



Nature-Based Solutions (NbS) through Multi-Stakeholder Collaboration: Case Studies from the Inbanuma Watershed

Jun Nishihiro

**Climate Change Adaptation Center,
National Institute for Environmental Studies, Japan**



National
Institute for
Environmental
Studies, Japan



Cross-ministerial
Strategic Innovation
Promotion Program



AP-PLAT
Asia-Pacific Climate Change Adaptation Information Platform



JBON
日本生物多様性観測ネットワーク
Japan Biodiversity Observation Network

Nature-based Solutions (NbS)

Definition of NbS

"Actions to **protect**, sustainably **manage**, and **restore** natural or modified **ecosystems** that **address societal challenges effectively and adaptively**, simultaneously providing human well-being and biodiversity benefits." (IUCN 2020)

Key Characteristics

- **Co-benefits:** Enhances biodiversity, improves well-being, and strengthens resilience simultaneously.
- **Cost-effective and sustainable:** Often lower-cost and more adaptive than hard infrastructure.
- **Community-based:** Requires involvement of local communities and stakeholders in planning and management.
- **Knowledge-intensive:** Relies on ecological science, monitoring, and adaptive management.

Cohen-Shacham et al. (2016). *Nature-based Solutions to Address Global Societal Challenges*. IUCN.



by IUCN

What is Eco-DRR

Ecosystem-based Disaster Risk Reduction (Eco-DRR)

→ Using nature to mitigate disaster risks.

- Utilizes natural ecosystems to enhance disaster resilience.
- Reduces risks while providing environmental and socio-economic benefits.
- Examples of Eco-DRR in action:
 - 🌿 **Mangroves** for coastal protection
 - 🌲 **Forests** for slope stabilization
 - 🌿 **Wetlands** for flood regulation



by Ministry of Environment, Japan



National
Institute for
Environmental
Studies, Japan

What is EbA?

EbA (Ecosystem-based Adaptation)

→ Using biodiversity and ecosystem services to help people adapt to climate change.

- **Enhances climate resilience** by leveraging natural ecosystems.
- **Reduces vulnerability** to climate-related hazards.
- **Supports biodiversity conservation** while benefiting human communities.
- **Integrates natural solutions into climate policies and planning.**

Examples of EbA in Action:



Mangroves & wetlands for coastal protection from rising sea levels.



Agroforestry & soil restoration for drought resilience in agriculture.



Forest conservation for regulating water cycles and preventing landslides.



by Ministry of Environment Japan

NbS

EbA

Measures that utilize nature to address the issues posed by climate change (other than disaster)

e.g. green space in urban areas

Measures that utilize nature to deal with disasters that are becoming more serious due to climate change

e.g. restoration of forest to prevent land slides

Eco-DRR

Measures that use nature to manage disasters, independent of climate change.

e.g. restoration of mangrove against tsunami

NbS (or Green Infrastructure) bridge environmental sustainability with human resilience.

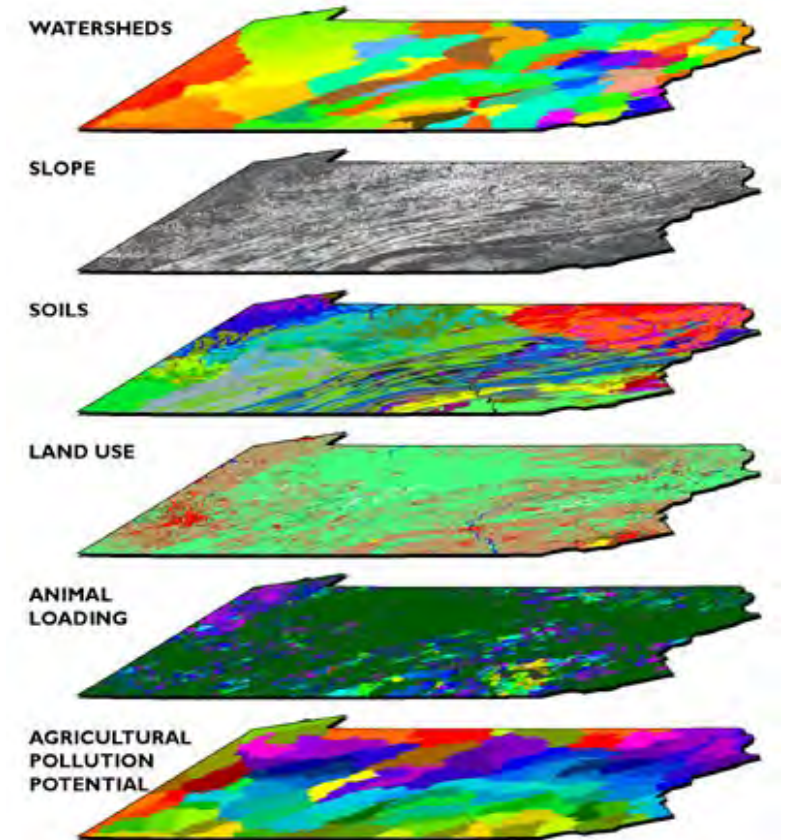
Importannnce of the Landscape Approach

Landscape Approach

- Designing in an appropriate spatial scale
- Consideration of geological, ecological, and social aspects
- Implementation of measures suitable to the local characteristics

Emphasizing on the Landscape Approach

- CBD The Kunming-Montreal GBF
- UN FCCC Paris Agreement
- TNFD “Collective action at the landscape scale” “Landscape engagement”



