73RD INTERNATIONAL EXECUTIVE COUNCIL MEETING

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3RD OCT - 10TH OCT 2022

ADELAIDE | SOUTH AUSTRALIA

Theme: Innovation and research in agriculture water management to achieve sustainable development goals

INSTITUTIONAL APPROCHES TO SOCIAL WATER SCARCITY IN JAPAN

03 October 2022: 08:45-10:30 and 11:15 to 13:00 Hours

Adelaide, Australia

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Today's Content

- Social, relative, and dynamic "water scarcity" concepts
- River water use and water use order based on Asian monsoon climate and geographical conditions
  - Prior-appropriation, coordinating body of conflicts, commons, management by small and large number of farmers
- River-flow management (water rights system based on replenishment of natural flow of rivers by multi-purpose dams)
- Drought response: basin level ("drought adjustment") and field level (water conservation through block rotational irrigation)
- Summary and Discussion

What is social "water scarcity"?

- Water demand > water supply (FAO, 2012; ICID, 2017) as social, relative, and dynamic concepts
- Consideration required of all social and technological factors, determining the quantity and quality of demand and water
- Many hints available to mediate scarcity: review of the current system, construction of inlara, development of technology, water resources development planning and implementation, the changing social orientation towards environmental protection, and the transition of values related to water.

Japan's climatic and geographical features and river intake

- Located in monsoon Asia and blessed in terms of annual precipitation
- However, seasonal variations are large.
- For stable production of paddy rice cultivation, it is essential to use irrigation, especially rivers that can withdraw large amounts of water, as a water source.
- Rice paddy irrigation using river water has a history of more than 2,500 years in Japan
- Water withdrawals from rivers reflect their characteristics as water resources

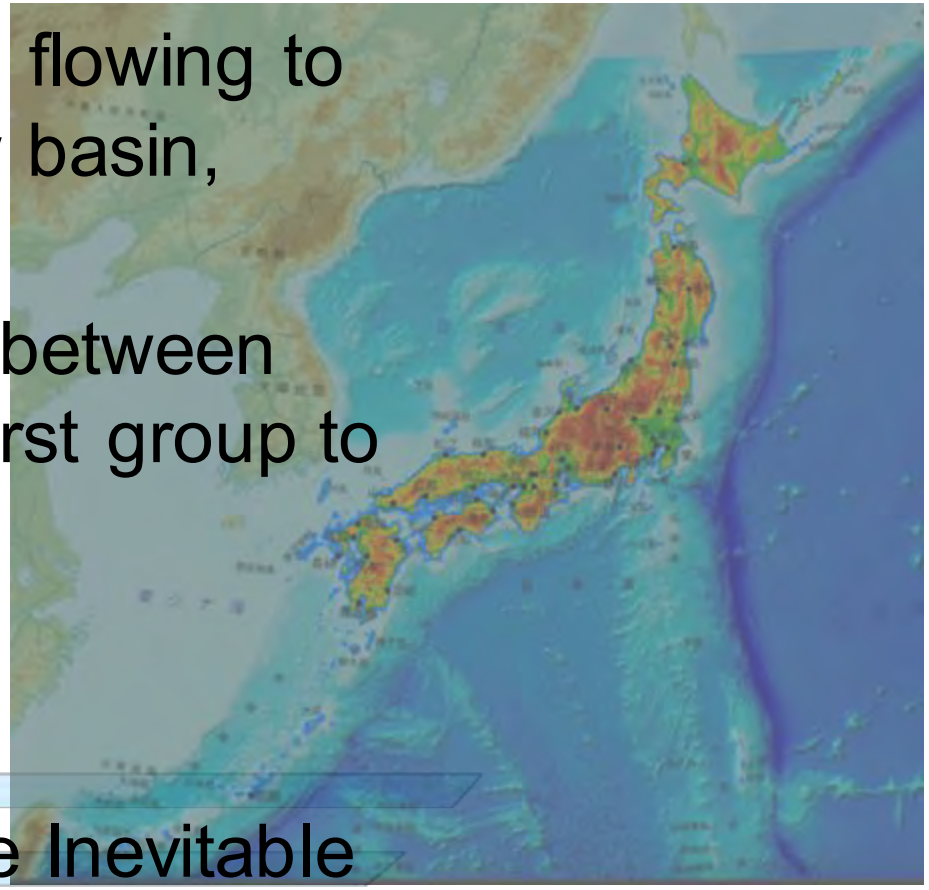
Characteristics of river water and its use

