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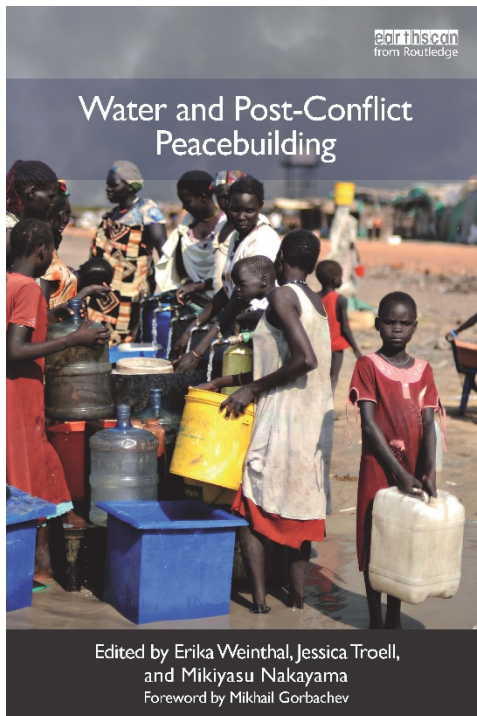
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Irrigation management and flood control in post-World War II Japan

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Mikiko Sugiura, Yuka Toguchi, and Mona Funciello

The Japanese government prioritized irrigation and flood prevention following World War II by establishing a new legal framework. In the new framework, irrigation and flood prevention were divided between two separate management systems, with irrigation management maintaining a bottom-up approach while flood prevention shifted to a top-down, government-directed approach. These two strategies increased agricultural productivity and decreased flood damage in the short term, and they enhanced economic development and food security in the long term. The differences between the two approaches yield several lessons for water resource management in a post-conflict period, particularly with regard to institutional capacity, effective management with limited supplies, consensus building between local populations and the government, and creation of membership incentives through collection of fees.

This chapter examines the legal framework for and management of irrigation and flood control in post–World War II Japan (1945–1952).¹ The analysis focuses on benefits brought about by maintenance of the village as a bottom-up management unit for irrigation following the separation of irrigation and flood-control programs after World War II. The first two sections present the background of water and land management in Japan, pre- and post-1945, respectively. The chapter then offers an overview of the legal framework for water management. The subsequent

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¹ The post-war period is defined here as the years from 1945, when the Potsdam Declaration was accepted by the Japanese government as unconditional surrender, and 1952, when the San Francisco Peace Treaty entered into force and diplomatic relations with the United States were restored. The year 1952 was the beginning of a period of high economic growth. From 1955 to 1972, Japan's real gross national product grew by an average annual rate of 9.4 percent (MIC 2000).

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two sections examine, respectively, irrigation management from the perspective of agricultural productivity, and the development of a new legal framework for flood control.

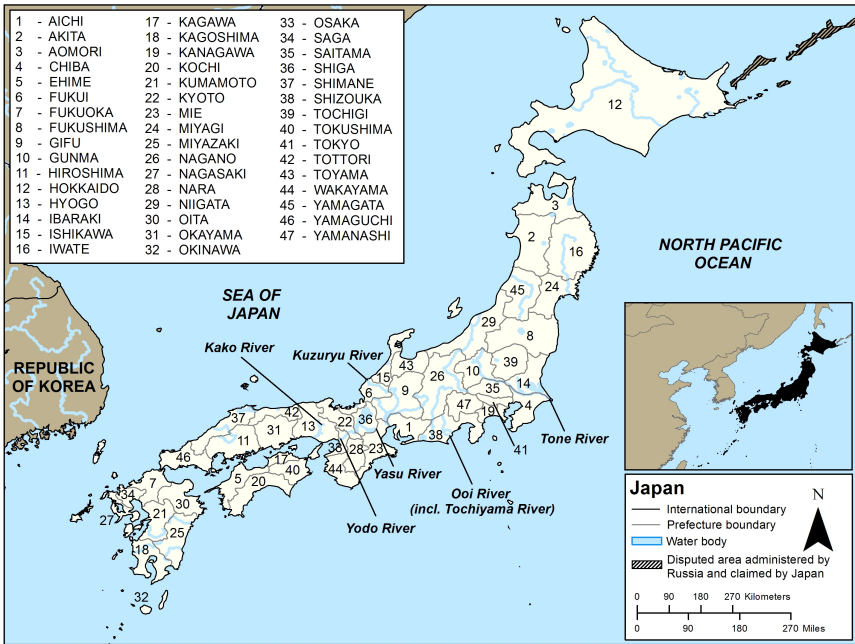
Irrigation management is examined through the lessons of the Ooi River National Agricultural Water Project, one of four national water projects implemented soon after World War II. The Ooi River project demonstrates the importance of enabling villages to retain their roles as local management units while the role of national authorities is simultaneously expanding. Maintaining consistent management units for irrigation was a key part of consensus building in Japan. The Ooi River project also highlights the links between land reform and water reform in post-war Japan. By contrast, Japan's flood-prevention program involved increasing government control and decreasing opportunities for local involvement. The latter experience shows that top-down management was essential for post-conflict restoration of flood-control facilities but also that beneficiaries' declining awareness can negatively affect future flood-control efforts.

LAND AND WATER MANAGEMENT BEFORE 1945

For centuries land and water management in Japan have been closely linked. Before World War II, water resources were managed by water associations responsible for both irrigation and flood control. These associations were based in local villages (Tanaka and Sato 2005). The origins of this method of governance date back to the Edo period (1603–1868), when feudal lords imposed a land tax on villages, rather than on individual villagers, with rice as the form of payment (Nagata 1994). Water was managed primarily for agricultural use, and water management areas were determined by the land-tax payment, which was based on the amount of rice each hectare was able to produce. Villagers collectively built, operated, and maintained the water infrastructure necessary to produce a sufficient quantity of rice to pay the tax; this included constructing networks of irrigation canals, ponds, and dams.