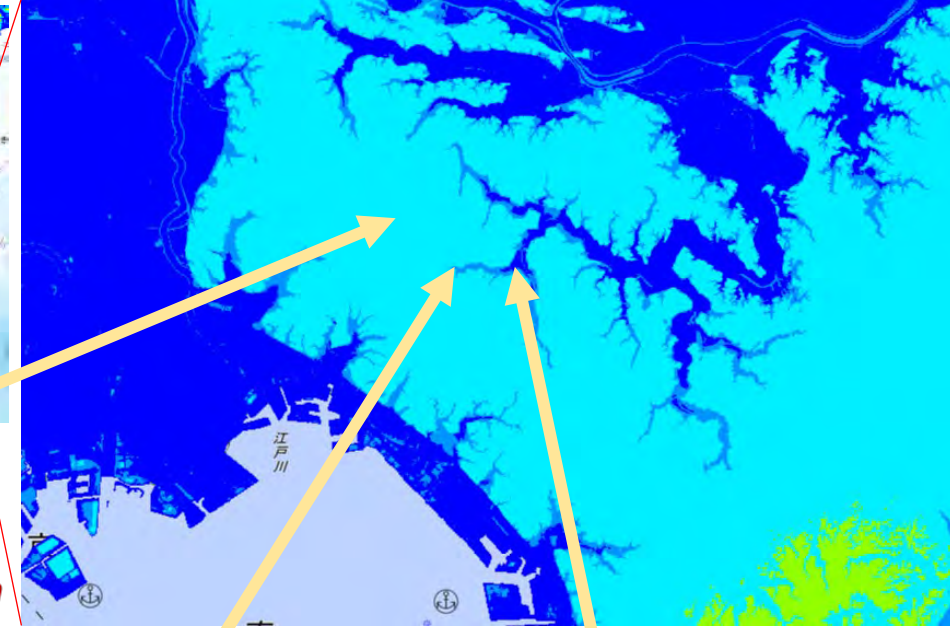
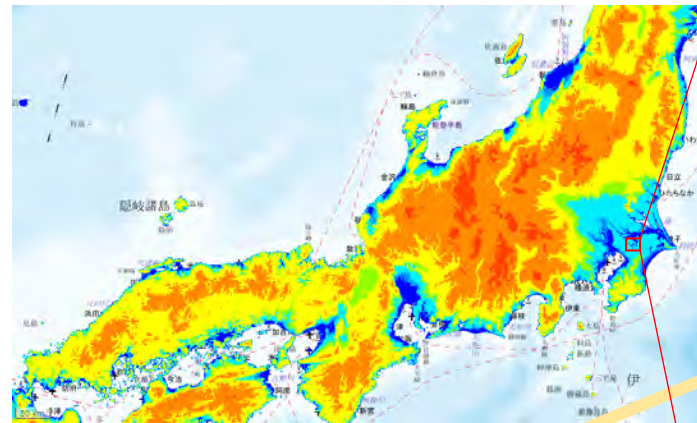
<https://www.e-education.psu.edu/natureofgeoinfo/book/export/html/1771>

Lake Imba Watershed; Topography and Water Cycle



Lake Imba

- Lake area: 9.43 km²
- Eutrophic shallow lake
- Catchment area: 541 km²
- 760 thousands people



