



Built Environment
leArning for Climate
AdaptatiON



An integrated approach to improve urban resilience and climate actions via adopting nature-inspired solutions (NIS) with community-based observing networks (CBON)

Lessons learnt from urban planning approaches in Japan

CORE project (science & human factor for resilient society in Europe)

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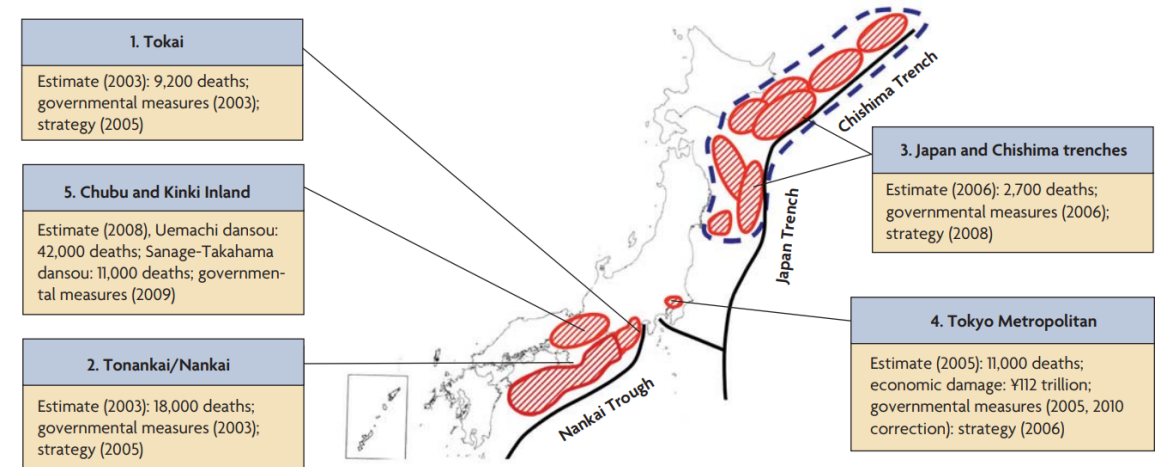


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Introduction

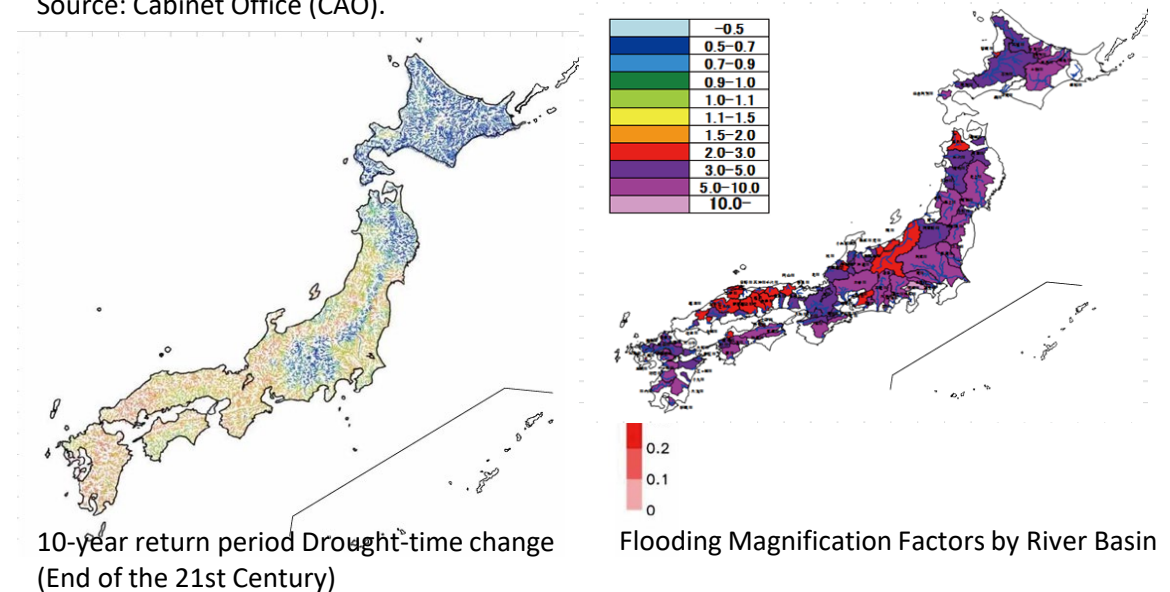
- Japan is a country that deals with natural hazards and is considered to be one of the most vulnerable nations in the world (INFORM Global Risk Index, 2019).
- Japan effectively combats natural hazards and climate change by merging traditional cultural knowledge with modern technologies.
- Japan blends indigenous knowledge with environmental studies for sustainability and resilience, prioritizing community involvement.
 - Ex: The incorporation of CBON, an indigenous scientific approach to monitor environmental changes with NIS such as slime mould behaviour patterns to produce multi-objective urban planning strategies.
- The CORE (Science and Human Factor for Resilient Society) project funded by the Horizon 2020 program investigates the state of the art within such complex characteristics, to develop a harmonized resilience approach for strengthening the multi-hazard risk management capacities of Europe countries.