- Mountains in the center of the country, rivers flowing to both sides, short distance to the sea, narrow basin, steep riverbed⇨ Fluctuation
- Gravity-flow⇨The difference in water intake between upstream and downstream groups, but the first group to begin intake has priority.

⇨Prior-appropriation = <u>order in water use</u>

⇨But conflicts during droughts

⇨ Regional conflicts and the coordination are Inevitable



Source: Geospatial Information Authority of Japan Globe

Conflicts over Water Withdrawal and Coordinating Entities in the Early Modern Period

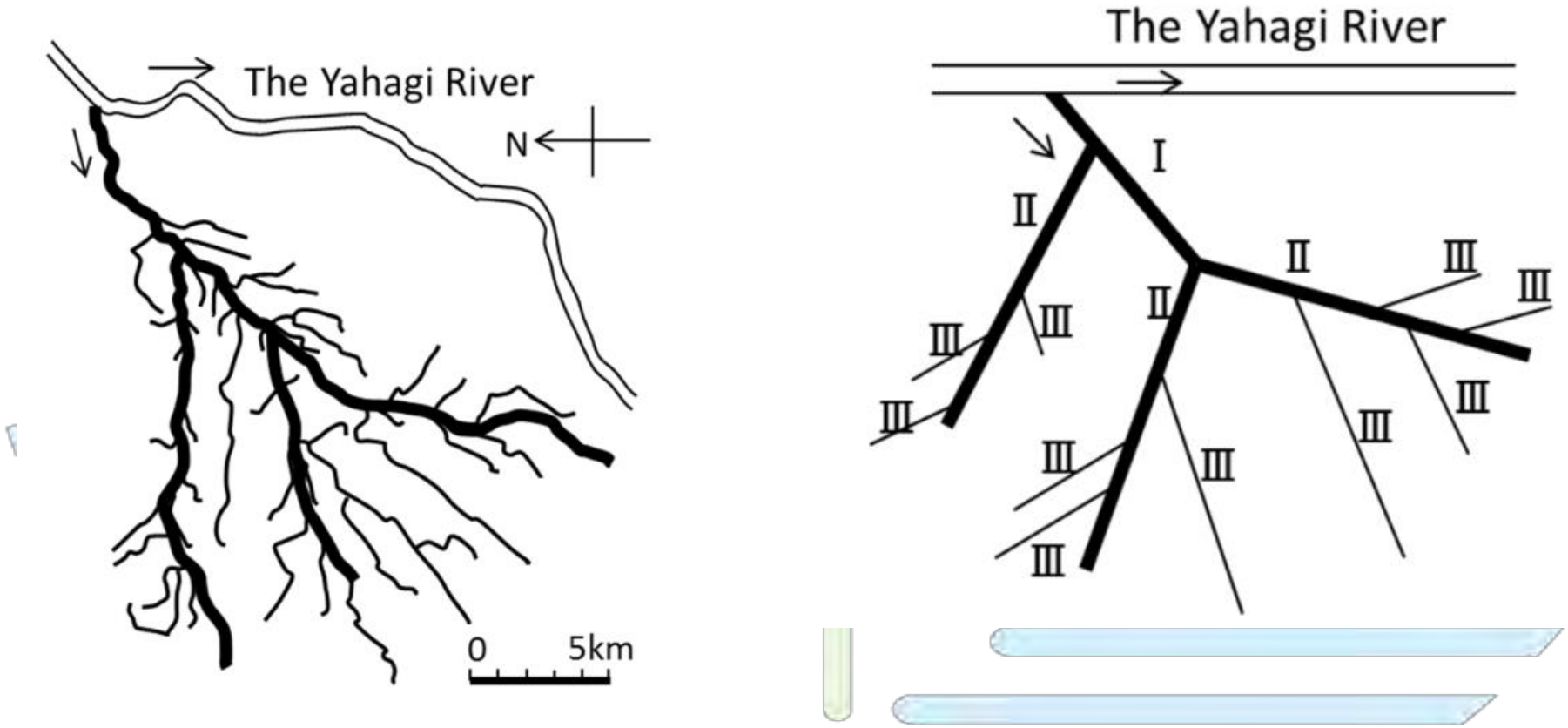
- The unit of conflict during drought is *Mura* (a unit of tax payment in 17th-19th century) ⇨ Postwar LIDs
- Outside *Mura*: conflicts between upstream and downstream *Muras*