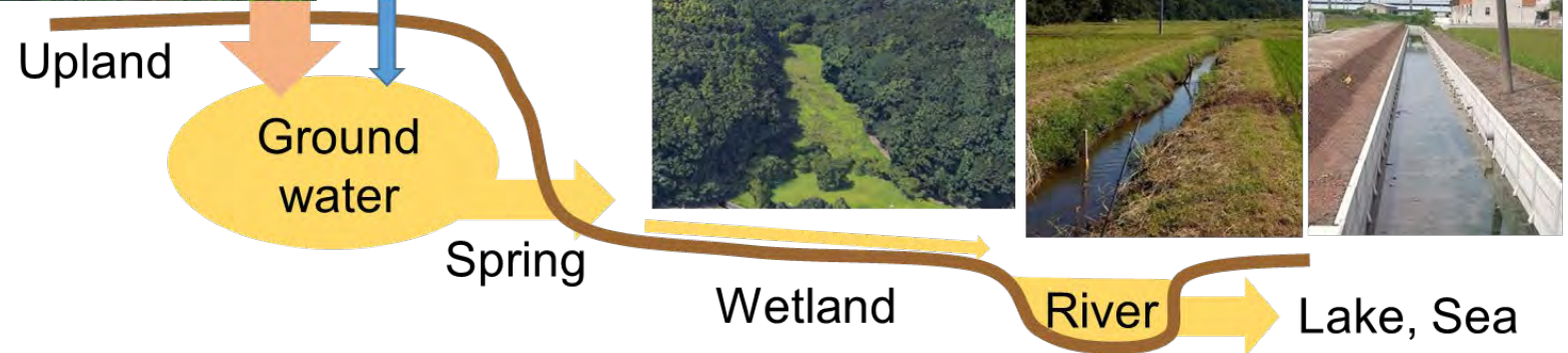
*Increment of
nutrient loading*



*Decrement of
water infiltration*



*Installation of
drainage channels*



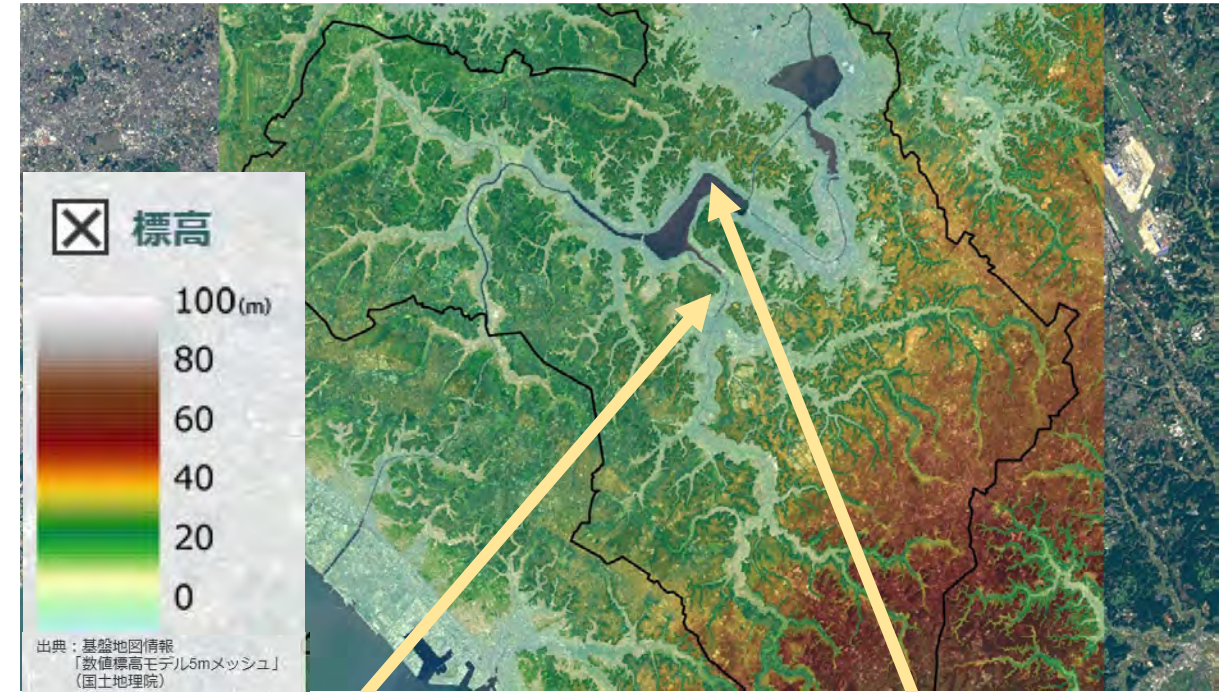
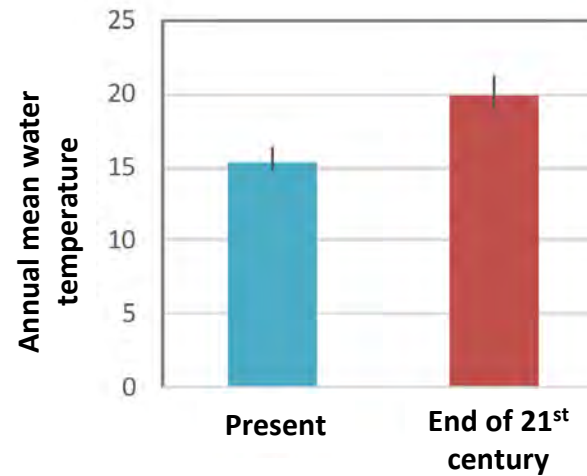
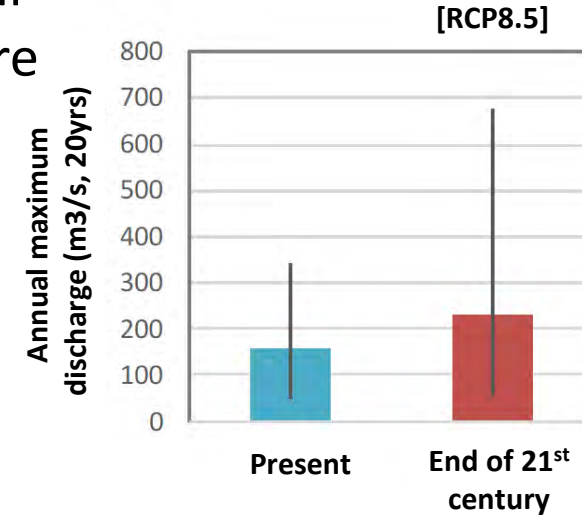
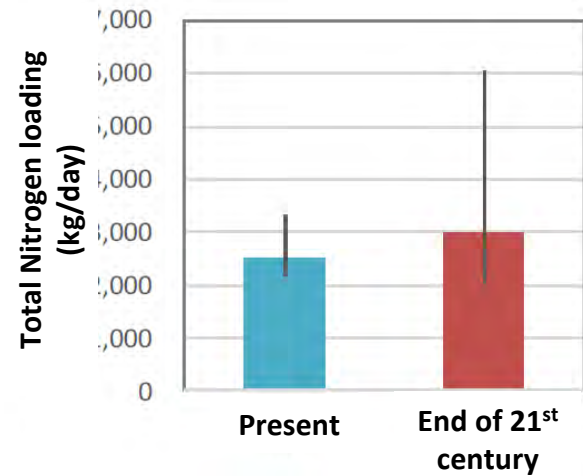
Lake Imba Watershed; Climate Risks

Climate Change

- Increase in heavy rainfall
- Rising water temperature

Risks

- Flooding
- Harmful algae bloom
- Biodiversity loss



Strategy for NbS in the Lake Imba watershed

Watershed scale; Watershed Committee

(based on the Basic Law on the Water Cycle)

