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The Development of Irrigation and Drainage on Shōnai Plain

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This paper is based on on-going research into the organization of rice agriculture on Shōnai Plain, one of Japan's major rice-producing areas.* One focus of this research is the pattern of agricultural water supply on the plain, *i.e.*, the technical and social organization of irrigation and drainage. An attempt is being made to assess both the role of irrigation-drainage arrangements in shaping agricultural work groups and the importance of irrigation-drainage as an interface between local interests and national bureaucracy and policy objectives.

Shōnai is a coastal plain of about 530 sq. km. in Yamagata Prefecture. It is surrounded on three sides by mountains, and to the west, it is separated from the Japan Sea by a thin line of sand dunes. The principal water source for the southern half of the plain is the Aka River and its tributaries. The Aka River flows north from the mountains onto the plain at its southern end; the river flows across the plain in a generally NW direction, irrigating 13,000 ha. of paddy (1).

This paper is but a brief sketch of some features of the development of irrigation-drainage in this Aka River area. Construction

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projects and organizational changes in the recent past have stabilized the water supply for rice cultivators, and conflicts among cultivators and between agricultural and non-agricultural interests appear to be largely neutralized. However, the critical importance of water as an input in rice cultivation insures that even in periods of security, the water-use methods and network will remain a cornerstone of rice production organization.

On balance, the natural conditions of the plain do not inhibit a prosperous rice cultivation, but neither have they lent themselves easily to the present advanced state of Shōnai agriculture (2). Reclamation of the low-lying sections has required considerable time and effort, and soil conditions need careful attention to maintain a high productivity (3). The cold winter closes in on the growing season from both the spring and autumn ends, and while the melting snow provide a plentiful water supply, the control of the Aka and other rivers has from the surrounding mountains provided plentiful water for spring planting, the steep river grade and the consequent, fast run-off has led to periods of drought in the summer months: the control of the Aka and other rivers has required centuries to accomplish.

The *han* period.

Although wet-rice cultivation on the plain can be traced back about 1200 years (4, 5), as with other downstream plains (6), effective irrigation-drainage networks were not established along the Aka River until the Edo period. Once developed, however, they have continued to serve until the present-day as the basis of agricultural water use. Until the completion of a unified head works in 1970, irrigation water along the Aka River was drawn by nine separate intake works. Corresponding to each intake was a group of water users which shared, by means of a system of canals and division works, the

water drawn through the intake. Both the intake weir itself and the body of water users were termed a *seki* (except in the case of Shoryujigawa). Of the nine, the upstream Shoryujigawa and the downstream Inaba Seki and Nakagawa Seki are conspicuously larger in area served than the remaining six.

Name of <i>seki</i>		Irrigated acreage (ha.)	Intake location
1.	Kumaide Seki 熊出堰	45	left bank
2.	Sankason Seki 三ヶ村堰	48	left bank
3.	Shoryujigawa 青龍寺川	5,200	left bank
4.	Ogawa Seki 大川堰	110	right bank
5.	Shida Seki 志田堰	350	left bank
6.	Inaba Seki 因幡堰	1,500	right bank
7.	Gokamura Seki 五ヶ村堰	240	left bank
8.	Nakagawa Seki 中川堰	4,000	right bank
9.	Daihoji Seki 大寶寺堰	47	left bank

NB: order of *seki* is from upstream to downstream.

Throughout the Edo period (during which Shōnai *han* remained under the control of the Sakai family), Shoryujigawa apparently enjoyed a preeminent position among the *seki* in terms of water intake rights; in the dry periods of July and August, when it constructed a temporary cofferdam across the river to maintain the flow to its intake, representatives of the downstream *seki* had to journey to the Shoryuji intake and, following prescribed procedures, enter requests for irrigation water (7, 8). This superior position was no doubt due in part to the upstream location of Shoryujigawa, a situation common in Japanese river irrigation (9), but it is also due to rights accorded it by the *daimyo* as one of its tributaries, the Uchi River, flowed through Tsuruoka, the castle town, and was the source for the castle moat (10).

