

1 NTNU Winter Institute 2026 (2026.1.23)

Resilience of Mountain Village Communities to Natural Disasters and Sustainable Forest Management



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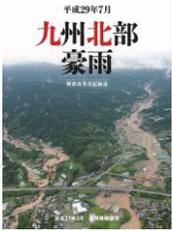
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1

 **KYUSHU UNIVERSITY** Today's contents 2

1. Climate Change Impacts of Global Warming on East Asia
2. Challenges in Sustainable Forest Management Amid Increasing Disaster Severity
3. Impacts on Rural Areas from Heavy Rainfall Disaster "Based on the 2019 Northern Kyushu Heavy Rainfall Case study"
4. Disaster Recovery Efforts and Community Resilience at the Local Level
5. Summary



平成29年7月
九州北部 豪雨
2019年7月

Asakura city (2019)

2

 **KYUSHU UNIVERSITY** 1. Climate Change Impacts of Global Warming on East Asia 3

- ✓ Extreme weather events caused by global warming (IPCC AR6, 2021)
- ✓ East Asia faces increased risks of typhoon intensification, more severe torrential rain damage, and heightened flood risks due to rising Pacific Ocean sea temperatures.

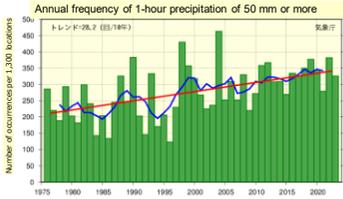


<https://gooddo.jp/magazine/climate-change/>

3

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Linear precipitation zones occur at the end of the rainy season, increasing the frequency of torrential rainfall.



https://www.data.jma.go.jp/cpdinfo/extreme/extreme_p.html

4

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Distribution of epicenters and plates worldwide

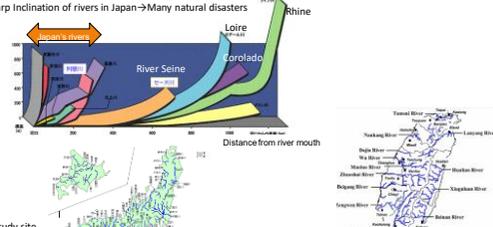


Source: White paper on disaster prevention
Note: 1968-1991, magnitude 5 or greater, earthquakes shallower than 100 km
Japan is often referred to as an "archipelago of disasters".
=>Earthquakes, tsunamis, torrential rain, floods, and so on.

5

 **KYUSHU UNIVERSITY** Features of rivers 6

Sharp Inclination of rivers in Japan → Many natural disasters

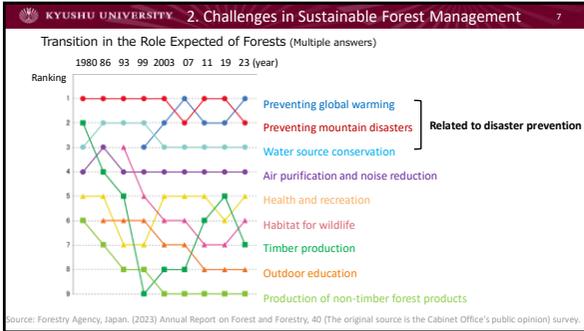


Case study site (Asakura)

Source: JGEI HP
<http://www.ike.ac.jp/knowledge/river/feature/river.html>

Source: Taiwan rivers map (<https://taiwanrivers360.com/>)

6



7

KYUSHU UNIVERSITY 2. Challenges in Sustainable Forest Management 8

Sustainable Forest Management

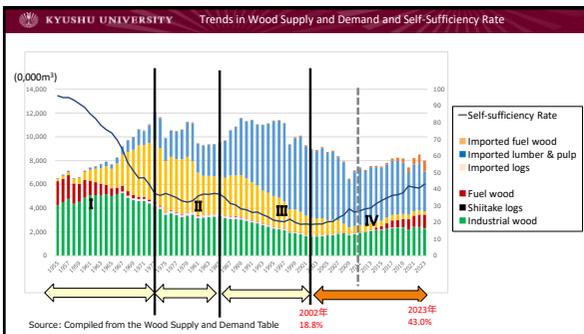
- Keyword since the Declaration on Forest Principles issued at the 1992 Earth Summit

Definition of SFM

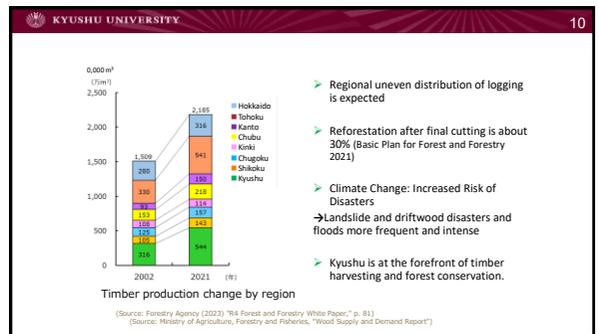
“Forests should be managed and operated sustainably to meet the social, economic, ecological, cultural, and spiritual needs of present and future generations.”