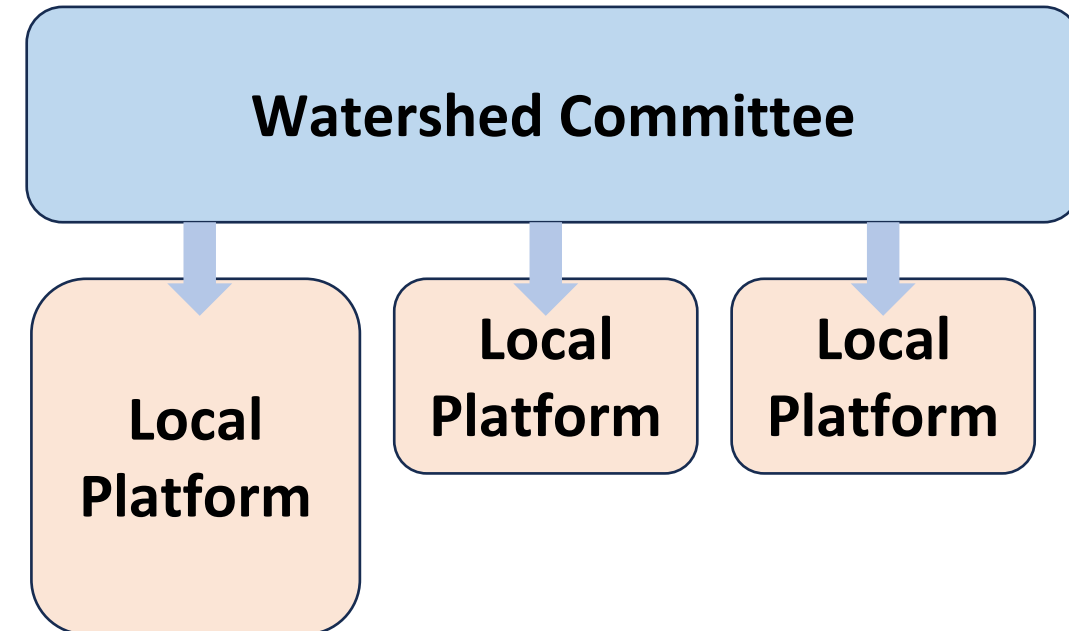
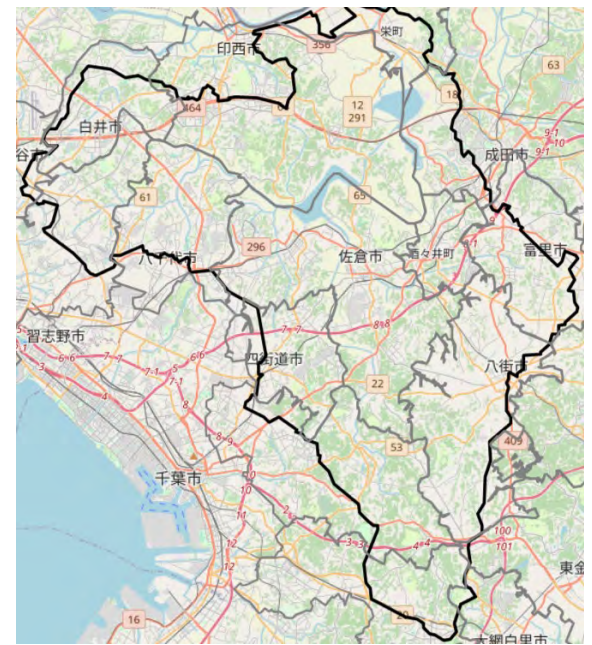
- Conducting the research on ecosystem functioning and sharing the scientific knowledge.
- Setting “Direction” of management
- Providing “**Effective Options**” and “**Maps**”.

Municipal scale; Local Platform

(governed by municipality or voluntary organization)

- Setting “**Local Goal & Role of each Stakeholder**”.
- Implementation of the effective options by collaboration with local government, private companies, and NGOs.

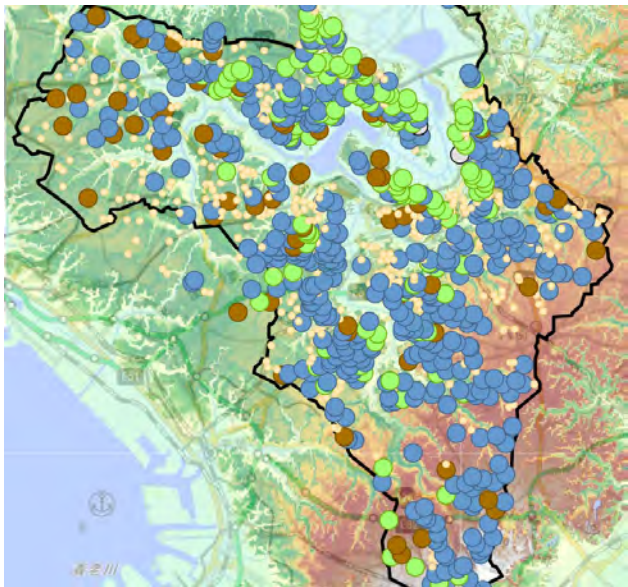
The watershed includes **thirteen** municipalities



Flood Control Function of Small Valleys

Research on the ecosystem functions

Distribution of Small valleys
(1st order channel)

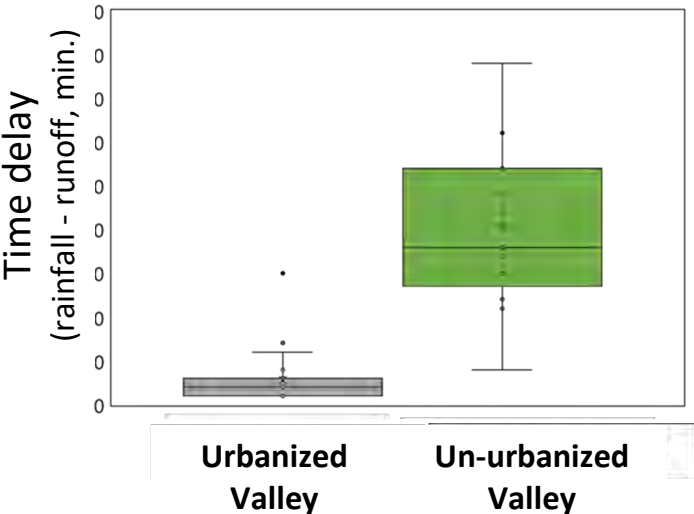
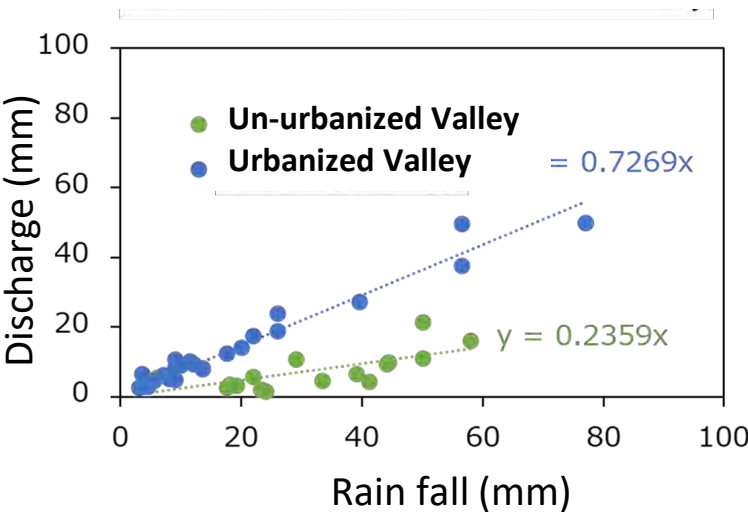