World_Bank. (2014). *Learning from Megadisasters: Lessons from the Great East Japan Earthquake* (Ranghieri, Federica, Mikio Ishiwatari, & eds., Eds.). World Bank. <https://doi.org/10.1596/978-1-4648-0153-2>



Five mega- earthquakes used as basis for risk assessment

Source: Cabinet Office (CAO).



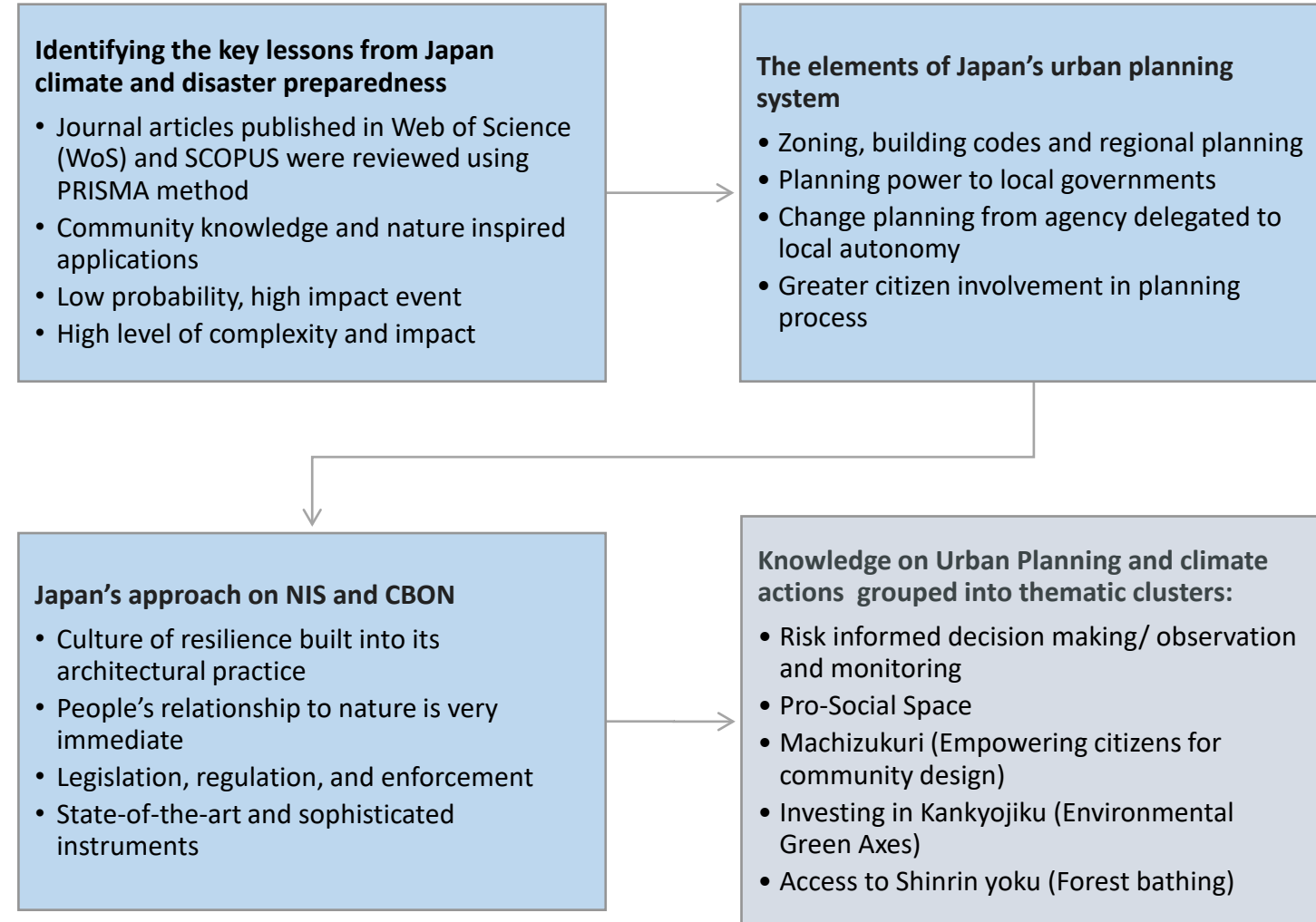
A photograph of a bamboo forest path. The path is paved and leads through a dense forest of tall, green bamboo stalks. A person is walking away from the camera in the distance. The lighting is bright, suggesting a sunny day. The path is bordered by a low wall made of bamboo and dried grass.