⇨ Coordination made by the higher political authority reigning both regions (ensuring productivity and tax revenues)

⇨ "Irrigation management is essentially reconciling regional conflicts" (Shinzawa, 1957)

- Inside *Mura*: Autonomous solution made as the irrigation commons
  - Irrigation commons (Ostrom, 1990; Sarker & Ito, 2001)

Typical Irrigation Modes in the Monsoon Region



Source: Adapted from Ishii & Sugiura (2016) and modified, based on Iwata & Okamoto (2000)

The Conflict Coordination since the Modern Era

- Population growth, urbanization, and increased demand for non-agricultural water use
- Development of engineering techniques (long-distance water transfer and construction of multi-purpose dams)

  ⇨Watershed change became possible
- Development of a modern water rights system

- Coordination" is now done within a new framework assuming river managers and water users, in addition to a *Mura*-based frame.

River Management Administration in Japan

- River-flow management
  - Ensure stable water withdrawal during the summer when irrigation and multipurpose use are competing
  - Allocate water resources to a large number of water users with different purposes
    - Market economy mechanims, quota system, water rights system
- Flood control

“Strong" Irrigation Water Use and Water Use Order

- Rice is the most productive grain under Japan's geographical and climatic conditions and can generate stable profits.
- A historically formed "rational" water-use order, focusing on the water use for irrigation purposes
- To get new water, it is a prerequisite that the existing water users not be encroached upon.

  ⇨ "Strong" irrigation water

Modern Water Rights System

- River water is "public property" and not subject to private rights (River Law, Article 2)
- To appropriate river water, it is necessary to apply to the river administrator for approval and permission to use the water on land outside the river channel (River Law, Article 23).
- Permitted water rights are granted when the river can still spare more water than the amount calculated at the point of planned intake based on a drought year, which occurs about once every 10 years
- Customary water rights gradually shift to permitted water rights as water river-related facilities are modified and improved

Water Rights System and the Need for New Water Sources

- There is a limit to the river flow conditions to which water rights can be granted, i.e. during the summer months, when irrigation water demands are competitive

  ⇨Serious conflicts between agricultural water and new water demands

  ⇨ Adopt creating new "water sources" to meet new water demands

- Augmenting natural river flow with a multi-purpose dam
- Long-distance water transfer from other water sources also effective

Modern Framework for Drought Response

NORMAL TIME

Multi-purpose dam and related infrastructure

water rights system

DROUGHT

Basin: Drought coordination (River Act, Article 53)

Field: Water-saving irrigation

When it becomes clear that the water rights holder cannot use the amount of water scheduled under the water rights system, the system moves to drought response

Drought Response at Basin Level

the "*Kassui-chōsei*" (River Act, Article 53) since 1964

During an abnormal drought, when river flows are low and normal water withdrawal becomes difficult or is likely to become difficult, water withdrawal is adjusted to be less than normal through discussions among the water users concerned with minimizing damage (Paragraphs 1 and 2of Article 53).