Un-urbanized Valley



Urbanized Valley

Runoff control Function



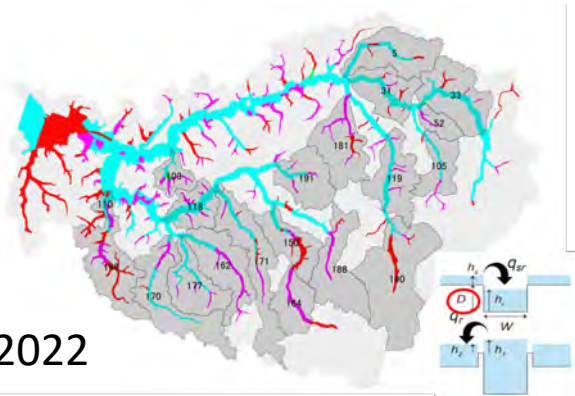
Effective options

1. Conserving the natural valley
2. Blocking the artificial drainage and restoring wetlands



Map

Distribution of the effective sites



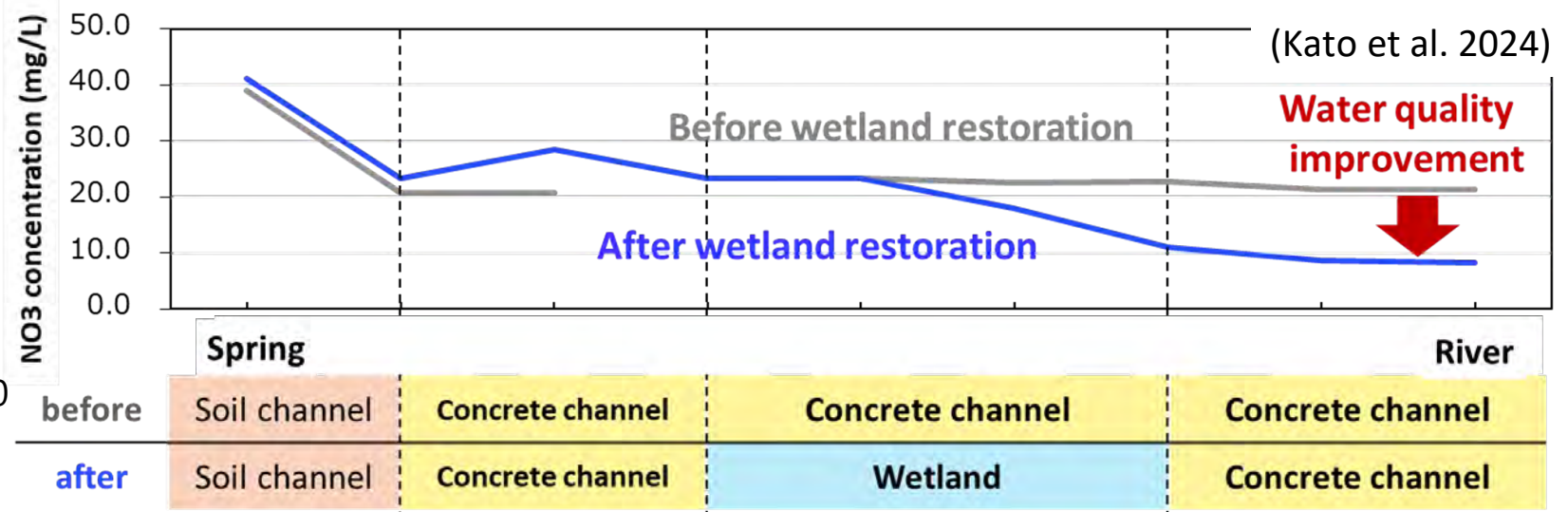
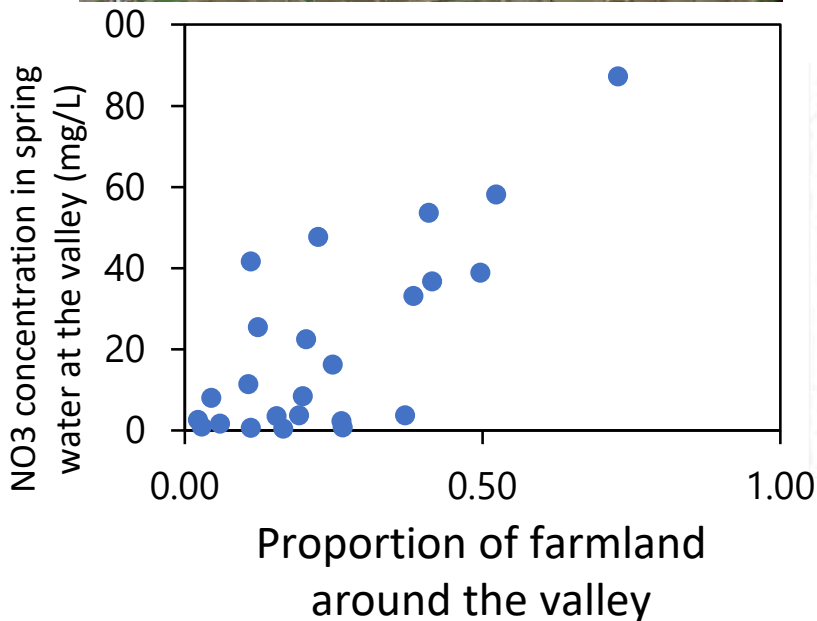
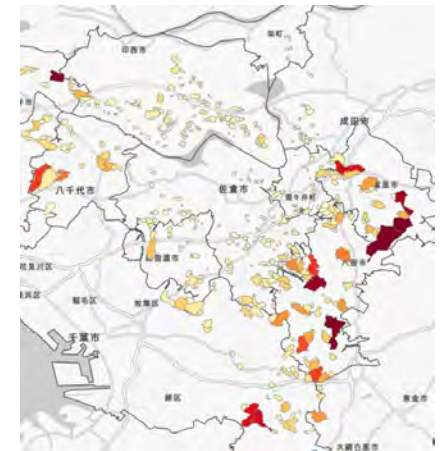
Nutrient Removal Functions of Wetlands