Objectives

- **This research aims to highlight Japan's best practices of CBON and NIS in developing multi-objective urban planning solutions, which provide a promising way forward for climate action.**
- Showcasing Success: Highlight Japan's best practices of CBON and NIS in urban planning for climate action.
- Learning from Japan: Extract valuable insights from Japan's experience for global application.
- Advancing Climate Action: Promote CBON and NIS as solutions for sustainable urban development.

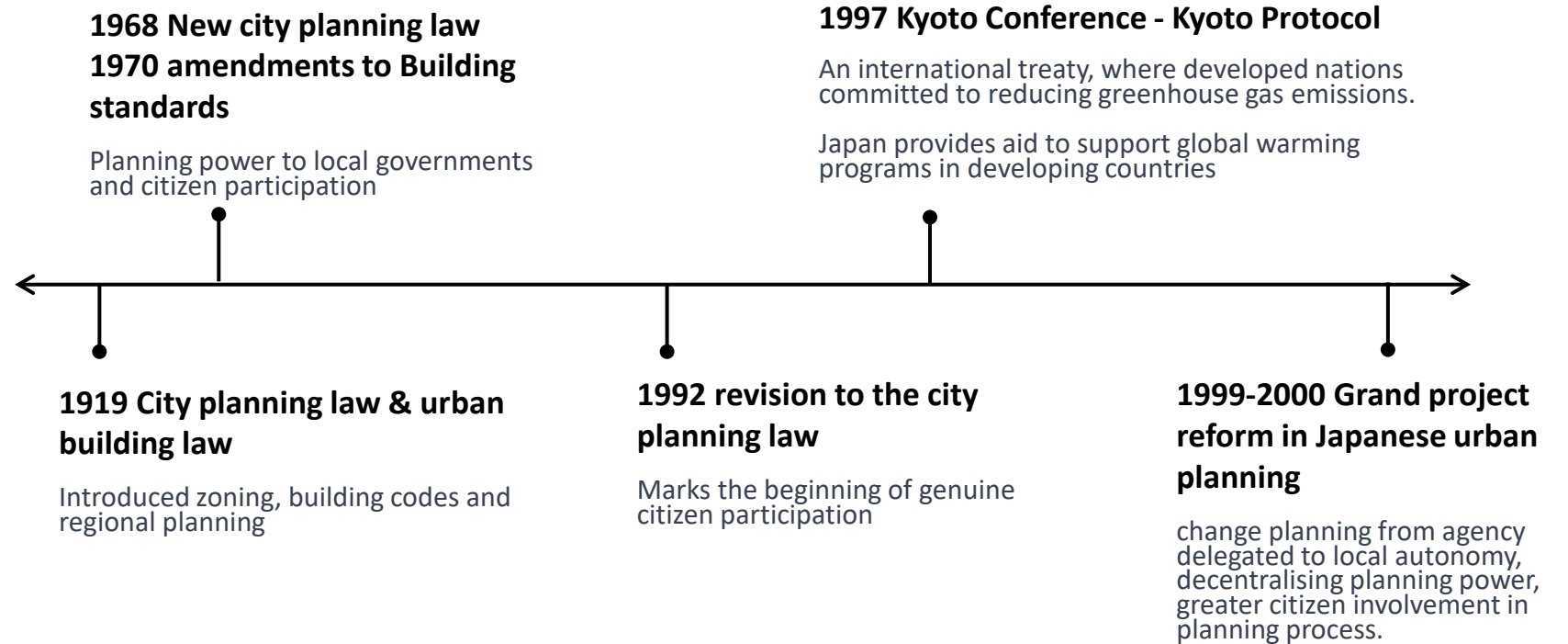
Methodology

- This research explores the CBON approach which generates comprehensive data on environmental variables and successful applications of NIS in Japan's urban planning problems via reviewing published sources.
- Review of published sources to explore the CBON approach and successful applications of NIS in Japan's urban planning.
- Analysis of data on environmental variables and the impact of ecological and anthropogenic activities.