The Aka River itself was under direct *han* jurisdiction; flood control matters were under the control of the *gun* officials, while large-scale river works came under various *han* engineers. *Han* control even extended into the individual *seki*. Under the *gun* district official were assistants who oversaw water gate, channel, etc. construction (郡手代), officials who handled quota allocations for laborers (割役), local officers who functioned as labor group foremen (杖突), and of course the tier of administrative units within each *gun* (i.e., 通/組/郷村). And, in addition to these various officials under the *gun*, there were *seki* administrators and guards of the irrigation facilities themselves (大堰守/堰守/水門守) (11).

Allocation matters within the individual *seki* appear from surviving documents to have been conducted by the village *kimoiri* and the *kumi daishoya*. At the same time, the involvement of *han* officials in such negotiations and in matters of canal maintenance, *han* financial assistance in intra-*seki* repairs, and its direction of construction and labor requisition all suggest a strong degree of both concern and control over local irrigation-drainage matters. This would be congruent with other aspects of Sakai *han* policy—the rice warehousing network, the rice voucher system, involvement in the rice trade (12, 13, 14)—which indicate a conscientious attention to rice production and marketing.

The period of Irrigation Association (Meiji to post-World War II)

With more pressing demands, the new central government in early Meiji was slow in formulating a water resource policy, and when it did develop, it was initially based on “low-water” river works, projects designed to improve and protect major rivers as commercial arteries; engineers were brought from Holland as advisors, and through the third decade of Meiji, emphasis was in this direction. Only later did official attention shift to “high-water” flood control

projects of more direct benefit to agriculture—in line with railroad expansion which rendered river transport obsolete. Even when the policy and financial resources of the central government did shift to flood control, as reflected in the River Law of Meiji 29, application of the law to local rivers was slow, *e.g.*, the lower Aka River was not placed under the law until Taisho 6, the upper sections even later (2). Actual government-directed projects were even slower due to resistance of many local landowners who feared adverse changes to existing irrigation facilities and procedures (15).

National legislation concerning irrigation organization was more quickly forthcoming and played a role in the gradual shift to landlord-dominated irrigation arrangements in many areas, including southern Shōnai. A local administration law in Meiji 13 (區町村會法) and a similar law in Meiji 17 led to an association of all villages served by Aka River water but resulted in only formal changes in the organization of the *seki* themselves. Existing procedures for officials' duties and salaries, irrigation expense burden, etc. were ratified by charter, but the only references in these new documents to specific water allocation was that it was to be conducted ‘in accordance with customary procedure’ (16).

In Meiji 23, a new government ordinance (水利組合條例) led to the further reorganization of irrigation groups into Irrigation Associations (普通水利組合), an organizational form which remained with modifications until the post-World War II Land Improvement District period. The individual *seki* each became separate Irrigation Associations, and the Aka River association, too, became the Aka River Irrigation Association. However, while the former were local groupings for water allocation and facility maintenance within a single canal network, the latter was essentially an alliance of the nine *seki* for the purposes of flood control and river works which would assist the water flow to the *seki* intakes.

Among the projects undertaken in the Meiji and early Taisho periods by the Aka River Irrigation Association were watershed and water source conservation projects (the end of the *han* had led to the breakup of the *han*-controlled watershed forests, and subsequent heavy cutting led to watershed erosion and faster run-off); embankment construction along parts of the river; and revetment works to assist flow to the *seki* intakes.

From mid-Taisho, local leadership initiative, some government financial assistance, demands from farmers and landlords, and other factors led to an even more active role for the Aka River Irrigation Association. In this period, construction of continuous embankments, digging of the direct discharge channel to the sea, and rebuilding of all *seki* intakes led to a resolution of the centuries-long flood control problem. The introduction of hydroelectrical generation technology and the construction of upstream hydroelectric facilities resulted in the rapid diffusion of water pumps, which supplemented the canal water supply. This, together with the establishment of a control gate at the outlet of the upstream Otori Lake, led to considerable improvement in river water utilization.