Research on the ecosystem functions

Farmland on upland is the main source of nutrients

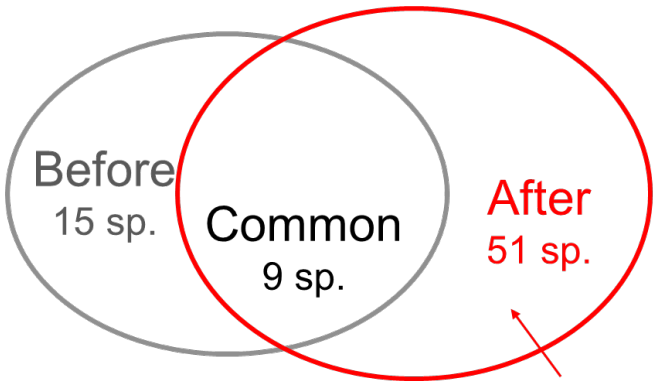
Water quality improvement through wetland restoration in valley bottoms (**Options**)

Distribution of farmlands (**Map**)



Biodiversity Conservation

Biodiversity recovery after wetland restoration



(Kato et al. 2024)

Six Red-list species were included

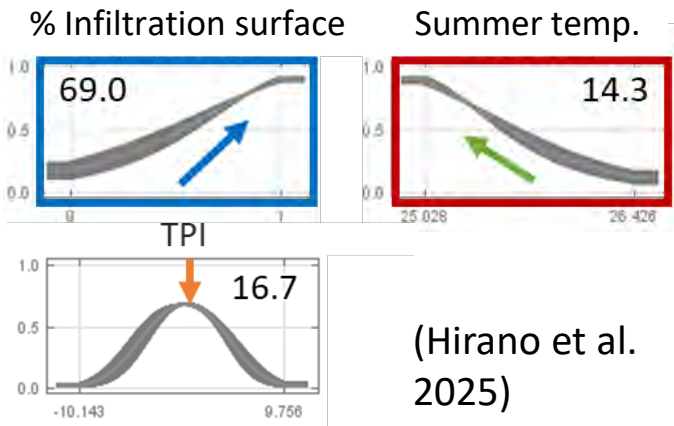
Ludwigia epilobioides, *Limnophila chinensis*, *Chara braunii*,
Nitella axilliformis, *N. megacarpa*, *Ricciocarpus natans*

Conservation of Endangered species

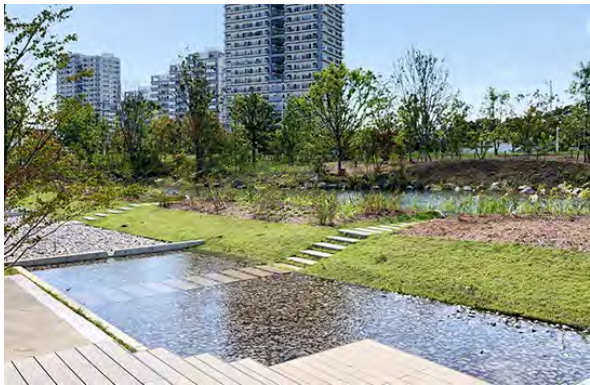


Lefua echigonia,
Spring dependent species

Habitat characteristics



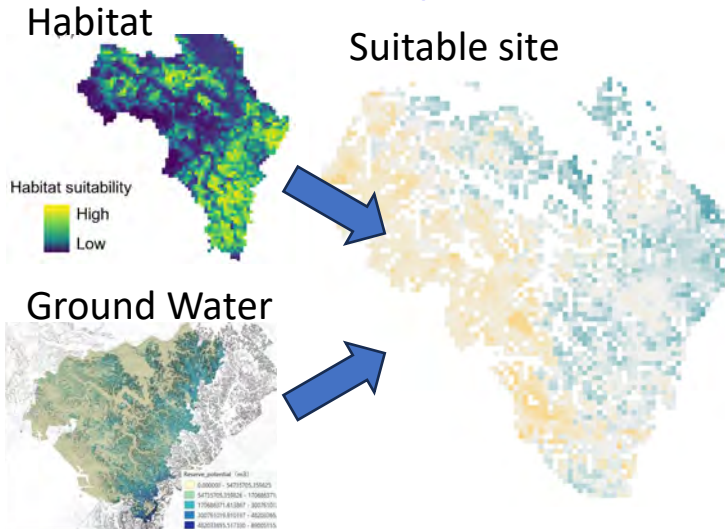
Effective option



<https://www.takenaka.co.jp/rd/nature-positive/shirabe/>

Improvement of
rainwater infiltration

Suitable site map



(Hirano et al.
unpublished)

Implementation at the Local Scale

Collaborative Ecosystem Management

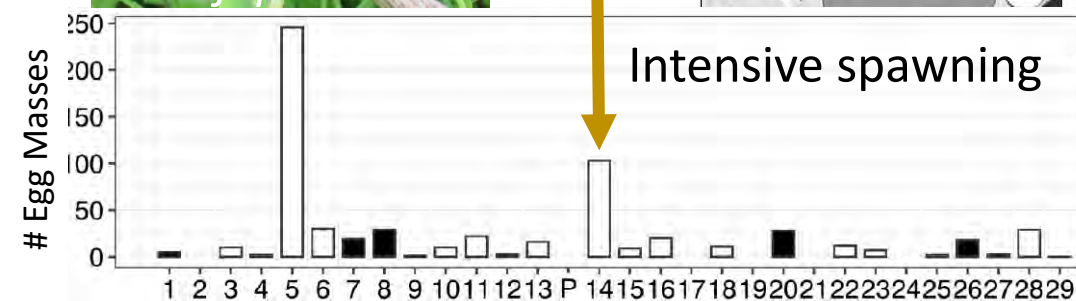
Private companies & Local NGOs & Local Government



Shimizu Corporation
(Construction)