This process evolved into a tiered system, with individual villages, also called water user groups, occupying the lowest tier (Nagata 1994). Farmers became the labor force that carried out the tasks associated with the operation, maintenance, and management of these systems. The two most essential tasks were removing mud from canals and clearing vegetation from canal banks, which facilitated the flow of water through the irrigation systems. At an intermediate level, the water user groups were managed by a water management association that was responsible primarily for water distribution, operation and maintenance of irrigation facilities, and control of branch canals. At the highest level, a single water management association controlled the main canal and was responsible for water distribution among upstream and downstream users, facility maintenance, irrigation systems, and resolution of water disputes.

The Meiji Reformation, which began in 1868, sought to transform the feudal system of administration, based on the village unit, into a new system of individual



landownership. This supported the formation of cities, towns, and villages and required new administrative arrangements. Although in most cases the water management systems functioned as intended and met the water use needs of the villages, conflicts often arose over the distribution of water between upstream and downstream villages because upstream water users had the power to take water without accounting for downstream users (Nagata 1994; Tanaka and Sato 2005). This inequity led to the development of laws that reformed the management and distribution of water resources. The first of these was the Ordinance on Water Management Associations, enacted in 1890, which created new irrigation organizations that supported the land-reform process.

At the same time that land management policies were being transformed, a series of severe floods led to alterations in water management policy as well. The River Act, enacted in 1896, administered river controls for flood prevention and codified the customary water rights of water management associations. One year later, the Sabo Act addressed riverine erosion. These two acts and the Forest Act of 1897 were considered the “Three Laws for Flood Control” that covered the full extent of rivers from their mountain sources to the upper and lower reaches of the rivers (Sanbongi 2006).

A decade later additional legislation adjusted the legal regime governing arable land. In 1908 the Water Association Act confirmed the creation of new irrigation associations, which comprised individual landowners and often covered several cities, towns, and villages. This act supported shifting the responsibility

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for managing irrigation facilities from the village unit to individual landowners. Wherever a city, town, or village was not able to effectively operate and maintain irrigation facilities, the act provided for the establishment of a new irrigation association; in many instances, several water user organizations that had managed water collectively were replaced by a single irrigation association (Nagata 1994). The act also outlined coordination of responsibilities for agricultural water management. Arable-land-readjustment associations implemented irrigation and drainage works for land improvement, while the irrigation associations managed the operation and maintenance of water use facilities (Nagata 1994).

Because the organizations created by the Ordinance on Water Management Associations included only those that controlled main canals, almost all water management performed at the village level continued with traditional operation and maintenance of irrigation facilities and distribution of water (Nagata 1994). Through the Arable Land Readjustment Act of 1899, land was consolidated into more efficient paddy units, and revisions to the act in 1905 and 1909 focused on enabling the paddy units to manage irrigation, drainage projects, and reclamation, with the conversion of upland fields into paddy fields also taking place (Akino 1979). This act also created the arable-land-readjustment associations, local nonprofit organizations in charge of implementing land-improvement, irrigation, and drainage projects. Membership, leadership, and decision-making authority were limited to landowners only.

Although at the time these acts functioned well and met the needs of water users, political and economic changes following World War II resulted in their reexamination and modification—again in conjunction with ongoing land reforms.

OVERVIEW OF LAND AND WATER MANAGEMENT SINCE 1945

Following World War II, the General Headquarters of the U.S.-led Allied occupation force insisted that Japan reassign property titles from landlords to the renters working the farmland, with the specific intent of ending feudal oppression and addressing severe food shortages (McDonald 1997). Ownership of farmland was reorganized between 1946 and 1950, with the government purchasing uncultivated holdings and land belonging to absentee landlords for redistribution and sale to current tenants and other interested parties. Approximately 1.93 million hectares of farmland were purchased and sold to 4.75 million private farm households (Nagata 1994). Individual landownership was limited to the purchase of three hectares, and tenant farmers were limited to one hectare plots (Takemae 2002).

As farmland ownership reform came to a close, the Land Improvement Act was enacted in 1949. This act transformed the past property system, which dictated that most farmers rent land for cultivation, into a new system of landowner-farmers who purchased farmlands from the government at low rates and cultivated their land directly. Suggested by Allied General Headquarters, the act provided for the creation of land-improvement districts, which were charged with construction of irrigation and drainage facilities; land-improvement measures such as the

building of farm roads and consolidation of farmland; and the operation and maintenance of canals, watercourses, reservoirs, pumping units, and other irrigation facilities (Nagata 1994; Mitra 1992). The districts had the additional benefits of providing a stable food supply to the country's burgeoning population and of ensuring that local stakeholders remained involved in irrigation management.

Land-improvement districts were incorporated bodies for a specific geographic area, and all members were farmer-cultivators. They were established when fifteen or more farmers with the prescribed qualifications wanted to implement a project for land improvement. The application required two-thirds agreement of potential beneficiary farmers, and the dissenting farmers were required to participate in the project once it was implemented. Because land improvement was considered beneficial to individual farmers, part of the cost of each project was assigned to the beneficiaries through a surcharge to the farmers involved (Nagata 1994).

World War II was also a major impetus for a shift of water resource management from local water associations to the national government. Water-related infrastructure (dams, canals, irrigation ditches, pipelines, and storage tanks) had been abandoned because of war-related financial deprivation and a severe labor shortage. Exactly how much of the infrastructure was destroyed or abandoned during the war is not documented; however, the many incidents of acute water shortage and serious flood damage that were recorded during the post-war period indicate the severity of the problem.