- Study is carried out as part of the CORE project case study on 2011 Great East Japan Earthquake and Tsunami.



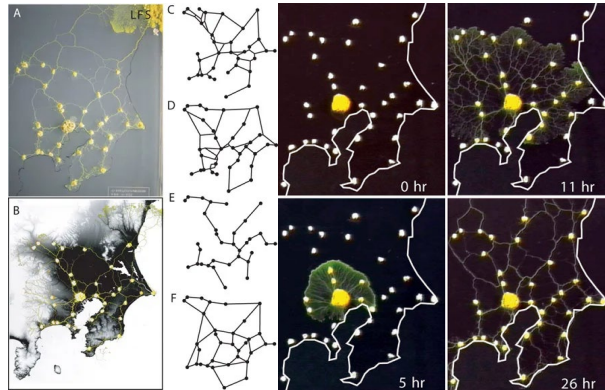
The elements of Japan's urban planning system

The Japanese culture since the Edo period embraced sustainability, with a mindset of "Mottainai," valuing the efficient use of environmental resources.



Source: Sorensen (2002), Watanabe (2004), Shibata (2002)

Japan's Best Practices of NIS for Climate Actions and Urban Planning



"Slime Mold: Nature-Inspired Rail Network Design"

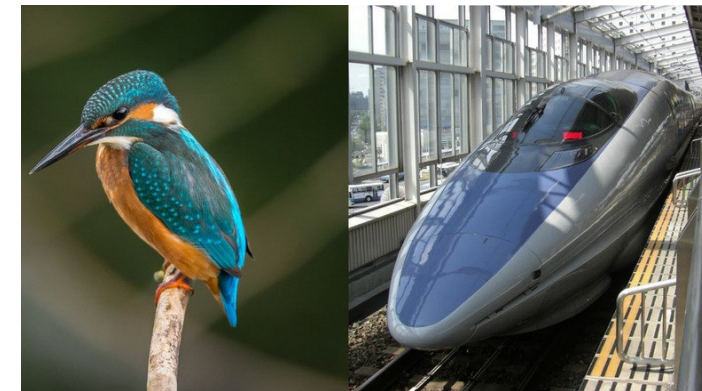
- Single-celled slime molds create nutrient-channeling tubes resembling the Japanese rail system when given oat flakes arranged as Tokyo's city pattern.
- Researchers from Japan and England found this striking similarity, as reported in *Science*.
- The slime mold's behavior offers a model for designing efficient and adaptable networks.
- Potential implications for improving transportation network design inspired by nature.