These pre-war projects resulted also in major modifications in the inter-*seki* water allocation procedures. In particular, there was a trend to an equal, per-acreage water distribution principle and a rise to preeminence of the Aka River Irrigation Association as the arbitrator superordinate to the nine individual *seki*. This situation was not in fact originally intended, as the Aka River Association was given no authority by the member *seki* to handle river water allocation. Gradually however, with diffusion of electric pumps and river projects, total water supply was both increased and stabilized, and pressure was brought by the downstream Inaba Seki and Nakagawa Seki against Shoryujigawa for readjustment in the customary, unequal water division. With administration responsibility for all river facili-

ties (except the separate *seki* intakes), the *de facto* power of the Aka River Irrigation Association was considerable, and the downstream *seki* chose to work toward their objective of equal water allocation by strengthening the role of the Aka River Association. Whereas the downstream *seki* had previously brought their request for additional water directly to the Shoryujigawa officials at the latter intake, they now forwarded them to the Aka River Association which acted as an intermediary, passing them along to the Shoryuji officials. Gradually the Aka River Irrigation Association officials developed a more active role in the negotiations, and a study of the various dry season agreements in early Showa clearly indicates trends towards equal per-acreage division of water volume and to a general acknowledgement of the Aka River Irrigation Association as administrator of water allocation (16).

From Meiji to World War II, Shōnai was one of the typical landlord-dominated rice plains, and landlord influence extended to irrigation affairs as well. In the Meiji 23 Irrigation Association Ordinance (水利組合條例), the central government had attempted to distinguish between local administrative units (i.e., cities, towns, and villages) and irrigation groups and to give responsibility to the latter only where the boundaries of the former units did not lend themselves to management of an irrigation-drainage network. However, the administrative units were poorly organized at the time, and landowners were not eager to lose direct control over water affairs, so in most cases, irrigation associations were formed—or rather reorganized from existing groupings (17). The membership criterion for these Meiji associations was paddy ownership and not cultivation; this was strengthened in the subsequent Irrigation Association Law of Meiji 41 (水利組合法), and these groups remained landowner and not cultivator groups until the post-World War II period.

There is little evidence thus far to contradict the general notion of

the widespread influence and control of the landholding strata in Shōnai agricultural and political affairs, including irrigation, in this pre-war period (16). At the same time, it is necessary to specify the nature of this landowner involvement as there were various patterns of paddy landholding (18). In late Meiji, of the 42 landlords in Higashitagawa-*gun* and Nishitagawa-*gun* with over 30 *cho*, 6 were on the 34-member council of representatives of the Aka River Irrigation Association, the other 28 members having smaller landholdings. This and other evidence suggests that this irrigation organization was dominated more by the smaller, resident landlords and wealthy cultivating landowners than by large, non-resident landlords (19).

Irrigation-drainage projects of this period must be viewed not only in the context of landowner organization but also in the context of sweeping changes in agricultural methods which Shōnai experienced in late Meiji, Taisho, and early Showa. Changes in land tax legislation, increased demand for rice, and other factors encouraged paddy owners to seek per land unit increases in productivity and set the stage for the acceptance of new rice cultivation methods developed in the Meiji period by experienced farmers (老農) working by themselves or in conjunction with the nascent agricultural schools. These methods, collectively known as the Fukuoka Agricultural Methods, were based on two major changes—animal-drawn plowing (in Shōnai, primarily the horse) and periodical paddy field drying (a change from the past, year-round standing water method) (20). Beginning in Meiji 14, at a national meeting (全國農談會) held in conjunction with an agricultural exhibition in Tokyo (勸業博覽會), government-sponsored agricultural societies (農談會 and 農事會) on prefectural and local levels encouraged adoption of these methods. In Shōnai, acceptance was particularly enthusiastic and rapid, as landlords went to Fukuoka and elsewhere on study trips and brought in farmer-teachers who through circuit seminars and demonstration plots diffused the new

techniques (21, 22).