MS&AD Insurance
Holdings Group

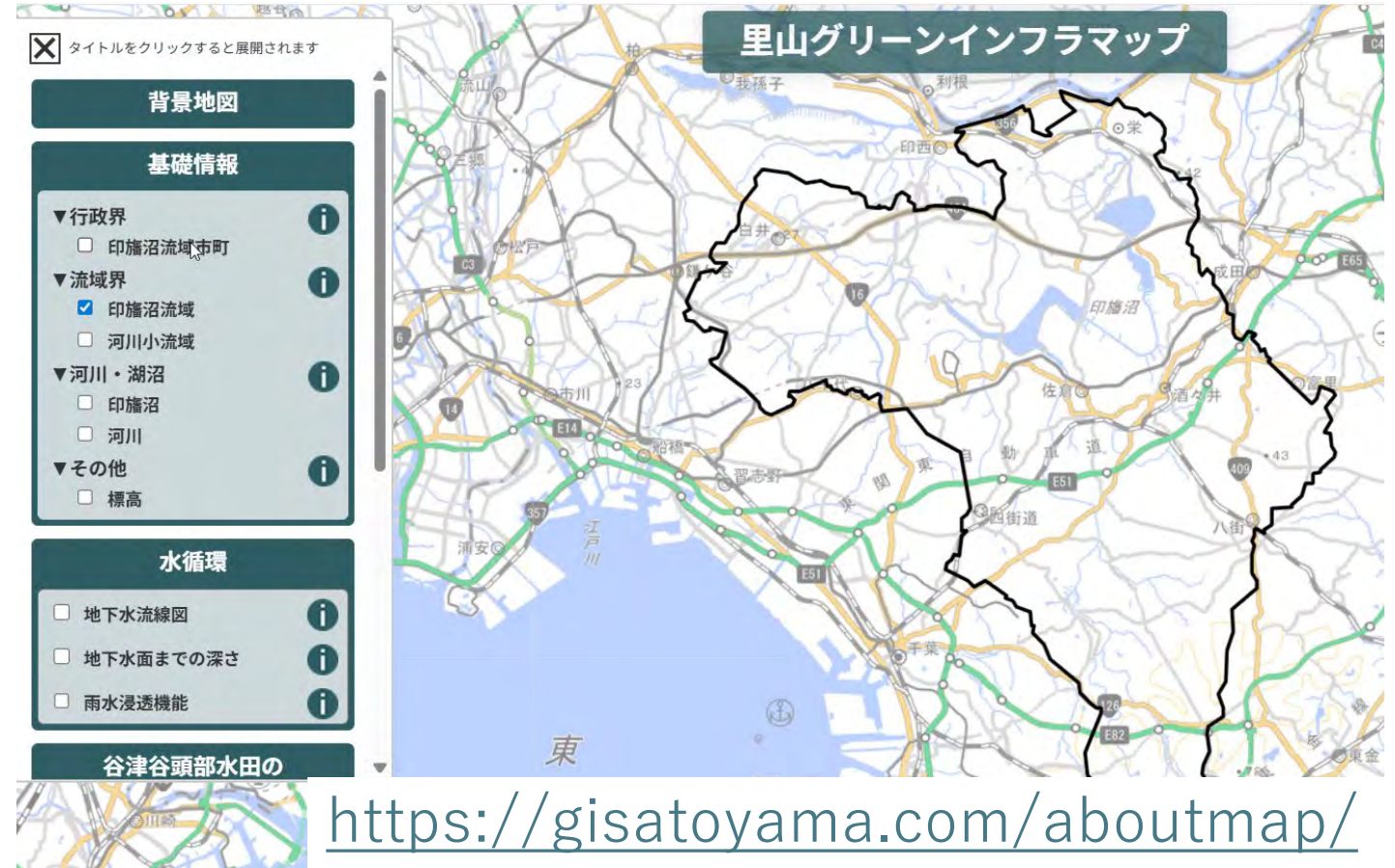
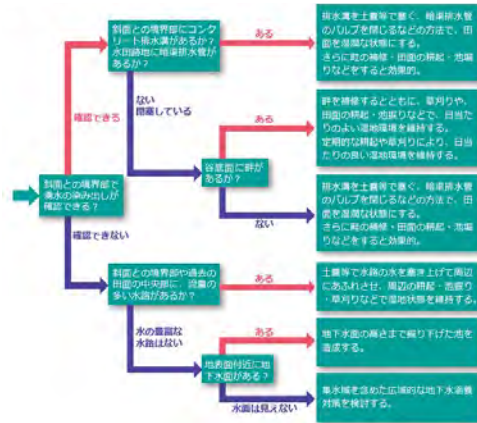


(Matsushima et al. 2023)

Sharing the Watershed-scale Information

Sharing scientific information and current issues

- Publication of web GIS and leaflets
- “Satoyama Green-Infra Network”
~250 people are belonging.
- Study meetings with government officials.
- Site visits with company persons.



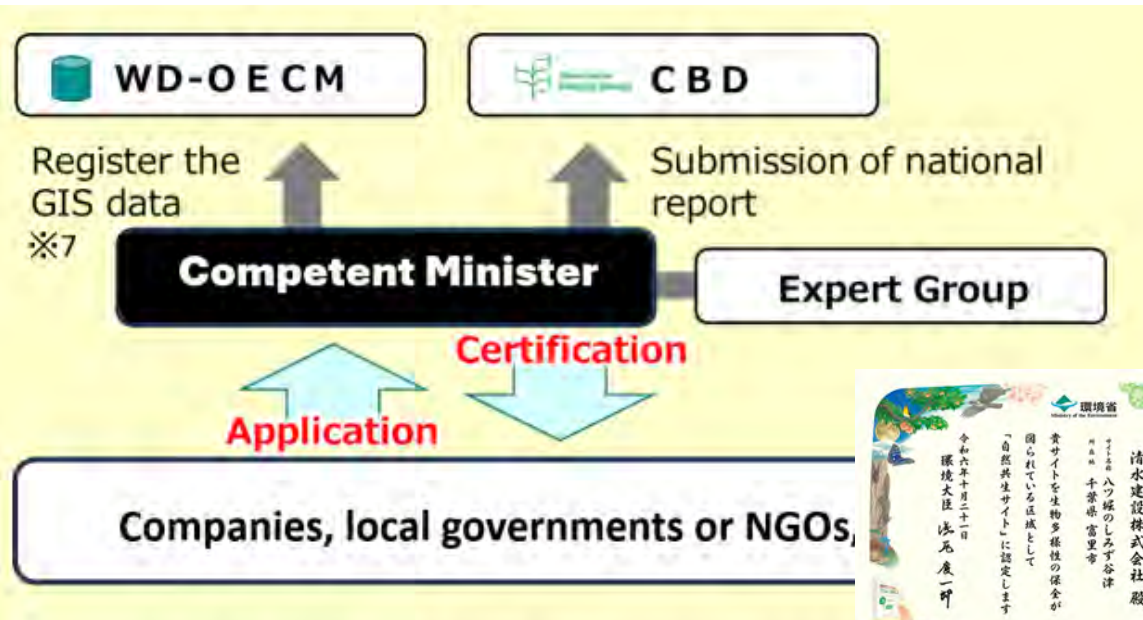
Incentives for the Collaborative Practices