Ito, M., Okamoto, R., & Takamatsu, A. (2011). Characterization of Adaptation by Morphology in a Planar Biological Network of Plasmodial Slime Mold. *Journal of the Physical Society of Japan*, 80(7), 074801. <https://doi.org/10.1143/JPSJ.80.074801>

"Kingfisher-Inspired Train Design: Eliminating Tunnel Booms with Nature's Inspiration"

- The kingfisher, known for its remarkable diving abilities, served as inspiration for the design of the front of the train.
- The bird's beak, gradually increasing in diameter from tip to back, allows it to dive into water with minimal splash.
- By incorporating a design similar to the kingfisher's beak on the train, the issue of tunnel booms was successfully eliminated.

Penick, C. A., Cope, G., Morankar, S., Mistry, Y., Grishin, A., Chawla, N., & Bhate, D. (2022). The Comparative Approach to Bio-Inspired Design: Integrating Biodiversity and Biologists into the Design Process. *Integrative and Comparative Biology*, 62(5), 1153-1163.



Climate Change Adaptation in the Coastal Built Environment



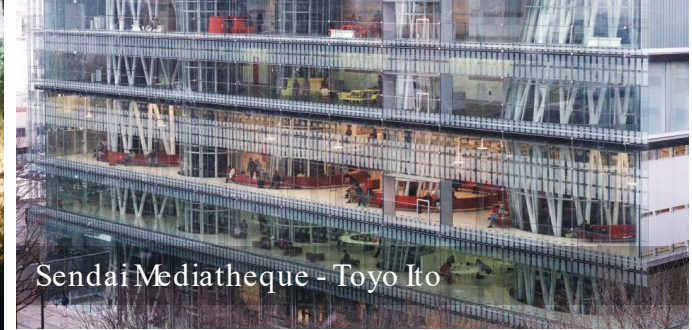
Tanada rice terraces in Takayama



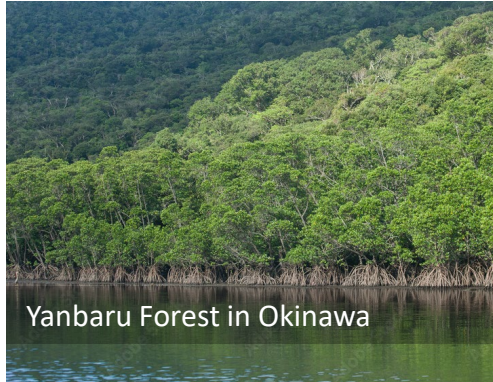
Kankyojiku (Environmental Green Axes)



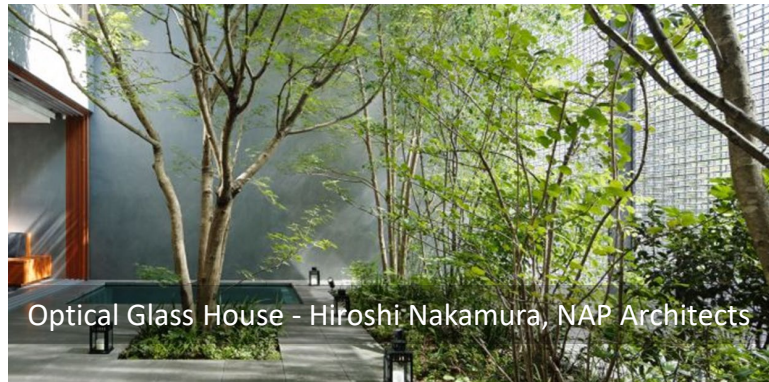
Shinrin yoku (Forest bathing)



Sendai Mediatheque - Toyo Ito



Yanbaru Forest in Okinawa



Optical Glass House - Hiroshi Nakamura, NAP Architects



Mille Arbres - Sou Fujimoto, Manal Rachdi Oxo Architects (Paris)



House before House - Sou Fujimoto



Tsunami Stone Forest in Aneyoshi, Iwate Prefecture



Polytechnique University - Sou Fujimoto (Paris)



White Tree - Sou Fujimoto (Montpellier)



Moriyama House - Ryue Nishizawa



Japan's Best Practices of CBON for Climate Actions and Urban Planning

CBONs as Community Connectors:

- CBONs serve as a vital link between communities and critical changes related to climate and disaster risks, providing real-time monitoring and appropriate warnings at the local level.