For instance, immediately following the war, conflicts over water availability erupted among irrigation farmers. Meanwhile, a series of major floods hit Japanese rivers almost every year during this same period, claiming more than a thousand lives per year and causing catastrophic damage (Musiake and Koike 2009; Aki and Takahasi 1956; Takahasi 1955). The severe effects of the flooding compounded the damage left in the wake of World War II and crippled reconstruction efforts (Takahasi 2009). These events led the government to prioritize flood prevention at the national level and coincided with the government's focus on increasing food production (Musiake and Koike 2009).

Food security had been tenuous during World War II, and during the occupation Japan was highly dependent on the food aid provided by the Allied General Headquarters. To reduce its reliance on foreign food aid and boost domestic food production, Japan sought to improve and develop farmland (Nishikawa and Latz 1981). On the basis of research by the National Resource Section of the Supreme Commander for the Allied Powers, the U.S. Committee on Foreign Affairs also emphasized the necessity of paying political attention to food and population problems (Ackerman 1948). The General Headquarters report enhanced Japanese economic recovery by leading to effective natural resource management (Ishimitsu 1986), in part by proposing the construction of irrigation and drainage systems as a viable path to food security.

The response to food security needs was an important dimension of an overall effort by the United States to generate reforms that would demilitarize the country and simultaneously help it to develop a peaceful, economically stable,

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and politically democratic society (Madsen and Samuels 2010; Iyori 2002; Kawagoe 1999). The priority placed on improving food security was a key consideration in the promulgation of the Land Improvement Act, which, along with related reforms, increased food production, specifically of rice, and augmented the amount of government funds devoted to further developing land and agricultural projects.

Because Japan was constrained by natural resource scarcity and a severe food shortage, effective natural resource management was essential for long-term social and economic stability (Ackerman 1948).² Under dire post-war conditions, characterized by deteriorating infrastructure, poor sanitation, and general social upheaval, water projects remained a significant political priority. Within five years of the end of the war, the government had launched four national irrigation projects as part of laying a foundation for peace and stability. Flood control was implemented simultaneously in a prompt and concerted response to recent flooding. Additionally, eleven river-development projects and multipurpose dams were completed during that same time period; these were necessary to repair damage caused by a series of typhoons that hit Japan in 1945 and 1947 (Takahasi 2009).

Because Japan is a collection of narrow and mountainous islands, the East Asian monsoon brings both abundant precipitation and occasional typhoons, which often result in natural disasters. One especially difficult issue in water management is the unpredictability of flooding and droughts resulting from fluctuating rainfall levels and extreme weather events. These cycles of flood and drought were prevalent in the post-war period, and people suffered from their effects on food and water supplies.

In the future, as climate change-related weather events escalate in quantity and severity across the globe, other post-conflict countries will increasingly be looking for ways to improve natural resource management. This chapter's analysis offers a number of useful insights and lessons for transitioning between different forms of governance.

The separation in administration of flood prevention and irrigation activities occurred in 1949 with the creation of the Flood Prevention Association Act. Flood management at the national level was required because of conflicts among land-improvement districts, particularly related to long-term land use planning and to transboundary management of water to prevent short-term flooding. Additionally, government intervention was necessary because of the high costs associated with flood prevention and maintenance, and because the irregularity of natural disasters lowered residents' perception of risk and thus made it difficult for flood-control associations to collect annual fees.

² Japan lacks reserves of many natural resources. There are multiple arguments about Japan's motivation for territorial expansion during World War II (Yasuba 1996), but the country's interest in decreasing its reliance on natural resource imports has been regarded as one of the driving factors behind the decision to send military forces into Southeast Asia in search of strategic materials such as petroleum, coal, copper, zinc, and rubber (Stranges 1993).

This separation of irrigation and flood prevention aided short-term post-war economic recovery by leading to increased food production; however it weakened long-term stakeholder involvement because it removed local user groups from participation in flood prevention. Subsequent water management legislation continued the separation of these functions.³

EVOLUTION OF THE LEGAL FRAMEWORK FOR WATER MANAGEMENT

The evolution of the legal framework for water management in Japan is an important backdrop for the case studies on irrigation and flood control. The following section highlights key irrigation and flood control legislation that was enacted from the latter part of the Edo period (mid-nineteenth century) to the end of the post-conflict period in 1952. The changing roles of the management units, as detailed in table 1, provide important context for the pivotal legal changes that took place in 1949.

From the latter part of the Edo period through the early Meiji period, villages were responsible for the management of water resources (both flood control and irrigation), as well as for the collection of taxes on agricultural production. During this time water resources were held entirely in common.

At the beginning of the Meiji period, the established system did not change significantly. Although the village began to take on a broader number of administrative and management responsibilities, it did not have the legal authority to perform water management functions. However, because villages played a large role in irrigation and flood control, gradually those activities came to be accepted as village functions.

Several trends fueled shifts in water management. First, in order to meet the needs of projects that extended beyond the jurisdiction of villages, such as construction of water catchments that crossed village boundaries, water management responsibilities shifted from villages to larger administrative units under the Ordinance on Water Management Associations, which was the first significant legislation governing water use.

The 1908 Water Association Act established flood-prevention associations and consolidated flood-prevention and irrigation associations under a single law. Both irrigation and flood prevention were considered public goods, and both were subject to the same regulations under the legislation. The associations were also permitted to engage in water-usage and drainage projects. The Home Affairs Ministry was supposed to be the government agency that administered the act; however, administrative conflicts arose because the projects carried out by irrigation

³ Following the post-war period that is the focus of this chapter, Japan continued to develop its legal regime governing water. Key legislation includes the Water Quality and Control Act (1958), the Industrial Effluent Control Act (1958), and the new River Act (1964, last revised in 1997) (Sanbongi 2006).