National system of 'Certified Sustainably Managed Natural Sites (自然共生サイト)'

-> Selection of OECD toward GBF 30by30 goal

City-specific incentives

Ex. (*Tomisato-city*) Financial support for cutting down of and biochar production from excess bamboos.

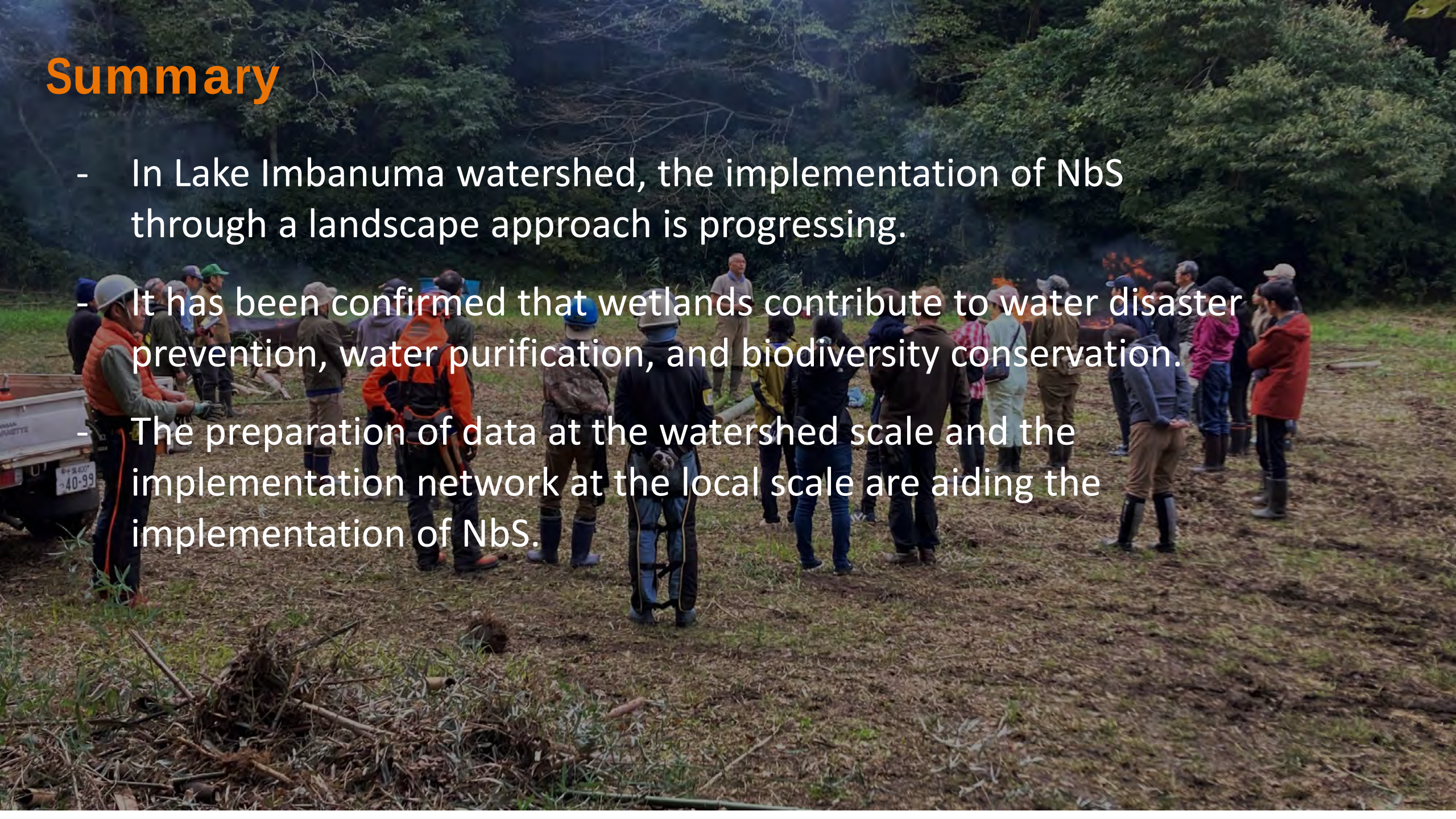


30by30; the global commitment to conserve or protect at least 30% of the Earth's land and ocean areas by the year 2030 (GBF, CBD).

OECD; Other Effective Area-based Conservation Measures. It refers to geographically defined areas, outside of traditional protected areas, that are managed in ways that achieve positive and sustained long-term outcomes for the conservation of biodiversity.

Summary

- In Lake Imbanuma watershed, the implementation of NbS through a landscape approach is progressing.
- It has been confirmed that wetlands contribute to water disaster prevention, water purification, and biodiversity conservation.
- The preparation of data at the watershed scale and the implementation network at the local scale are aiding the implementation of NbS.





Acknowledgement

I would like to thank all my collaborators, laboratory members at NIES and UT, as well as citizens, NGOs, business people, and government officials working in the field.

This research was partially supported by the Environment Research and Technology Development Fund (JPMEERF20232002) by ERCA of Japan and Cross-ministerial Strategic Innovation Promotion Program (SIP JPJ012187) of CSTI.