Foundation for Understanding Climate Change:

- Observation and monitoring form the basis for comprehending climate change and its impacts, enabling effective adaptation strategies. Accurate projections rely on high-quality observation and monitoring data.

Earth Observation Promotion Strategy:

- Japan has prioritized the elucidation of global warming phenomena, impact projections, and mitigation and adaptation measures under the Earth Observation Promotion Strategy. This strategy involves collaboration among government ministries, agencies, and various observation methods.

Diverse Observation Approaches:

- Japan employs a range of observation techniques, including terrestrial fixed-point observation, ecosystem observation (from alpine to coastal areas), ocean and polar region observation (e.g., ships and Argo floats), aircraft observation, CBONs, and satellite observation using remote sensing.

Risk Knowledge	Monitoring and Warning Service	Dissemination and Communication	Response Capability
<p><i>Systematically collect data and undertake risk assessment</i></p> <ul style="list-style-type: none"> • Awareness on hazards and vulnerabilities. • Patterns and trend in these factors. • Risk mapping and data. 	<p><i>Develop hazard monitoring and early warning services</i></p> <ul style="list-style-type: none"> • Monitoring right parameters. • Sound scientific basis for making forecasts • Generating accurate and timely warning. 	<p><i>Communicate risk information and early warnings</i></p> <ul style="list-style-type: none"> • Communicating warning to all of those at risk. • Ensuring explicit risks and warning. • Usable and clear warning information. 	<ul style="list-style-type: none"> • <i>Built national and community response capabilities</i> • Up to date and tested response plans. • Making use of local capacities and knowledge. • Ensuring peoples' preparedness and readiness for reacting to warnings.

Alessa, L., Kliskey, A., Pulsifer, P., Griffith, D., Williams, P., Druckenmiller, M., McCann, H., Myers, B., Beaujean, G., & Jackson, L. (2016). *Best Practices for Community-based Observing: A National Workshop Report*. Arctic Domain Awareness Center, University of Washington, University of Alaska Anchorage.

Japan's Best Practices of CBON for Climate Actions and Urban Planning

Machizukuri: Japanese community-driven management models, empowering local communities to address urban issues through collective action and local resources.

- Example: Ishinomaki's alternative reconstruction project influenced by Machizukuri, emphasizing solidarity design and local participation.
- Machizukuri is a bottom-up approach fostering creative solutions and collective decision-making.