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Table 1. Transition of the legal framework in Japan for flood-control and irrigation management

<i>Period</i>	<i>Legislation</i>	<i>Flood control or irrigation management unit</i>
Latter part of the Edo period (late-eighteenth century to mid-nineteenth century)	Not applicable	Village as management (control) unit.
Early part of the Meiji period (mid- to late-nineteenth century)	Not applicable	Village as administrative unit.
1890	Ordinance on Water Management Associations	Irrigation associations formed by private landowners, under Home Affairs Ministry.
1896–1897	River Act Sabo Act Forest Act	Flood-prevention associations and flood-fighting associations.
1908	Water Association Act (Ordinance on Water Management Associations abolished)	Irrigation associations and flood-prevention associations treated uniformly under the Home Affairs Ministry.
1909	Arable Land Readjustment Act	Two-track system: Agriculture and Commerce Ministry handled arable-land-readjustment projects; local government or irrigation associations handled maintenance after completion.
1949	Land Improvement Act Flood Control Act Flood Prevention Association Act (Water Association Act and Arable Land Readjustment Act abolished)	First, authorities under the Land Improvement Act and the Water Association Act; later, authorities under the Flood Control Act.

associations included elements that were essential to agricultural management and thus within the purview of the Agriculture and Commerce Ministry.

The Arable Land Readjustment Act of 1909 was designed to address these administrative conflicts and inconsistencies by creating a path for the arable-land-readjustment associations to carry out water usage and drainage projects under the Agriculture and Commerce Ministry. An inconsistency between the 1908 Water Association Act and the 1909 Arable Land Readjustment Act was resolved when local administrations or associations were allowed to take over management of completed projects. This resulted in the development of a separate administrative control structure under which irrigation and drainage projects would be handled by the Agriculture and Commerce Ministry, and the Home Affairs Ministry would then take over the maintenance and control functions

once a project was completed. This structure later underwent major changes with the Land Improvement Act (Nishikawa and Latz 1981).

The Land Improvement Act and the Flood Prevention Association Act, both passed in 1949, had two objectives: (1) to reorganize the many laws dealing with irrigation and water use and drainage, and (2) to consolidate different associations with similar, overlapping functions. Irrigation and water-use activities were now under the purview of the Land Improvement Act, which replaced the 1909 Arable Land Readjustment Act, and flood prevention was governed by the 1949 Flood Prevention Association Act, which replaced the 1908 Water Association Act. These changes separated the management and administration of flood control and irrigation activities, which helped set in motion the economic recovery and stabilization of social systems that were essential to post-conflict peacebuilding efforts in the long term.⁴ Unfortunately, the separation also resulted in a long-term lack of stakeholder involvement in water resource management.

IRRIGATION MANAGEMENT

Japanese irrigation projects from 1945 to 1952 reveal the historical significance of natural resource management systems in post-war Japan, particularly in relation to the prioritization of agricultural productivity and the development of a nationally designed and controlled system.

Figure 1 shows changes over time in agricultural productivity both per hectare and per person. Although Japan experienced economic and social turmoil following the end of World War II, there was also an immediate and sharp increase in agricultural productivity. Japan's signing of the San Francisco Peace Treaty in 1951, and thus its reemergence as a member of the international community, coincided with the implementation of its four national agricultural water projects.

Before 1945, Japanese food security had depended highly on rice imports from Korea and Manchuria; at the end of World War II a decline in rice imports to 10 percent below the pre-war level meant that food security required urgent attention (Johnston 1953). Besides the lack of agricultural facilities and a labor shortage, the level of imports was restricted by a worldwide grain shortage that made it impossible for food-deficit countries to fully satisfy their imports needs.

⁴ The River Act of 1896 governed flood control in the pre-war period. In addition, it mandated the creation of both flood-fighting associations and flood-prevention associations. The difference between these associations was that the police had the right of command under the Home Affairs Ministry for the former, but not the latter. During the war, the flood-fighting associations became responsible for air defense and were transformed into voluntary guards. After the war, control of these groups passed from the police to local governments, and their focus shifted to firefighting and civil defense. Since passage of the Flood Control Act in 1949, both firefighting and flood-fighting units have worked on flood prevention, although they have differed in their degree of specialization.

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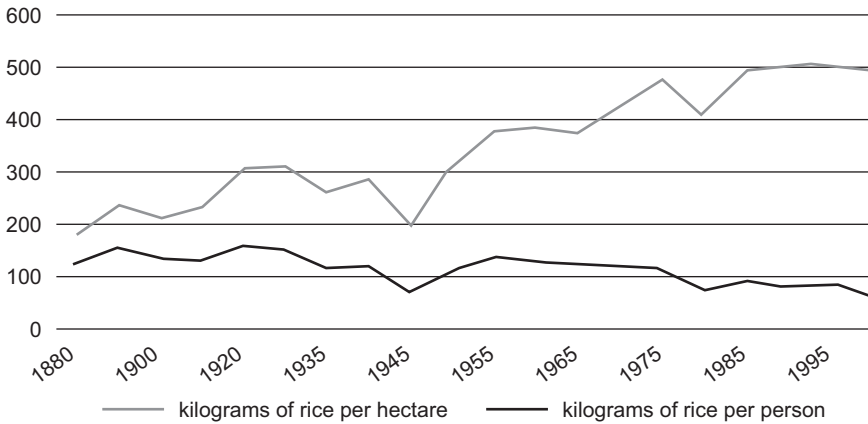


Figure 1. Agricultural productivity in Japan, 1880–1995

Source: MAFF (2007).

Additionally, food consumption greatly increased as demobilized soldiers and repatriates returned home, where most of the water resource infrastructure and food production facilities had been abandoned or destroyed.

