrial effluents by the govt. as well as public • Installation composter vessels cum biogas digesters to every houses in the villages • Waste separation units in every major cities • Two way feedback system waste management app and receiving benefits from the points gained for proper waste disposal and collection	• State and Central govt. • Software Engineers and scientists
2026-2030	• Verifying the water quality monitoring systems and WWTPs • R & D to improve the technology	• Trial period (Checking the efficiency of the waste separation) • R & D to improve the technology	• Implementation of new waste water treatment technologies • Implementation of recycling units	• Engineers and scientists • State and Central govt.

Road Map for River Pollution Management



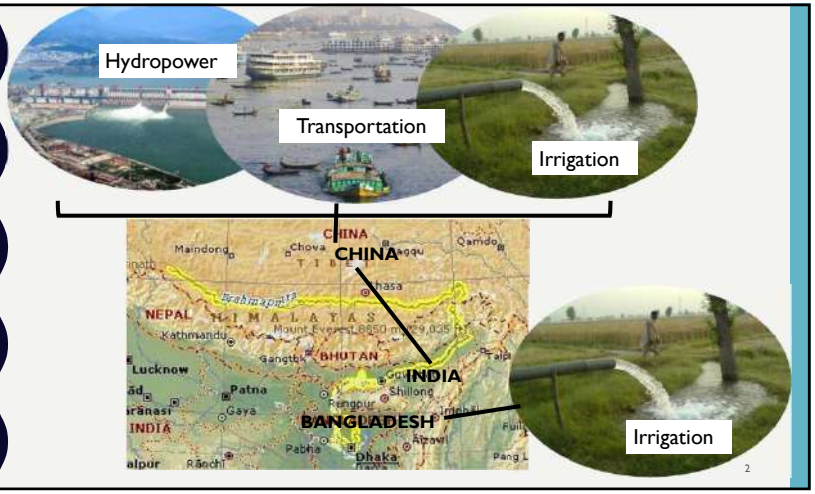


Robust Management of The Brahmaputra by 2030

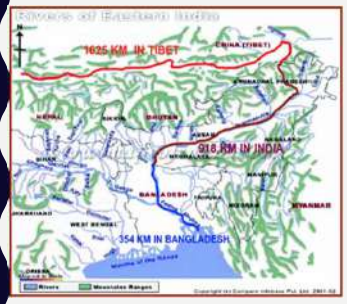


THE NERD HERD

ARBIND PATEL, CHANTO TEPY, HERNANDEZ STEPHANIE, LIU JIASHUO, MOCHIZUKI RYOUTA, ZHANG DANDAN, ZHAO HAODUO

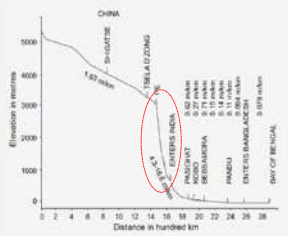


Introduction to Brahmaputra River



Length	2900 km
Total drainage area	570000 km^3
People within the basin	130 million

- This River has a steep slope, so sometimes can cause a flood



characteristic

- The Brahmaputra River is one of the largest rivers and it traverses China, India, Bhutan and Bangladesh

Current Problems with River Management

I. Flooding
   a) Death/Destruction (Upper Assam)
   b) Erosion of Bank
   c) Loss of Biodiversity
   d) Deposition of solids into river

Figure 1. Solid Waste Collected at Sluice Gate

Current Problems with River Management

II. Contamination

a) Heavy Metals, Pharmaceuticals and Personal Care Products (PPCPs), Microorganisms, Solid Waste

b) Unsafe to drink or irrigate

c) Severe damage to soil and groundwater, as well as local ecosystem

Table 1. Water Quality Index of Brahmaputra river and toxicity values

Imdex	Parameter	Range/Maximum	Safety Indicator
Chemical index	pH	6.5-7.7	6.5-8.5
	Turbidity *NTU	34.8	1
	Zinc (Zn)	2500 µg/L	1000 µg/L
	Copper (Cu)	50 µg/L	1000 µg/L
	Total Iron	480 µg/L	300 µg/L
Toxicological index	Cadmium (Cd)	3 µg/L	5 µg/L
	Nickel (Ni)	14.6 µg/L	20 µg/L
	Chromium (Cr)	50 µg/L	50 µg/L
	Arsenic (As)	1 µg/L	10 µg/L
	Mercury (Hg)	BDL	1 µg/L
	Lead (Pb)	10 µg/L	10 µg/L