The success of the Fukuoka Methods was tied to, among other factors, paddy of orderly shape and adequate size for horse plowing and improved irrigation-drainage facilities to meet increased water demand (roughly 1.4 times standing field method) and the need for effective drainage. The latter provided incentive to the Shōnai landowners to invest in Aka River area irrigation-drainage improvements, while the former was realized through an extensive paddy readjustment program based on the Meiji 32 Arable Land Leadjustment Law (耕地整理法). In Yamagata Prefecture, this program was carried out through the Agriculture Societies on the *gun* level, and as with the introduction of the Fukuoka Methods, it was initiated and directed by the landowning strata. This is seen in the control of the Agriculture Societies by the Shōnai landlords and in the provisions of the law itself (a project was initiated with the permission of 2/3—and later, 1/2—of the paddy owners in an area, calculated in terms of acreage, land tax, and landowner numbers) (19, 21).

The projects themselves were administered by a local Paddy Adjustment Association (耕地整理組合), and from the standpoint of some bureaucrats, there was organizational confusion with the irrigation associations. For example, the former were under the Ministry of Agriculture while the latter were under the jurisdiction of the Ministry of Internal Affairs. It was intended that the Paddy Adjustment Associations would disband upon completion of the project and turn over ownership and administration rights of any facilities constructed (e.g., irrigation channels and division works) to the relevant Irrigation Association, but in parts of Shōnai, it appears that they continued to exist as units within the Irrigation Association. Further work must be done on this point, though it appears that this confusion did not detract from and may have enhanced the owner-sensitive and not cultivator-sensitive changes in cultivation methods and paddy

conditions characteristic of this period.

The Land Improvement District period

Nearly to the extent that the post-war Agricultural Land Reform altered relations of farmland holding, the Land Improvement Law (土地改良法) of Showa 24 altered relations surrounding irrigation and drainage. There were four aims of the law. First, whereas membership in the previous irrigation associations had been limited to paddy land owners, the new groups were to be associations of cultivators (though of course through the Land Reform, the two categories had come to be filled largely by the same personnel). Second, the law was intended to combine the separate organizational lines of the pre-war period, the irrigation associations and the paddy land adjustment associations, into a single Land Improvement District, which would handle both land improvement and irrigation projects, maintenance of existing facilities and water allocation.

In addition, the law was intended to give legislative basis to national and prefectural operated irrigation-drainage projects, and in the past 30 years, the government has come to play a major role in the planning, financing, and operation of Land Improvement District projects (23). Fourth, the law attempted to give firmer guidance to paddy exchange and amalgamation of individual holdings, long an objective of government policy.

The Land Improvement District, as a 'folk concept' of bureaucratic organization, thus combines both maintenance and new construction, both water use and paddy land improvement—confusing those analysts who would try to distinguish simply 'water' inputs and organization. An example of this integrated approach is the current paddy field consolidation projects (圃場整備事業) now being conducted in the Aka River area, as elsewhere, by the Land Improvement Districts with substantial guidance and financial support from the prefecture and

central government. These projects combine the rebuilding of existing paddy into larger, rectangular fields of 30 areas or more, widening and straightening of the farm road pattern (for better machinery access), and improvement of the water channel network (through separation of delivery and drainage ditches, pipeline irrigation, etc.) (24, 26). Following the project, a paddy exchange is conducted by the Land Improvement District in which the previous fragmented and dispersed holdings of an individual household are brought together into proximate, large blocks.

Following the Land Improvement Law, the Aka River area irrigation associations quickly adopted the Land Improvement District form. The smaller associations on the left bank were later absorbed into the Shoryujigawa Land Improvement District, and at present there remain four related districts—Shoryuji, Ogawa, Inaba, and Nakagawa. The broad features of district organization are prescribed by legislation, although differences can be seen in the relative influence of the cultivator members, the elected representatives, and the salaried officials of the district (24, 25).