A combination of post-war extrinsic factors and pre-war intrinsic and continuous conditions resulted in the prioritization of water reform, which made it possible to speedily implement an effective resource management strategy. Water and land reforms associated with Japan's response to food insecurity were key factors in the country's post-war stabilization. Policies for the establishment of landowner-farmers, introduced by the reforms, created an incentive for high productivity and secured the stability of farmers' households (Ōchi 1966).⁵ Furthermore, because agricultural productivity was identified as a high priority by both the U.S. and the Japanese governments at an early stage of the post-conflict period, villages retained their roles as local management units while the role of the national authorities was expanding.⁶ The governance structure introduced in 1949 enhanced the level of engagement between local, prefectural, and national stakeholders, which in turn contributed to the overall post-conflict peacebuilding process.

⁵ Land reform contributed to Japanese economic development, but landlords, who were a link in a communication system joining the villages to the center of government, gradually became impoverished in the process of land reform (Dore 1959).

⁶ The land reform established legal and administrative connections to the local committees. These connections, along with the use of bureau resources, helped to maintain the balance between villagers and the authorities. For example, five tenants, three landlords, and two owner-operators served on each committee (Montgomery 1972). In the case of irrigation projects, when there was no apparent tension between villagers and the authorities, retention of local management units was preferred as a low-cost approach.

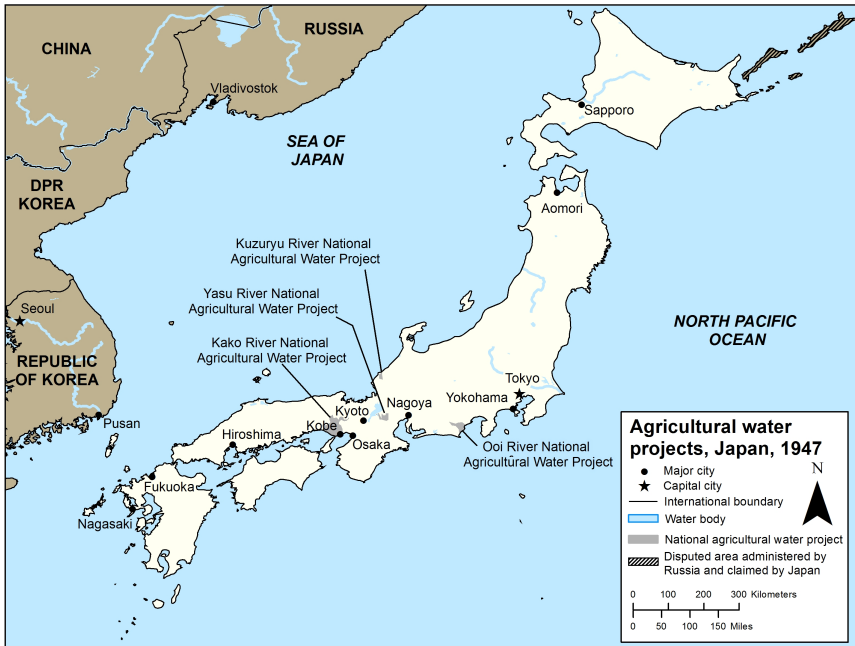


Figure 2. National agricultural water projects launched in 1947, Japan

The Ooi River project

The Ooi River National Agricultural Water Project was one of four national water projects implemented shortly after World War II that were called *kokuei-nogyo-suiri-jigyo*, or national reclamation works. The projects, which addressed food security by increasing agricultural productivity, were launched in 1947 by the Ministry of Agriculture, Forestry and Fisheries. They targeted four river basins: the Kako River Basin (Hyogo Prefecture, completed in 1951), the Yasu River Basin (Shiga Prefecture, completed in 1951), the Kuzuryu River Basin (Fukui Prefecture, completed in 1955), and the Ooi River Basin (Shizuoka Prefecture, completed in 1951) (see figure 2).

The Ooi River National Agricultural Water Project proposed to accomplish two things: first, to increase agricultural productivity and decrease the cost of irrigation-water intake by establishing new facilities or improving existing facilities located on both sides of the Ooi River; second, to create new jobs for the unemployed, including demobilized soldiers, repatriates, and families of war victims. While the second purpose, job creation, was specific to the post-war era, the first purpose, food security, existed both before and after the war. The project's plan included expanding existing water gates and building twelve new ones. Secondary and tertiary canals were built by local water association projects at

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the same time. The Ooi River National Agricultural Water Project took place between 1947 and 1951, with a total project budget of 36 million yen—in today's currency, about 530 million yen (US\$5.85 million).

The Ooi River project was not the first irrigation project in the area. It had several predecessors from before World War II. One such project was the 1931 Tochiyama River Main Drainage Improvement Project, which involved construction of a discharge channel from the Tochiyama River to the Ooi River for the purpose of preventing rice paddies and agricultural facilities from flooding. Although it attained some positive results, many issues remained because of serious budget and labor shortfalls. Just as continuance of Japanese institutions or systems from pre-war to post-war periods has been mentioned in the literature with regard to trade unions (Tabb 1995) and bureaucracy (Dower 1993), coherence can be seen in the case of water issues that need to be dealt with as well.

The interaction between management units at the local, prefectural, and national levels played an important role in the success of the Ooi River project. A five-village meeting that was held on May 10, 1946, became the impetus for the project. One of the committee members was the governor of Shizuoka Prefecture, who identified water resource management as an urgent and crucial concern that required immediate attention. The number of concerned villages along the Ooi River expanded from the original five to a total of thirteen, and the group eventually submitted a petition for an irrigation water project to the prefecture governor.