*BDL Below Detectable Limit

Pollution Control Board, Assam, Conservation of River Bharalu, Guwahati Preparation of Detailed Project Report., Indian Institute of Technology, Guwahati 2013

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A.S.A.P ! 2030

Attainable
Sustainability
Advancing
Perspective

Target at :

- ✓ Fighting against floods
- ✓ Raise awareness
- ✓ Improve water quality
- ✓ Building trust
- ✓ Rebuild ecosystem

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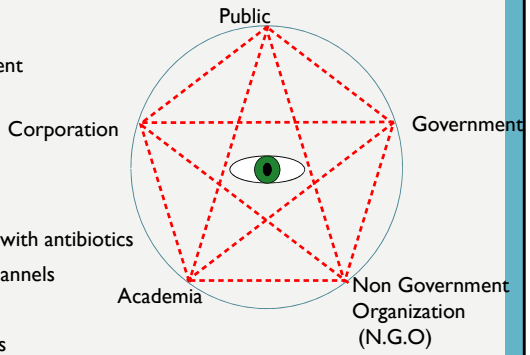
Current Problems with River Management

III. Co-operation

a) India-China-Bangladesh

b) Corporation-Government

c) Public-Government



IV. Further concerns:

- Villages relocated
- Diseases that can't be treated with antibiotics
- Contamination of irrigation channels
- Outbreak of Dams
- Conflicts over water resources

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Proposed Measures

Engineering

Waste Water Treatment
- ➢ Heavy metal ions
- ➢ Microorganism
- ➢ Pharmaceuticals and Personal Care Products (PPCPs)

Solid Waste Treatment
- ➢ Sludge
- ➢ Municipality solid waste

Domestic Sewage Drainage
- ➢ Water Quality

Checked dams and Embankments
- ➢ Flooding
- ➢ Erosion
- ➢ Infiltration
- ➢ Irrigation
- ➢ Energy

Policy

Education
- ➢ Cooperation
- ➢ Separation of Garbage
- ➢ Recycling of Materials

Laws of Enforce
- ➢ Garbage separation
- ➢ Water Quality Standard

Replacement of toxic Fertilizer
- ➢ Water Quality

Reforestation
- ➢ Air Pollution
- ➢ Biodiversity
- ➢ Flood and Erosion

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Detailed Management

Flood	Contamination	Cooperation
◆To build embankment in the flood area.	◆WWTP(Waste Water Treatment Plant) in cities	◆Establish an agreement of Brahmaptra River.
◆To equip tributaries with check dams.	◆To link houses to drainage systems	◆To form a board with academia from each country
◆To equip crop fields with irrigation channels	◆Industrial companies treat their waste water	◆Achieve agreement ➢ Discharge of water ➢ Water quality ➢ Real-time monitor
◆School teach courses on floods	◆WWTPs with thermal treatment(for PPCPs)	
◆First Aid response training	◆Public awareness of trash.	

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	Flood	Contamination	Cooperation
2018	None	None	● Establish the Conference for agreement on the Brahmaputra River between China, India and Bangladesh. Forming a 5-member Board in each country. ● Achieve agreement on:
2022			**1. Discharge of water** a) Fixed a discharge for every country; b) Prior information if discharge is above the permissible limit; c) Request of water in emergency; d) Request of survey of embankment through drone for leakage.
2026			**2. Real-time monitor of water quality** a) Use of sophisticated in situ well calibrated instruments Common annual monitoring chart for the countries; b) Data sharing point for each country equipped with an app.
2030			**3. Water Quality maintenance** a) Different water quality for each country; b) Identification of point source pollution for the respective country;