- Various initiatives aiming for SFM (e.g., forest certification systems)
- Importance recognized in the Paris Agreement and SDGs

8



9



10



11

12 3. Impacts on Rural Areas from Heavy Rainfall Disaster

- The 2019 Northern Kyushu Heavy Rainfall
 - ✓ Linear precipitation band: Heavy rain concentrated in a small area over a short period (Asakura observation site: 24-hour precipitation 545 mm)
 - ✓ 41 dead or missing
 - ✓ Numerous surface landslides, massive sediment discharge: approx. 20 million m³ (1 deep landslide, over 900 surface landslides)
 - ✓ Massive driftwood (200,000 m³) flowed downstream, exacerbating damage

“The largest driftwood damage on record”

大量の流木がまちを襲う

Source: Ministry of Land, Infrastructure, Transport and Tourism, Kyushu Regional Development Bureau (https://www.mlit.go.jp/kyushu/kyushu-ard/kyushu-ard.html)

12

13 Characteristics of the 2017 Heavy Rainfall: Concentration of Damage

Damage concentrated in mountainous areas and river floodplains

Asakura City (Dead and missing: 35)
 Amagi area: House damage rate (total collapse or partial damage) 284 HHHs (1.8%) / 15,763 HHHs
 Of which, Takagi community upstream of Dam 68 HHHs (36.8%) / 185 HHHs
 Asakura area: 373 HHHs (13.8%) / 2,704 HHHs
 Hagi District: 390 HHHs (17.7%) / 2,776 HHHs

*5 settlements remained uninhabited even after long-term evacuation orders
 Of these, Masue area: 164 HHHs (66.1%) / 248 HHHs (Source: Asakura City Tax Division)



2017年7月25日 朝倉市松末地区 (写真: 佐藤謙策)

13

14 Kyushu University's Initiatives

- Kyushu University Forms Disaster Investigation, Recovery, and Reconstruction Support Team
- Involves researchers from multiple research divisions
- Support Team Activity Guidelines
 - Academic Support
 - Support for Administrative Bodies
 - Support for local Communities and Residents





Support Team Activity Policy

Creating Disaster Prevention Maps for the Future

Construction of a Disaster Heritage Center

Source: https://www.jamu.ri.u-kyu.ac.jp/wp-content/uploads/2021/10/61_20.pdf

14

15 Sharing Disaster Experiences and Drafting Plans in the Matsue Community with Support Group Involvement



- ✓ Share evacuation routes
- ✓ Many residents voiced concerns: "The mountains are like bombs, terrifying." "Didn't the forest roads and farm roads get destroyed?"
- ✓ Compile residents' requests for the administration

2017.11.3 Recovery Meeting in Matsue community. (taken by Sato)

15

16 Issuing Village Newsletters and Community Newspapers



Source: made by the Watershed Systems Engineering Laboratory, Kyushu Univ.

16

17 Collapse Status of Forest Roads



● : forest roads
 ● : river
 ● : general roads

Map provided from Stho office. Photo: taken by Sato

17

18 Growing movement in "Zibatsu (自伐)" (small-scale self-logging forestry) and the Emergence of New Participants



Photo: Provided by Mr. Miyazaki, Sen

His biography
 Mr. Miyazaki, 40years old, 10ha forest owner. Returned from city, started Zibatsu 10years ago. Combined business (Zibatsu+wood craft + cottage near clear river).

- ✓ This site is owned by an elderly community member.
- ✓ Together operation of thinning with the owner.
- ✓ Using small forestry vehicle.
- ✓ 1.5m narrow path for the removal to avoid sediment run-off into the river (Shimanto).
- ✓ Making long log to aim high price.
- ✓ Discussion of future direction of forest management toward long rotation forests by many thinning or continuous cover forest (CCF).

18

19 4. Disaster Recovery Efforts and Community Resilience at the Local Level (2019-)

Overview of the **Hiraenoki Community**
Asakura City

Persimmon-producing area; forest managed jointly by the Production Forestry Cooperative

2017 Heavy Rainfall: No fatalities (mutual aid), but houses washed away or collapsed
Post-disaster depopulation (37HHs→19HHs) and aging accelerated rapidly

2019: Formation of the Hiraenoki Reconstruction Committee (6 members + District Chief)

2019: Consultation with Kyushu University Support Group





19

20 Long-Term Research and Community Development Policy in the Hiraenoki Community

- Stayed overnight in the Hiraenoki community and conducted half-structured interviews with 19 current resident HHs and former residents in January 2022. (Harada, Y., et al., (2023))
- Collaborating with researchers in forest landscape science and silviculture.