The lobbying succeeded in generating an official response. A stakeholders' meeting was an essential next step in establishing a relationship between the villages and the authorities at the prefectural and national levels. In many post-conflict situations social networks are obliterated, but in post-war Japan the continuity of social networks and human capital provided an important foundation upon which to rebuild. Moreover, in contrast with some other post-conflict situations, including Iraq, two types of social capital required for viable governance—vertical social capital, which connects citizens to government, and bridging social capital, which links across different social, religious, and ethnic groups (Brinkerhoff 2005)—remained, barely but to a degree sufficient to transfer the remaining tasks of former projects to the new national water projects.

The maintenance of social networks and human capital was manifested in villages, which were the smallest water management units. Some village mayors were from local gentries called *tokuno-ka*, whose ancestors used their personal money to fund critical community development projects. The village mayors equally shared the burden of the project with the farmers, and their sense of responsibility played an important role in consensus building and negotiation. As their communication roles diversified with the progress of post-war reconstruction, some of the village mayors became local politicians, while others fell behind (Dore 1959).

As national developmental goals shifted toward agriculture, local stakeholders were affected by changes in both the scale and purpose of water-related

Table 2. Number of dams, their purpose, and their available storage capacity, Japan, 1900–1993

Year of completion	Number of dams				Available storage capacity (1,000 cubic meters)	
	All dams		Dams for irrigation purposes		New	Total (accumulated)
	New	Total (accumulated)	New	Total (accumulated)		
1900–1925	200	788	161	749	85,618	183,202
1926–1945	412	1,200	289	1,038	623,682	806,884
1946–1955	219	1,419	139	1,177	1,220,263	2,027,147
1956–1965	355	1,774	150	1,327	5,180,546	7,207,693
1966–1975	327	2,101	150	1,477	3,218,732	10,426,425
1976–1985	267	2,368	97	1,574	2,421,685	12,848,110
1986–1993	188	2,556	88	1,662	3,666,213	16,514,323

Source: Adapted from Japan Dam Foundation (2005).

infrastructure, such as dams. The change in development scale and purpose coincided with a change of governance, as national authorities began to take over the management and implementation of large-scale water development projects. Dam building reached its peak in 1945, and available storage capacity peaked between 1956 and 1965 (see table 2). This indicates that the post-war period was a transitional time in terms of governance, stakeholders, development scale, and developmental purpose.

The Ooi River project was transitional not only from a historical perspective but also with regard to the type of irrigation projects. The targeted area was unusually large in relation to the length of the main canal, and the villages incorporated elements from both centralized and decentralized approaches into their project management practices.

It was more common at the time for irrigation-management projects to take a decentralized approach. In the local water system, water was provided by river diversion, which was traditionally supplemented by numerous small, local reservoirs that were interconnected to secure a reliable water supply. The water management unit was the village, the site of local demand. This demand-based approach was the most efficient and had the lowest cost under resource-limited conditions.

Robert Wade suggests that agricultural productivity is influenced by the manner in which irrigation water and water facilities are managed at the community and governmental levels (Wade 1982). His framework implies that as a project grows in scale the quality of management declines. This chapter shows that Japan's post-war water management practices led to an increase in irrigation productivity even though they represented a cross between a decentralized and a centralized system. Post-war Japan demonstrates that large-scale projects can be managed successfully and can have a positive impact on agricultural productivity,

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food security, economic revitalization, and other factors that contribute to post-war stabilization.

Official and unofficial interactions between the villages and the national government played an important role in these projects. Coordination between the national government and villages has been common since the beginning of the Meiji period in the 1860s. Several factors have facilitated effective and efficient communication between villages and the ruling elite.

First, family relationships aided efficient communication, coordination, and monitoring within villages despite the shift in management responsibilities from the villages to the national government. Conflicts of interest between villages concerning the quantity and timing of water intake could thus be addressed by the government authorities.

Second, sharing of accumulated knowledge about irrigation practices facilitated cooperation between villages, especially during abnormally dry periods (Sarker and Itoh 2001). When water is plentiful, the typical decentralized management system applies only minimal water controls because the need to limit water use does not exist. However, once water scarcity occurs, elaborate water-control techniques are required. Wade refers to this point as a “paradox” that characterizes decentralized irrigation water management (Wade 1982). Switching water-control techniques and placing limits on water use depending on the degree of water scarcity became common practice in Japanese water management.⁷

Finally, because expanding the land area affected by the project caused tension between the goals of land development and those of flood prevention, villages faced more risk of flooding and needed to request subsidies from the local government (Ooi River Land Improvement District 1976). The financial need necessitated effective communication on the part of local people.

Lessons from the Ooi River project

The Ooi River project had a positive impact on post-war peacebuilding and stabilization efforts. Most significantly, it involved the establishment of a continuous system of local governance that facilitated communication between national authorities and local communities throughout the series of projects. This bidirectional system of communication was important in building social capital, which yielded a flow of benefits to other development efforts. Because villages

⁷ This concept is demonstrated in the STIM model (Sustainable Triangle for Irrigation Management). The model shows that the relationships among three substitutable factors influence how irrigation water is sustainably managed: quantity of water available, cost of improving facilities, and labor costs for operation and maintenance. When available water is sufficient, water travels to the ends of even poorly built and leaking canals. During these times, it is difficult to justify the need to incur the costs necessary to improve the irrigation facilities. However, when water is scarce, repair costs become reasonable because the investment can alleviate the water shortage (Sugiura 2007).

were included in the governance structure and the benefits of the project were shared, various stakeholders contributed to the building of consensus and to the achievement of post-war food security and economic development objectives.

Transition of the management of large-scale irrigation projects from the villages to the prefectures and national government was inevitable as economic development progressed, and it was crucial to maintain open channels of communication between the different levels. This stands in direct contrast to changes in flood prevention that occurred during the same period.