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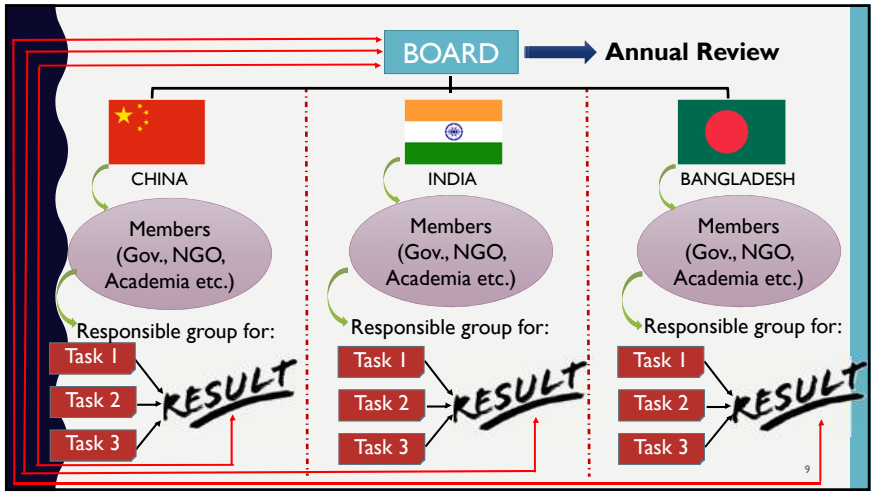

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	Flood	Contamination	Cooperation
2018	● 20% of river in the flood area should be protected with **embankment**. ● 40% of the tributaries should be constructed with **check dam**. ● 30% of the crop field	● 60% of the cities should be equipped with **WWTPs**. ● 70% of the houses should be linked to **draining system**. ● 40% of the industrial companies should treat their sewage by itself.	● 30% of the river dams in China, India and Bangladesh should work well to regulate the **discharge of water** as per agreement. ● 20% of the rivers in China, India and
2022	**How to implement?** ● Focus on most affected areas (upper Assam) ● Training 1-2% population of village: (Who) (What) Local :Participate Government :Pays NGO :Teach ● Crisis awareness Locals & Summary	**How to implement?** ● Robust wastewater treatment ● Who: Industrial companies (build private WWTP) Government (money) Engineers (design) Researchers (design) Locals (surveyors) NGO (surveyors)	**How to implement?** ● A legal agreement ● Who: Researcher; Engineer; Government; Local; in China, India and Bangladesh
2026			
2030			

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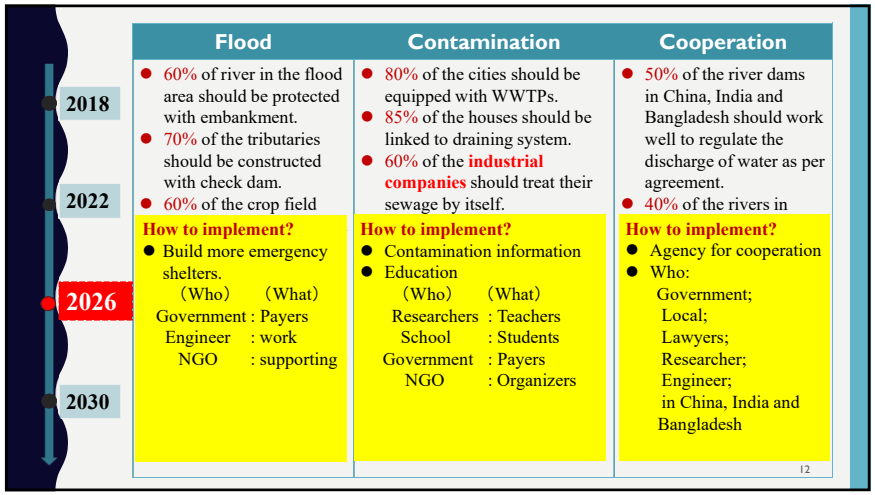
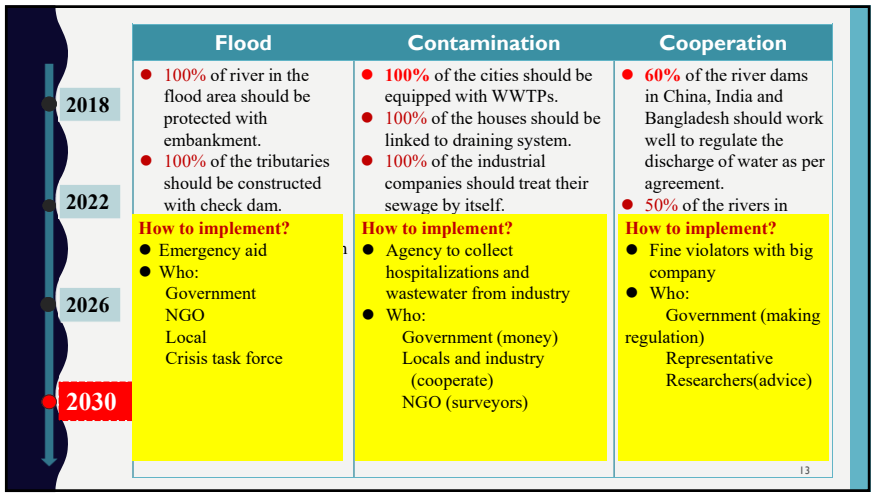