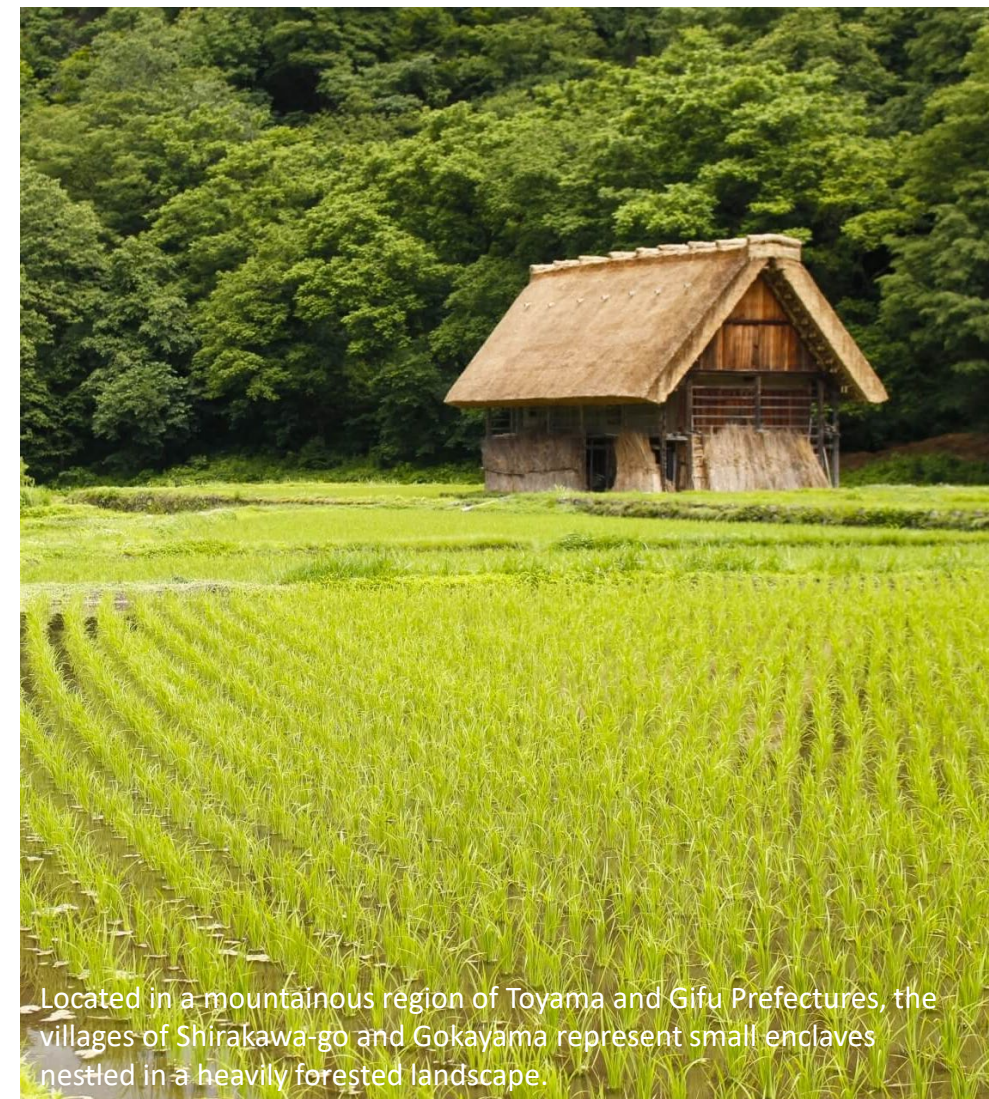
Local Knowledge and Insights: Contribution to people-centric urban environments.

- Example: Satoyama concept in Japan, representing traditional landscapes where humans coexist with nature.
- Conservation and sustainable use of Satoyama enhance biodiversity, ecological balance, and cultural preservation.

Satoyama Principles in Urban Planning:

- Efforts to integrate Satoyama principles into urban planning.
- Emphasis on green spaces, natural elements, and cultural heritage.
- Promotes sustainable and harmonious urban development.

McCay, L., Suzuki, E., & Chang, A. (2017). Tokyo, urban design and mental health - Journal of Urban Design and Mental Health. *Centre for Urban Design and Mental Health*. <https://www.urbandesignmentalhealth.com/journal-3---tokyo-case-study.html>



Located in a mountainous region of Toyama and Gifu Prefectures, the villages of Shirakawa-go and Gokayama represent small enclaves nestled in a heavily forested landscape.

Japan's Best Practices of CBON for Climate Actions and Urban Planning

Collaboration for Balanced and Sustainable Urban Development:

- Citizen participation in disaster recovery planning in Japan as an example.
- Collaboration among local residents, NGOs, experts, and government agencies.

Success of Community-Based Observer Networks in Urban Planning:

- Example: Minato Mirai 21 Observer Network in Yokohama City.
- Collaboration among local residents, business owners, experts, and government officials.
- Communication channels for dialogue, information sharing, and addressing concerns.
- Input and recommendations on architecture, green spaces, transportation, cultural facilities, and environment.