FLOOD PREVENTION

World War II was one of the triggers that produced two major changes in the management of flood prevention in Japan: flood prevention was split from irrigation management, and it shifted from the village to the national level. Flood prevention requires significantly more involvement from the national government than irrigation because of its high-maintenance technology and river-scaled development. In post-war Japan, the effective shift of management responsibilities from villages to the national government provided safeguards that protected residents from flooding in the short term and led to land use planning that enhanced agricultural productivity in the long term.

The shift of flood-prevention management from the village to the national level, however, weakened stakeholder involvement at the village level, which turned out to be a problem in the long term, particularly in the 1990s when integrated water resource management required an exchange of ideas between communities and the national administration.

Flood-prevention associations

Flood-prevention associations had four primary functions before World War II: to collect money from beneficiaries to meet part of the construction costs of flood-prevention works under prefectural management; to engage in urgent flood-prevention measures; to drive irrigation and drainage projects; and to petition national or local governments to implement flood-prevention works using public funds (Uchida 1994).

Of these four functions, the two most important after World War II were collecting money and managing urgent measures for flood prevention. According to a Chiba Prefecture representative, empirical knowledge about effective flood-management practices and a rapid-response plan were required during emergency situations, such as when water flowed from the cracked concrete of a dam.⁸

Under the Flood Control Act, three entities became responsible for managing flood prevention: municipalities, public flood-fighting associations, and flood-prevention associations. Flood-prevention associations originated at the village

⁸ Interview with author, December 15, 2008.

level. Flood-fighting associations were established where management by a single municipality was regarded as unnecessary because of land features; they were funded by the municipalities in a particular area. In addition, as management by a flood-prevention association became difficult—for example, when it had trouble collecting member fees from residents—it could be reorganized into a flood-fighting association.

The fluctuating number of flood-prevention associations is an indicator of the changing popularity of the village approach (Uchida 1994). Furthermore, there is a relationship between the change in the legislation and the number of associations. Most notable is that a significant decrease occurred between 1942 and 1960, the period when irrigation associations were legally split from flood-prevention associations. After the revision of the flood-prevention legislation in the 1950s, which simplified administrative procedures, the responsibility for flood control gradually shifted from flood-prevention associations to municipalities and flood-fighting associations.

National-level management was required to a greater extent for flood prevention than for irrigation due to the high costs associated with flood prevention. Such a shift offers financial advantages to local stakeholders as well as short- and long-term benefits, such as increased agricultural productivity and facilitation of land use planning. However, it also weakens the power of stakeholders at the local level.

Before 1900, governmental sources of financing for flood prevention in Japan were relatively limited. Local governments had to cover a significant portion of the costs, not only of maintenance of flood-prevention works on major rivers but also for the improvement and maintenance of such facilities on small and medium-sized rivers. This was impossible for local governments to sustain without additional financial resources. Therefore, the River Act of 1896 permitted local governments to request financing from the national government for the establishment of flood-prevention associations, which could in turn obtain national funding to build and maintain flood-prevention works. The flood-prevention plan for 1933 allowed for the implementation of flood-prevention works on some small and medium-sized rivers without encumbering the local populations with the projects' costs (Kikuchi 2004).

Following World War II, Japan faced land degradation and food shortages caused by a series of typhoons. The National Resource Section of the Supreme Commander for the Allied Powers conducted comprehensive research into the potential of using natural resource management to ameliorate post-war problems such as food shortages (Cohen 1987). Land planning was one of the critical tasks proposed in a report to the U.S. Committee on Foreign Affairs, which, as a result of indirect rule by the Allied forces, led the Japanese government to place a high priority on flood prevention as a way to address the labor and food-supply shortages (Ackerman 1948). It became crucial, therefore, for the national and local governments to engage with flood-prevention associations. Both the diversification of stakeholders involved in flood prevention and the difference between

flood-prevention management and irrigation management then contributed to the diminishing importance of flood-prevention associations.

Flood-prevention projects such as dam construction and bank enhancement were remarkable improvements to flood-risk reduction. In the decade following the end of World War II, more than a thousand people a year were killed or reported missing due to floods. Since then, the number of people killed or missing due to floods has dropped to a few dozen annually (Takahasi 2011). The dramatic drop in the number of fatalities is considered a success of the legal changes that occurred during the post-war period.⁹

Resident participation

After the post-war period, residents' awareness of stakeholder issues related to flood prevention declined as a result of three factors: difficulties in gathering member fees, the change in collection methods, and the legal shift in management responsibilities from local governments to the national government. The decline of resident awareness meant the absence of stakeholder input, which was to be expected in the short term but turned out to be a problem in water management in the long term because stakeholder involvement is key to decision-making processes intended to secure water management coordination (Jønch-Clausen 2004). When local populations bear the cost burden, it increases the efficiency of flood-prevention works and raises the public awareness of stakeholders. But amid rapid economic growth and industrialization in post-war Japan, stakeholder interests shifted and diversified.

In 1981, the Ministry of Construction conducted a survey of people in the Tsurumi River Basin that focused on two concerns (Keihin Work Office 1981). The first was deteriorating awareness of flood prevention among those who had begun living in the river basin after World War II. The other was people's tendency not to share costs. In answers to questions measuring attitudes toward personal cooperation in three flood-prevention measures, fewer than 8 percent of residents displayed a favorable attitude toward cost sharing. This illustrates that residents regarded flood-prevention measures as a public work and considered there to be no need for local residents to bear the cost burden. Ultimately, the flood-prevention association in the area was dissolved.