At first, the Aka River Irrigation Association too reformed itself as a Land Improvement District, which duplicated the *seki* districts. However, it had always been more properly an organization of the separate *seki*, without a separate constituency of its own, and by 1956, it assumed the more natural form of a Land Improvement District Association (赤川土地改區連合) (27).

Post-war dam construction together with the pre-war embankment works allowed for nearly complete regulation of high and low water periods and brought about internal stabilization of relations among agricultural water users. However, additional hydroelectrical and multi-purpose dam construction in the 1950's by Tohoku Electric Company led to a protracted dispute over damage to agricultural water use in two respects—a fall in river water temperature and a

lowering of the river bed which seriously complicated water intake at the *seki* (i.e., the silt and rock material which had been carried downstream by the river to maintain the river bed was stopped by the dams). In this dispute, the fact that relations between the *seki* had been stabilized allowed them to present a united bargaining front under the leadership of the Aka River Association; the result was an agreement which protected the agricultural interests and brought a sizeable indemnity payment from the electrical company. In turn, this indemnity was used to partly finance what was by then the obvious and necessary technical solution to the intake problem—a unified head works at the point where the river entered the plain and from which all the Districts would draw irrigation water (16). This program was undertaken from Showa 40 under the direction and financial support of the Ministries of Agriculture and Construction and in conjunction with additional national and prefectural projects which redesigned and rebuilt all the major irrigation and drainage channels, installed supplementary pumping stations, and initiated the paddy consolidation program. The total cost of all of these programs, intended to benefit a paddy area of about 13,000 *cho*, is estimated at \$163 million (490 億圓).

The result of this massive program is that agricultural water supply is fully adequate, reasonably guaranteed, and at least as far as the secondary channels, rationally organized. Local problems remain in paddy water use, drainage, etc., but the general water control and irrigation supply problem appears to be solved. One is tempted to add 'finally solved,' but there are several caveats to be noted. First, while non-agricultural water demand is low, further hydroelectrical generation or industrial development could conceivably come to restrain agricultural water supply; this is of course a major problem elsewhere in Japan, though not yet of concern in Shōnai.

More importantly, the rather sophisticated solution to water control

in Shōnai has come at the expense of local cultivator control over the water supply and delivery system. The Aka River itself is no longer under the control of agriculturalists, be they landowners or cultivators. The Aka River Land District Association has operating responsibility for the headworks and the main canals while ownership itself is retained by the national government. Even the cultivators' usufruct water rights are expressed as a transferred right from the Minister of Agriculture, who is formally given irrigation water intake rights from the Minister of Construction, representing the public ownership of river water. These maintenance conditions together with the centrally-directed course of recent projects suggest considerable leverage by non-local interests over Aka River area irrigation. This is perhaps of no immediate concern to the cultivator who at last receives a secure water supply; it may be a desirable, or at least necessary, trade-off. However, should the supply and demand conditions change, the freedom of action of local agricultural interests will have been somewhat compromised.

The social significance of irrigation and drainage.

This paper has briefly described some features of the development of agricultural water use and organization along the Aka River. In closing, I would like to suggest why such data are important for a social anthropological study of rice cultivation.

Water is a crucial input in rice cultivation, and the supply and manner of delivery and use is of critical concern to all involved in the production of rice: the cultivator, the paddy owner, the officials of the larger society, etc. From this follow two probable consequents. 1) It may thus be expected that the nature of irrigation-drainage will affect directly the relations among cultivators in growing rice and affect, at least indirectly, more general patterns of cooperation and conflict in a rice-growing area.