Even if this is not the case, the river administrator is expected to mediate or arbitrate when an application is made by a party or when there is a risk of serious interference with the public interest (Paragraph 3 of Article 53).

Drought Response: Coordination among Sectors

- Every four years on average
- Frequency and water saving rates vary as they are determined on a regional basis
  - A maximum restriction rate of 30% (the Tone River)
  - 50% restriction for manufacturing and agricultural water (the Yahagi River)
- Voluntary adjustment; government only summon the meeting
- In practice, substantial temporary transfers from agriculture to other-purpose users (Fujimoto, 2004)
- "Quasi-markets" (Kobayashi, 2006)

Drought Coordination Council

- An organization established in 1974 in accordance with a notice issued by the former Ministry of Construction (now MLIT).
  - Reflecting the harsh experience in the droughts in 1972 and 1973.
  - Aiming facilitating water use coordination among water users during drought
  - As a rule, by water system
  - Water users, river administrators, etc. discuss timing, methods, etc. of water use adjustment.
- However, there is no clear and unified understanding of the relationship between Article 53
  - Mula-based LIDs, managing irrigation water on the field, are not included as members

The Role of "Public" in Drought Response

- Profit adjustment to cope with drought is possible only when the augmentation of natural flow by a multi-purpose dam ensures a promised minimum withdrawal at a water-saving rate determined by the coordination
- Involvement of river managers is essential
- The current Drought Coordination Council, as opposed to the field-level response (block rotation) as irrigation commons

Transition to a New Water-Use Order

- According to the prior-appropriation doctrine, the conclusion should be that in times of drought, water withdrawal should be first restricted from new water rights.
- However, recent drought responses have used fixed-rate water withdrawal restrictions based on each sector's water withdrawal performance.
- In some places, not only is little consideration given to old and new water use, but the cut-off rate for old agricultural water is even higher than that for new urban water.

Drought Response at Field Level

- Switch from simultaneous and continuous water delivery, diversion, and distribution by free-operation to non-continuous, block-by-block water supply
- Within the LID, the LID executives decide to introduce a block rotational system at the request of the downstream areas where water shortages are severer (no direct government involvement) (Sarker et al., 2014)
- Highly effective
  - 1994 drought recorded higher yields than usual (Tanaka, 1995)

Irrigation Management as Irrigation Commons

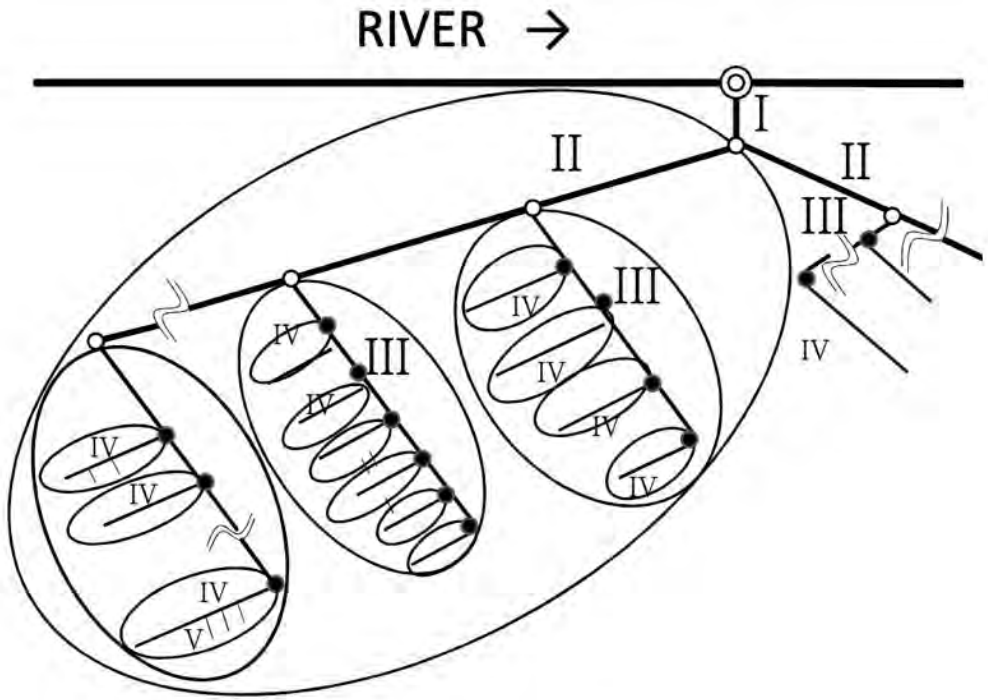
- Irrigation management meets the conditions of Common Pool Resources (CPRs), representing sustainable resources management; irrigation commons (Elinor Ostrom, 1992)
- Field-level drought response in Japanese LIDs is typical of irrigation commons (Sarker & Ito, 2001)
- The interconnected and nested responses among field LIDs, upper LIDs, prefectures, and the national government (Sugiura, Ishii & Tajima, 2013)