Methodological changes in the gathering of member fees also resulted in residents having a diminished awareness of their stake in flood prevention. A hearing conducted on November 28, 2008, in Chiba and Osaka prefectures that

⁹ The most notable exception is the devastating tsunami that followed a 9.0-magnitude earthquake on March 11, 2011. In 1962 Japan began installing seawalls, banks, and protective structures with heights of approximately ten to twelve meters, although it was known that the seawalls were limited in their ability to protect the land from high waves and tsunamis (Isobe 1998). As it turned out, these seawalls and protective structures were ineffective against the force and height of the 2011 surge (MOFA 2011).

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focused on the Imba Tone River and Yodo River Left Bank flood-prevention associations uncovered several important issues (Imba Tone River Flood-Fighting Association 2008). The Imba Tone River flood-prevention association had collected member fees from each beneficiary until it was reorganized into a flood-fighting association in 1964. After the reorganization, the expenses for flood prevention were paid by a local municipal entity, which also took over responsibility for flood prevention. In a similar situation, the Yodo River Left Bank flood-prevention association reorganized into a flood-fighting association in 1958. The amount of money that had been gathered for flood prevention was so small that it was not worth the cost to collect a member fee from each person; high population turnover due to rapid economic growth had also made collecting member fees difficult.

When member fees were collected directly from local populations, residents were made aware of their stake in flood prevention. Also, when flood control was managed jointly with irrigation, residents had incentives not only for harvesting but also for coping cooperatively with natural disasters, such as floods and droughts. That system for flood prevention was efficient in pre-war Japan.

After World War II, however, due to the increase in population, the cost of flood-prevention works, and the increasing scale of construction, local participation in flood-prevention works was drastically reduced. Finally, the legal framework allowing local populations to bear the cost of projects through flood-prevention associations was eliminated in the 1964 revision of the new River Act. The flood-prevention and flood-fighting associations offer a number of lessons about the importance of local awareness of flood control and prevention. They also highlight the revenue effects of different types of governance.

Lessons from Japan's flood-prevention strategies

In post-war Japan, bottom-up associations for flood prevention were weakened while water users associations were not. Flood-prevention associations were undermined by beneficiaries' declining awareness of their stake in flood prevention—a decline that resulted from increasing government control and decreasing opportunities for local involvement. With regard to economic reconstruction, government control was an efficient short-term approach to urgent post-war problems such as flood control, although it was accompanied by a decline in beneficiaries' awareness in the long term.

Over time the necessity of bottom-up associations like flood-prevention associations became clear. Structures such as dams and banks are important for flood prevention, but they may not be sufficient in the event of an unexpected typhoon, when urgent measures are sometimes required to repair breached banks and evacuate flooded areas. Villagers and other local stakeholders are an important source of knowledge in such situations. Flood prevention thus requires involvement by both local and national governments.

Although top-down flood control was essential for post-conflict economic restoration in the immediate post-conflict period, over the long term it has not

adapted well to new challenges. This first became evident in the 1970s when residents in many regions filed flood-damage lawsuits, claiming that government flood-prevention works had been insufficient. The series of lawsuits shows that local stakeholders' awareness of the importance of their role in flood prevention was returning.

In the 1990s Japan implemented integrated water resource management to increase public participation in flood control. The 1997 revision of the River Act included improvements to and conservation of river environments. This resulted in a new planning system for river development that includes a set of environmental standards in addition to flood-prevention and water-use standards, incorporating ideas put forth by local residents. The communication system created by the new River Act conveys opinions and input from local residents to prefectural and national authorities.

As a consequence of rising environmental interest and integrated water resource management, residential participation has increased significantly, although there are few local associations to convey people's ideas regarding flood prevention to the national government, and therefore few opportunities to apply innovative community-based approaches and experiential knowledge to flood-prevention measures.

CONCLUSION

Irrigation and flood prevention in post-war Japan were managed in significantly different ways. The government maintained a bottom-up approach to irrigation management after World War II but initiated a top-down approach for flood prevention, with the national government replacing villages as the management unit. These two approaches give rise to several conclusions.

First, during the post-war transition, it was critically important to maintain open communication channels between local populations, the prefectures, and the national government. When communication operated effectively, irrigation projects were successful in contributing to a post-war increase in agricultural productivity.

Furthermore, limited human and natural resources must be allocated efficiently to meet urgent needs during post-war periods. With flood prevention, a top-down, government-oriented approach was the most efficient. Different goals require different approaches. The goal of irrigation is to increase agricultural productivity, and the goal of flood prevention is to decrease harm. Irrigation results in tangible immediate benefits and therefore encourages interaction between local people and the prefectural and national governments. Prevention of irregular events such as floods does not encourage the same degree of interaction. Therefore, a top-down approach became necessary for flood prevention.

Keeping incentives high for stakeholders' participation in water resource management, however, is required even in post-conflict situations. Post-conflict legislative changes should be made in a way that alleviates the risk of decreasing

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the incentives for local stakeholders to be involved. One water user group in the Gifu Prefecture of Japan managed to maintain stakeholder involvement in spite of the legislative changes, continuing to function as both a flood-prevention and an irrigation group. It dissolved itself in 1951, at the end of the post-conflict period, but it was reestablished in 1978, shortly after the area suffered the effects of a 1976 typhoon. The group operates outside of legislative control because the present legal framework does not provide for general water groups to do both flood prevention and irrigation. This case demonstrates that a bottom-up approach to both major aspects of water management can be effective.

Post-war Japanese water projects have been commended in the international community for their effectiveness, particularly in India, where Japan's natural resource management practices have been considered a model for land and water management reforms (Mitra 1992). Overall, the lessons offered by Japan's experience with water and land reform efforts following World War II provide valuable insight into how shifting the legal framework for natural resource management can enhance post-conflict peacebuilding and economic recovery efforts.

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