“Community Development” Policy
Creating a settlement where residents and newcomers feel glad to have lived here

- ① Creating a Livable Environment
- ② Maintaining Persimmon Orchards (10+ years target)
- ③ Landscape Development



20

21 Concretization of the Landscape Creation Policy

- Landscape Creation Centered on Persimmon Orchard Views: Installation of a Viewing Platform within the Village
- A recreational space where residents can easily take strolls
- Recognition by outsiders and non-local residents → Leading to regional revitalization
- Location: Unmanaged persimmon orchard land (21.8a) 20-year lease agreement
- Application and selection for the National Land Greening Promotion Organization's Fund Project
- “Community Revitalization through Landscape Creation after the 2017 Northern Kyushu Heavy Rainfall”
- Expenses for seedling purchases, tree planting costs, and workshops+ Ward funds, donations
- Materials, heavy machinery procurement, and labor: Residents saved costs—“Local Engineering Capabilities of Rural Residents”
- **The abundant knowledge and execution power of baby boomer generation rural residents (around 75s years old)**
- **Landscape creation, especially tree planting, can become a symbol of recovery: Able to speak of the future**




21

22 Collaboration with external organizations
Activities of the General Incorporated Association **Asa★Kuru**

A community support group launched in response to the 2017 North Kyushu torrential rain disaster
“Here lies a hometown we can be proud to pass on to children a century from now”
We cultivate local culture and rebuild the bonds between people, nature, and society.

- ✓ Established by a woman from this district
- ✓ Nature and cultural experiences for children wishing to attend Haki Elementary School



22

23 Tree-Planting Festival (March 6, 2021)

- Participants formed connections with the community by attaching name tags to each tree they planted
- Children's kalimba performance (made from driftwood from the disaster)




Photo by Mr. Harada

Photo by Mr. Harada

出典 : <https://asakuru2017.wixsite.com/asakuru>

23

24 Initiatives from 2022 to Present

- Continue the Autumn Foliage Festival while promoting local discussions and encouraging participation from women and younger generations.
- **Balance collaboration with external organizations and internal consensus building.**
Explore information sharing within the community and women's participation.
- Explore utilizing the new observation deck
Sustainable management system: For the next generation + economic aspects
Trial dog run program also serving as wild boar/deer countermeasure.
- The challenges of depopulation and aging have not been resolved, yet discussions continue regarding resident participation in regional revitalization and the sustainable conservation and use of forests.



Fruit Cutting Workshop
Taken by Sato (2021.11.28)

24

5. Summary

- The challenge of balancing forestry and environmental conservation in East Asia under climate change
- Forests serve multifaceted functions, but **soil conservation** is particularly crucial
- SFM addresses the need for small-scale forestry and conservation activities based on **locals' resilience**
- The necessity of activities that integrate not only the economy but also the environment, landscape, and education

Layering of Forest Functions

The intensity of direct social needs

The weight of the forest ecosystem

Soil = Carbon dioxide storage

Forest Carbon Sink

Timber accumulation = Carbon dioxide absorption + storage

Source: Fujimori, T.(2003) New Forest Management, p69

25

26 References

- Asakura City <http://www.city.asakura.lg.jp/> (accessed 2020/12/03)
- Sato, T.; Shuin, Y. Impact of National-Scale Changes in Forest Cover on Floods and Rainfall-Induced Sediment-Related Disasters in Japan. *J. For. Res.-Jpn.* **2023**, *28*, 106–110.
- Sato, N.; Yoshimura, T. Post-Restoration Forest Management Issues in East Asia under Climate Change: Based on the Special Issue "Economic and Societal Losses Due to Environmental Impacts on Forestry Productivity". *Forests* **2023**, *14*, 1845.
- Forestry Agency, Japan. Annual Report on Forest and Forestry in Japan (Summary); Forestry Agency, Ministry of Agriculture, Forestry and Fisheries, Japan: Tokyo, Japan, 2021
- Takahashi, T.; de Jong, W.; Kakizawa, H.; Kawase, M.; Matsushita, K.; Sato, N.; Takayanagi, A. New Frontiers in Japanese Forest Policy: Addressing Ecosystem Disservices in the 21st Century. *Ambio* **2021**, *50*, 2272–2285.
- Harada, Y.; Ichinose, A.; Owake, T.; Asahiro, K.; Sato, N.; Fujiwara, T. The Process and Challenges of Resident-Led Reconstruction in a Mountain Community Damaged by the Northern Kyushu Torrential Rain Disaster: A Case Study of the Hiraenoki Community, Asakura City, Fukuoka Prefecture, Japan. *Forests* **2023**, *14*, 664.
- IPCC AR6 (2021) Chapter11 (https://www.ipcc.ch/report/ar6/wg1/chapter/chapter-11/?utm_source=copilot.com)
- Fujimori, T. (2003); New Forest Management, Zenkokingyokairyofukyuyoukai, Tokyo

26

Thank you for your attention !

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27