2018
2022
2026
2030
Flood
60% of river in the flood area should be protected with embankment.
70% of the tributaries should be constructed with check dam.
60% of the crop field
How to implement?
Build more emergency shelters.
(Who) (What)
Government : Payers
Engineer : work
NGO : supporting
Contamination
80% of the cities should be equipped with WWTPs.
85% of the houses should be linked to draining system.
60% of the industrial companies should treat their sewage by itself.
How to implement?
Contamination information
Education
(Who) (What)
Researchers : Teachers
School : Students
Government : Payers
NGO : Organizers
Cooperation
50% of the river dams in China, India and Bangladesh should work well to regulate the discharge of water as per agreement.
40% of the rivers in
How to implement?
Agency for cooperation
Who:
Government;
Local;
Lawyers;
Researcher;
Engineer;
in China, India and Bangladesh
12


2018
2022
2026
2030
Flood
100% of river in the flood area should be protected with embankment.
100% of the tributaries should be constructed with check dam.
How to implement?
Emergency aid
Who:
Government
NGO
Local
Crisis task force
Contamination
100% of the cities should be equipped with WWTPs.
100% of the houses should be linked to draining system.
100% of the industrial companies should treat their sewage by itself.
How to implement?
Agency to collect hospitalizations and wastewater from industry
Who:
Government (money)
Locals and industry (cooperate)
NGO (surveyors)
Cooperation
60% of the river dams in China, India and Bangladesh should work well to regulate the discharge of water as per agreement.
50% of the rivers in
How to implement?
Fine violators with big company
Who:
Government (making regulation)
Representative
Researchers(advice)
13

SUSTAINABLE WATER MANAGEMENT IN LOCAL RIVER FOR 2030
JINZU RIVER (JAPAN)

Tonami Camp 2018

Group E: Kazuyoshi Koike, Kento Ishi, Chen Qian, Phraewploy Singhanart (F), Pich Yanghav, Li Yuqing (F), Li Xicheng (F)

Group E: Environmental

Target Jinzu River


Kento Ishi


Chen Qian


Kazuyoshi Koike


Li Yuqing


Phraewploy Singhanart


Pich Yanghav


Li Xicheng

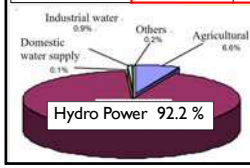
Content

Introduction

a. Outline of Jinzu River

	Item	Annual estimate ($x10^3$)	Rate (%)
By usage type	Sports	34.647	0.12
	Playing in the water	7.109	0.03
	Fishing	63.646	0.22
	Walking	177.49	0.63
	Total	283	
Another place to use	Surface of water	24.448	0.09
	Shoreline	46.307	0.16
	Flood channel	191.339	0.68
	Embankment	20.798	0.07
	Total	282.892	

Purpose	Water intake(m^3/s)	Case
Agricultural water	103.289	777
Hydro power	1441.452	58
Domestic water supply	1.853	4
Industrial water	13.972	21
Others	2.301	8
Total	1562.867	868



River Name	Jinzu River
Length	120km
Catchment Area	2,720km^2
Population in Basin	380,000

Problems

b. Problem of Jinzu River

71% of Use

23% of Use

- ❑ Fresh water species endangered
- ❑ The climate change make the Jinzu river high risk of flooding area
- ❑ People not concern the management of the river
- ❑ Lack of technologies to improve the method to manage water
- ❑ High precipitation
- ❑ High Watershed (Many Mountains)