Multi-layered Water-Use Organization

- Operation of LIDs (Land Improvement Districts) relies on a system based on *Mura* (Satoh & Ishii, 2021)
- *Mura* is a traditional rural unit, and water use organizations have a multilayered structure based on it (Iwata & Okamoto, 2000; JICA, 2012).
- LIDs (the Land Improvement Act: LIA) are one example of postwar democracy
  - A bidirectional communication and implementation system
  - Equal and independent rights of all members to LID operations

Nested structure

- Nested hierarchical structure corresponding to the structure of irrigation infrastructure, characteristic of monsoon Asia (Sugiura, Tjima & Ishii, 2013)
- Peculiarities of irrigation commons
- Conflicts occur between WUAs that use different diversion facilities on the same river



Two Elements of Irrigation Commons

- Physical irrigation structures
  - Reservoirs, tanks, headworks, weirs, channel networks, etc.
- Institutions
  - Technologies and knowledge to establish sustainable water management, determined by sustainable organizations and their practices.
- These have been inherited by modern irrigation groups WUAs, such as LIDs, through technological development, legislation, and modernization (Sugiura et.al., 2015)

Summary

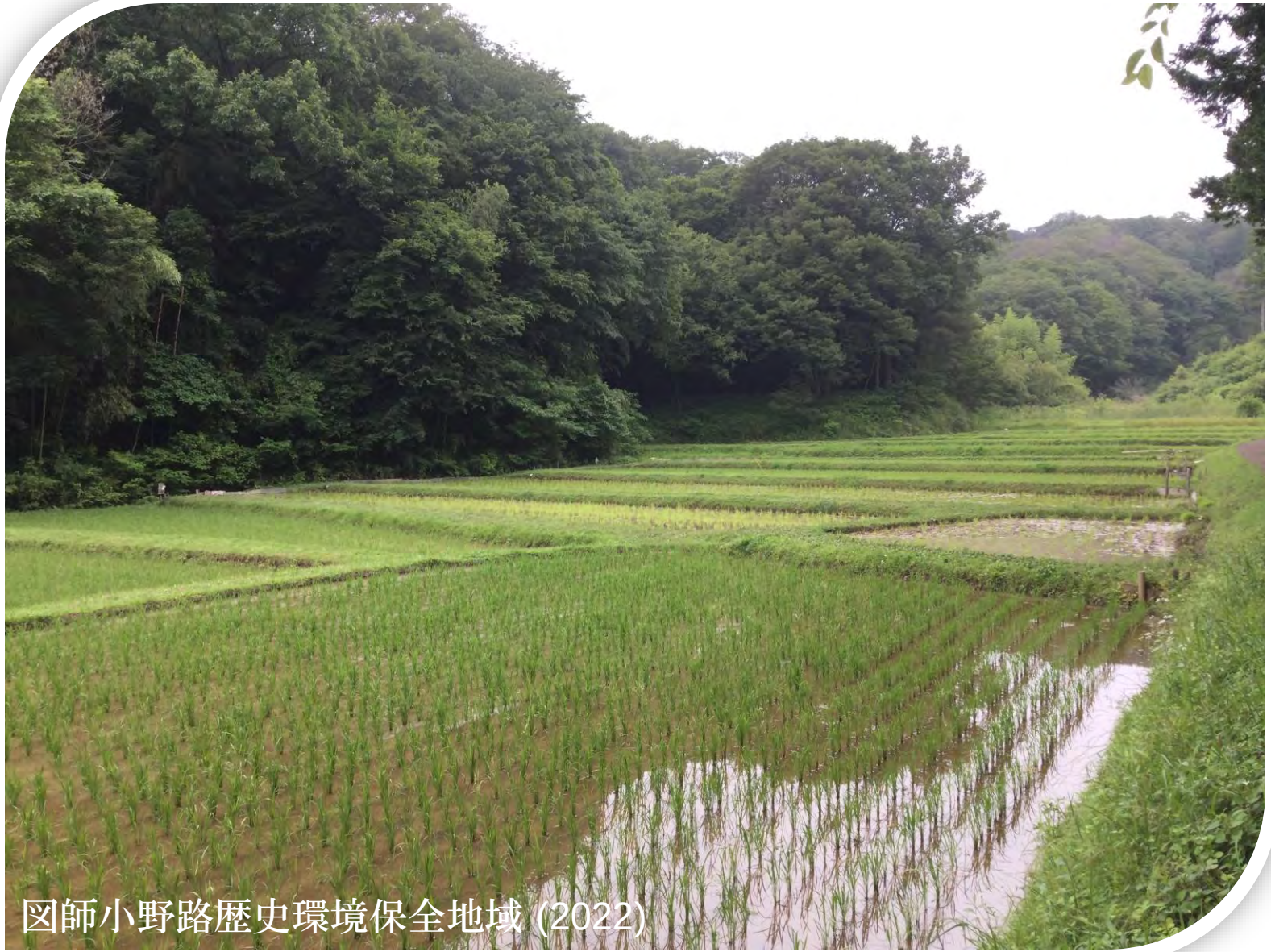
- The institutional response to societal water scarcity is simply two options: increase supply or decrease demand. However, the means are diverse and dynamic, reflecting climatic and geographic conditions
- In Japan, which is located in monsoon Asia and experiences irregular rains and a month-long drought once every ten years, a water use order has been formed based on the use of water for irrigation purposes using rivers as a source of water
- River water is "public water" and is not traded with water rights, but various administrative strategies were implemented to create new water rights

Summary

- In terms of increasing supply, engineering advances in modern times have made it possible to augment river flows by releasing water stored in multi-purpose dams, which enabled the establishment and operation of the modern permit water rights system
- In terms of reducing demand, block rotational irrigation as field-based irrigation commons still plays an important role today
- There, LIDs, which are Mura-based WUAs, conserve water through effective and efficient water management as part of a nested hierarchical structure

Discussion

- The response at the basin level, especially drought coordination, is made possible by the sufficient water diversion capacity of the multi-purpose dam complex and the effective functioning of these related infrastructure improvements combined with traditional Japanese adjustment practices at the basin and field levels. Considering these factors, it is difficult to apply to countries other than Japan where these conditions are not met (Ishii & Sugiura, 2016)
- Most small farmers will quit farming and be replaced by a limited number of large farmers in the near future (Satoh & Ishii, 2021). Institutional responses to social water scarcity, as well as other related issues, are likely to undergo a major transformation
- The key will be how to position the "public" in irrigation management in Japan



図師小野路歴史環境保全地域 (2022)