Observer Networks as Monitors and Advocates for Community Interests:

- Example: Community Land Trusts (CLTs) in Japan.
- CLTs acquire and manage land for long-term community benefit.
- Focus on affordable housing, sustainable development, and community control over land use.

Tsunami Tendenko:

- Tsunami tendenko refers to the practice of evacuating to higher ground immediately after feeling an earthquake as a precaution against potential tsunamis.
- This community-based practice in Japan contributes to disaster preparedness and the safety of coastal residents.



Hashire, Ue e!: Tsunami Tendenko [Run up!: Protect Yourself from Tsunami] | Japanese Children's Literature: A History from the International Library of Children's Literature Collections. https://www.kodomo.go.jp/jcl/e/section6/detail06_01_27.html. Accessed 17 June 2023.

Mavrodieva, A. V., & Shaw, R. (2020). Disaster and Climate Change Issues in Japan's Society 5.0—A Discussion. *Sustainability*, 12(5). <https://doi.org/10.3390/su12051893>

Alessa, L., Kliskey, A., Gamble, J., Fidel, M., Beaujean, G., & Gosz, J. (2016). The role of Indigenous science and local knowledge in integrated observing systems: moving toward adaptive capacity indices and early warning systems. *Sustainability Science*, 11(1), 91-102. <https://doi.org/10.1007/s11625-015-0295-7>

Discussion

Cultural Perspective:

- Practices like Mottainai and the resource-consciousness of the Edo period showcase Japan's cultural tradition of valuing sustainability and harmonizing with nature.

Nature as a Blueprint:

- Integration of nature-inspired urban planning approaches in Japan, such as green roofs, vertical gardens, and urban forests, demonstrates successful implementation of nature as a blueprint for sustainable and resilient cities.

Collaborative Co-Creation:

- Involvement of diverse stakeholders, including local governments, communities, and organizations, in co-creating and implementing nature-inspired solutions ensures their relevance and impact on urban resilience.

Scalability and Replicability:

- Successful examples like river restoration projects, green infrastructure networks, and sustainable drainage systems in Japan showcase the scalability and replicability potential of nature-based solutions in different urban contexts.

Lessons for Success:

- Documentation and sharing of lessons learned from Japan's experience provide valuable insights, including best practices, innovative approaches, and challenges encountered, for regions and cities adopting similar strategies.

NIS (Nature-Inspired Solutions):

- Green roofs and vertical gardens
- Urban forests
- River restoration projects
- Sustainable drainage systems
- Integration of natural elements in architecture
- Biodiversity conservation
- Urban greening initiatives
- Incorporation of Satoyama principles



CBON (Community-Based Observer Networks):

- River Ranger System
- Weather Observation Network
- Forest fire monitoring by local communities
- Volunteer snow clearing groups
- Citizen participation in disaster recovery planning
- Community Land Trusts (CLTs)
- Minato Mirai 21 Observer Network
- Tsunami Tendenko

Conclusion and recommendation

Harmonizing Nature and Urban Environments:

- Japanese thinking recognizes no distinction between built and natural environments.

Leveraging Nature's Blueprint:

- Nature's time-tested processes such as Satoyama principles offer a wise blueprint for urban development.

Maximizing Opportunities:

- Diverse platforms for co-creating nature-inspired solutions and learning from urban social innovation such as Machizukuri planning tradition in Ishinomaki after the 2011 tsunami.

Scalable and Replicable Solutions:

- Designing nature-based solutions that can be scaled and replicated such as Environmental green axes and Forest bathing.

Enabling Collaborative Governance:

- Citizen participation in disaster recovery planning for collaborative governance approach for integrating nature-based solutions

Building Resilient, Sustainable Cities:

- Community land trusts in urban planning and climate action for socially inclusive, resilient, and sustainable cities.





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Thank you

More details: CORE project (science & human factor for resilient society)

<https://www.euproject-core.eu/>

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