5

Slogan and Targets

JINZU River

River For Generations

People  **Environment**

between

BFF

6

Slogan and Targets (suits)

Three Targets

Best management

- ➔Renewable energy use (23%→40%)

No Flooding

- ➔Solve flood problem

Environmental Friendly

- ➔Improve the environment in Toyama Prefecture and promote tourism development

7

Road Map

2018

2024

2030

No Flooding

- Protect riverside (Check the unprotected riverside for protection(18-22), and then regularly repair the riverside(22-30).))—— Japan government
- Dam maintenance (sludge /sand removal)(18-21)—— Hokuriku Electric Power Company

Environmental Friendly

- Wetland Park (decentralized treatment of rain water)(18-26)——TY government and company partnership
- Rain barrel (18-30)—— Resident
- River festival (mascot & advertisement)(26-30)——company or culture committee or NGO

Best management

- 23%-36% (Improve efficiency of electricity generation) (21-25)—— power plant companies
- 36%-39% (By encourage the industrial factories to use electricity at night & discourage day time use of electricity)(21-25)——TY government
- Build new hydro power plant to increase the use of hydro power and to place thermal powerplant (39%-40%)(25-30)——TY government and company partnership

8

Solutions for No Flooding

There are three dams for hydroelectric power generation on Jinzu River.
(Jinzu first dam, Jinzu second dam, Jinzu third dam)

There are three dams for flood control on Jinzu River drainage system.
(Muromaki dam, Kumanogawa dam, Kubusugawa dam)

Remove the sediment from bottom of these dams and do flood control with Jinzu first dam.

Advantage
The flood control capacity of the Jinzu River system increases.
Prevent deterioration of the water quality of the dam due to the winding up of the sludge.

Disadvantage
We can not generate electricity until the water level returns to its original level.

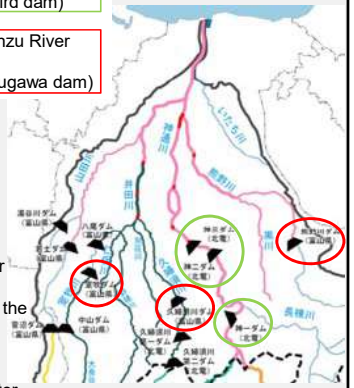


Fig. | Jinzu River watershed and dam
出典：神通川水系の流域及び河川の概要（案）

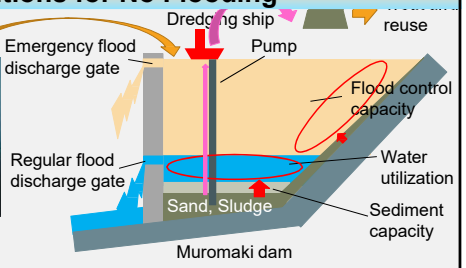
9

Solutions for No Flooding

Sustainable management

Dredging ability (m^3/h)	1,500
Applicable depth (m)	5 - 30

Fig. | Pump dredging ship
出典：日本社団法人 ポンプ浚渫船「第三東亜丸」



1,500[m^3/h] x 6[h] x 245[day] x A[year]
=2,829,000[m^3]
A ≒ 1.3

It takes 1.3 years to remove all the sediment.

Table | Specs of Muromaki dam

Dam	Muromaki
Manager	Toyama Prefecture
Catchment area(km^2)	85.2
Completion date(Year)	1961
Total water capacity ($x10^3$ m^3)	17,000
Sediment capacity ($x10^3$ m^3)	3,500
Sediment volume in 2015($x10^3$ m^3)	2,829

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Solutions for No Flooding

Flood damage by erosion of the river side

Rapid stream river countermeasure
- Reuse the treated sand and sludge as bank
- Protect river side

Restore the vegetation of the protected side

Recovery ecosystem, consideration for people's livelihood

Fig. | Erosion of the river side
出典：神通川・庄川で観測史上第２位の洪水

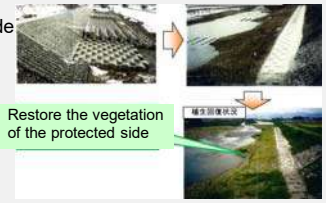

Fig. | Protection and recovery ecosystem
出典：神通川水系河川整備計画［大臣管理区間］（原案）

11

Increase Hydropower Energy Use

1. Improve electric generation efficiency

10~20 times up

Good points
✔ High efficiency
✔ High applicability

"2,000 × 10^6 kwh up"