For Japanese villages, this is often cast in the following terms: relations of water bind a village as a cooperative unit, while relations of land bind a household as a cooperative unit (28). Yet when one begins to explore individual situations carefully, a number of further distinctions become necessary; for example, different bases of cooperation in water affairs among cultivators must be distinguished. In some Tokugawa period villages, the concentration of water rights in the hands of the titled farmers was one element binding titled and non-titled farmers in a complex of hierarchical economic and social relations (29). By comparison, a careful study by Kakizaki of irrigation in an Okayama *buraku* (Niiike), reveals a seeming balance of power underlying village water relations. That is, Niiike paddy are connected to three separate irrigation networks, and an analysis by household and household group (株内) of paddy holdings showed that the holdings of each are fairly distributed among the three irrigation systems. Thus, no one household or household group can effectively control a single irrigation network, and all must pay attention to each of the three (30).

Present-day Shōnai presents a complex maze of cultivator groupings and relations, and assessing to restraints or directions which irrigation factors may give them is difficult. One source of difficulty is there appear to be few exclusively irrigation groups on a local, *buraku* level: often irrigation-drainage matters are handled individually through the Land Improvement District representative, through the *buraku* production cooperative (生産組合・実行組合等), or through temporary groups, such as project associations for paddy consolidation (第一區推進協力會).

A second difficulty is the complexity of present cooperative arrangements surrounding rice growing. Shōnai is well-known for the recent development of *buraku*-based group cultivation (部落ぐるみの集團栽培), but there are many meanings to this term. It can mean coopera-

tive agreements regarding rice varieties to be used, fertilizer type and purchase, weeding, water application, and the work calendar (栽培協定); it can mean work groups which jointly conduct some or all of the cultivation tasks, e.g., transplanting, weeding, harvesting (共同作業); and it is used to describe cooperation in the form of joint ownership and/or use of farm machinery such as tractors and harvestors (共同利用) (31). Within a particular settlement, one may find all three types in varying strength and form as well as purely single household operations (32). While some have argued that characteristics of irrigation method and paddy conditions constitute the primary cause of the development in Shōnai of such groupings (33), the complexity in type and distribution is clearly indicative of many factors, only one of which is irrigation-drainage. Others include changing national agricultural policy; prefectural and Agricultural Cooperative encouragement of particular rice varieties; technical imperatives of fertilizer use and machinery; methods of machinery financing; economic factors external to agriculture, leading to the drain of farm labor, etc. (34).

A third difficulty in assessing the role of irrigation in the organization of Shōnai rice cultivation is the transitory nature of present-day patterns. When one examines Shōnai cultivation arrangements over the past 15 years, one is immediately impressed with the ephemeral nature of many of the patterns of cooperation; for a particular settlement—or individual household—they may vary considerably from year to year. This is no doubt due to the fast-changing economic and technical environment of rice cultivation at the present time—an unstable agricultural policy, rapid changes in machinery and cultivation techniques, movements in the national economy, and, to be sure, the recent irrigation projects and paddy consolidation program touched upon here.

2) It also follows from the importance of water in rice cultivation

that matters regarding irrigation-drainage will constitute an arena of social relations among local cultivators, landowners, local officials, prefectural and national bureaucrats, and others with a stake in the disposition of water resources. Even this short sketch of Aka River irrigation organization has hinted at the complexity of such relations and the changes over time in the balance of control over water use. The role of *han* officials in construction and maintenance of irrigation-drainage facilities, the landowner-dominated Irrigation Associations, and the strong government direction of the present Land Improvement Districts all suggest that the cultivator has always had something less than full control over water utilization. This is, however, hardly surprising; indeed, it would be difficult to imagine how a cultivator-directed development of Aka River water would proceed. Yet it is inadequate merely to take note of irrigation affairs directed from above. The *gun* official of Shōnai *han*, the local landowner of Meiji and Taisho times, and the present-day ministry bureaucrat represent, respectively, regional, local elite, and national levels of society; each has had varying interests in Aka River irrigation-drainage, and only when these are traced out separately can we begin to appreciate the development of Shōnai irrigation-drainage and the changing relations between the plain and the larger Japanese society.

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