2. Encourage the reduction of household electricity consumption

Household electricity consumption
4,400 kwh/household

How to reduce
➢ Frequently turn off main power
➢ Unplug the outlet
➢ Use auto-off and display-off functions

220 → 110 kwh/household (50% ↓)

400,000 household in Toyama

"50 × 10^6 kwh cut"

Data source: General Foundation Energy Conservation Center "Survey Report on Standby Power Consumption in 2012"

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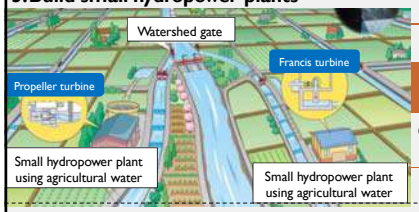
Increase Hydropower Energy Use

3. Build small hydropower plants



	Now	Target
Plant number	26	50
Generation amount	65×10^6 kwh	125×10^6 kwh

"60×10^6 kwh up"

Expectations

Electric usage in Toyama is $13{,}000 \times 10^6$ kwh/year → $3{,}200 \times 10^6$ (23%) by hydropower

	Amount (kwh)	Ratio (%)		Year
	Goal	Start	Goal	Goal
Improve efficiency	$2{,}000 \times 10^6$ ↑	23	36	2021
Encourage reduction	50×10^6 ↓	36	39	2025
Build plants	125×10^6 ↑	39	40	2029

"We can achieve 40% from renewable resource"

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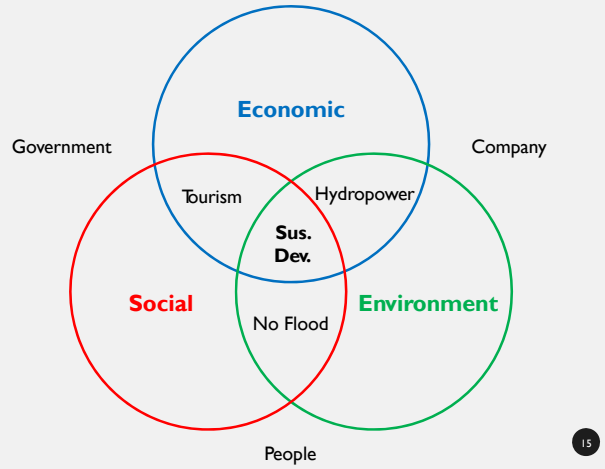
Ecofriendly—solutions to increasing tourism income

Engineering/Policies	Present	Goal (year 2030)
• River festival/Carnival -Mascot -Advertising videos -Night market	No	Celebrate annually and will attract 200,000 tourists

Schematic Integrations



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Conclusion

- ✔ We found mainly three improvements(Flooding, Less attractively, Non-renewable resource) in Jinzu river.
- ✔ We made road map along the "River For Generations", then integrated actions and stakeholder.
- ✔ We examined possibility of solutions(Dam improvement, Wetland Construction, Hydropower increase etc.).

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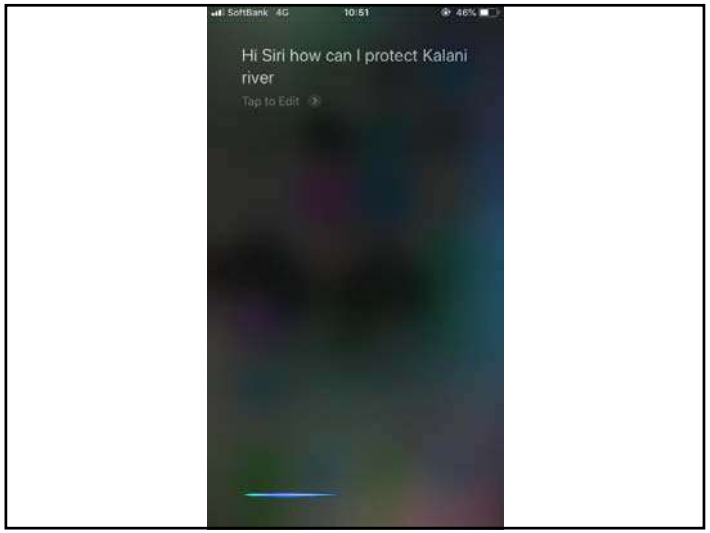
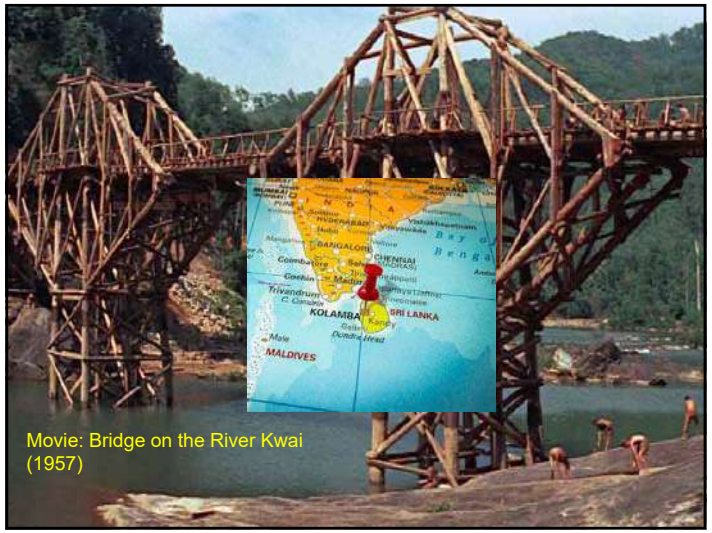




"Hey Siri!"

Study Camp on Environment Technology

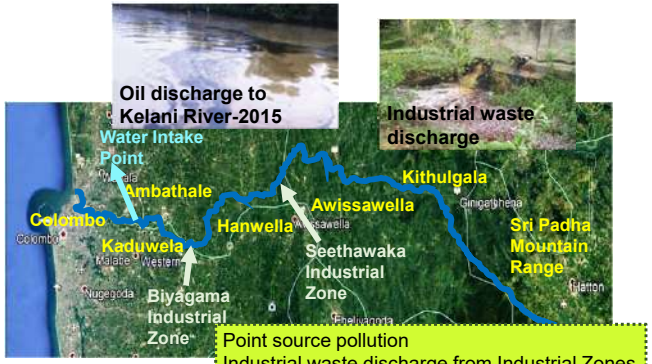
TONAMI CAMP 2018

Kelani River, Sri Lanka

Group members:
Som Kanhchany
Rintaro Sakuda
Liu Yajiao
Wu Xiner
Tao Jiliang
Mo Xiaohan
Himaya Sandamini

Introduction

Current problems

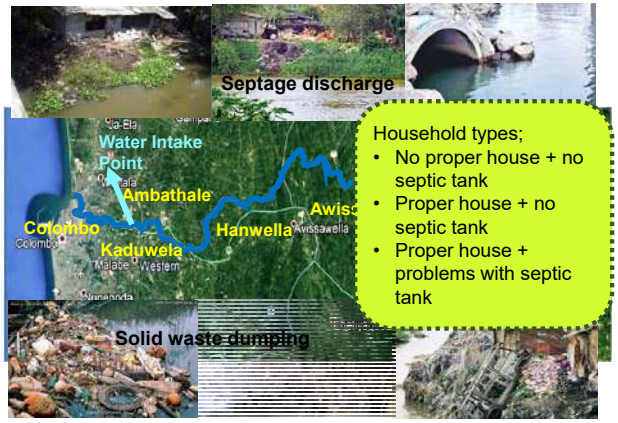


Point source pollution
Industrial waste discharge from Industrial Zones
- Chemical dyes
- Oil
- Hot water`

Current problems cont.

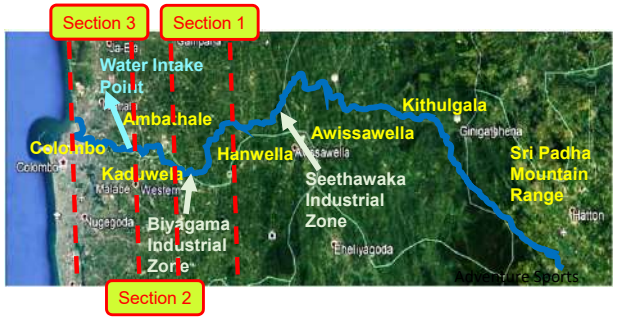
Severe flood with SW monsoon
Illegal sand mining
Threats to aquatic lives

Current problems cont.



Household types;
- No proper house + no septic tank
- Proper house + no septic tank
- Proper house + problems with septic tank

Current problems cont.



To implement strategies
- Section 1: Hanwella-Kaduwela
- Section 2: Kaduwela-Ambathale
- Section 3: Ambathale-Colombo

Slog

Section3 Section1

Section2

Targets

I. Elimi

II. Contr

III. Susta

Milestones

milestone1
- Investigate current situation
- Establish policies

milestone3
- Complete construction in Section 3
- Water quality: 80% pollutant is decreased
- Water quantity: the river level rise 30%

2018 2020 2024 2028 2030

Current problem

milestone2
- Complete construction in industrial zones and Section 2
- Water quality: 30% pollutant is decreased
- Water quantity: the river level rise 20%

milestone4
- Complete construction in Section1
- Water quality: 100% pollutant is decreased
- Water quantity: the river level rise 40%

Milestone 2

2018 2020 2024 2028 2030

Complete construction in **Section2**.
Water quality: **30% pollutant** is decreased.
Water quantity: the river level rises **20%**.

Gov&Res

Design and build waste water treatment plant and sewer network.
Determine the monitoring methods, and work out the payment scheme according to the pollutant load.

Gov&Res&Fac

Design and construct housing schemes for unauthorized household (Type1).
Build sewer network and WWTP in the area between water intake and Kaduwela (Type2 & Section2).
Check the tank of household every 5 years and repair if necessary (Type3).
Solid waste collection and transportation system: build facility, employ staff and trucks, place bins(Section2)

Milestone 1

2018 2020 2024 2028 2030

Investigate the **current situation**.
Establish policies.

Gov&Res&Cit&Fac

Appoint the Kelani River Management Committee.

Res&Fac

Sampling and analyzing. Identify the pollutant, the quantity and the pollution source.

Gov&Res&Fac

Obtain the census of each type of householder.
Solid Waste Separation: food waste, paper, glass, plastic, metal, electronic waste, and others.
Categorize factories based on pollutant types and load, then warn the bad factories (according to Water quality standards for effluent / river)

Gov&Res

Investigate the quantity of water usage
Monitoring system for WWTP/river/ leakage/solid waste/ sand mining

Milestone 2

2018 2020 2024 2028 2030

Complete construction in **Section2**.
Water quality: **30% pollutant** is decreased.
Water quantity: the river level rises **20%**.

Gov&Res

Establish **a rainwater harvest** system for houses.

Build **permeable pavement.**

Improve the existing **salinity barrier**.

Set Env. Subject since primary school.

Workshops, **training** & **poster** about environmental protection

Milestone 3

2018 2020 2024 2028 2030

- Complete construction in **Section3**.
- Water quality: **80% pollutant** is decreased.
- Water quantity: the river level rises **30%**.

Gov&Res

Monitoring the water quality of treatment plant.

Shut down the factories whose effluent doesn't reach the standard.

Gov&Res&Fac

Build sewer network and WWTP in the area between water intake and Colombo (Household Type1&2+Section3)

Gov&Fac

Solid Waste Collection and transportation for solid waste in the area between water intake and Colombo (Section3)

Milestone 4

2018 2020 2024 2028 2030

- Complete construction in **Section1**.
- Water quality: **100% pollutant** is decreased.
- Water quantity: the river level rises **40%**.

Gov&Res&Fac

Build sewer network and WWTP in the area between Kaduwela and Hawella (Household Type2+Section1)

Gov&Fac

Solid Waste Collection and transportation for solid waste in the area between Kaduwela and Hawella (Section1)

Gov&Res

Establish **a rainwater harvest** system for houses

Workshops, **training** & **poster** about environmental protection.

Recreate **areas/parks** and protect **wetland** along the river.

Milestone 3

Gov&Res

Establish **a rainwater harvest** system for houses.

Workshops, **training** & **poster** about environmental protection.

Recreate **areas/parks** and protect **wetland** along the river.