Program: Grants for Improving Doctoral Dissertation Research in the Social Sciences
Amount: $5,138.  Effective Date: September 1, 1975  Duration: 18 months
Title: An Ethnography of a Japanese Irrigation System
Principal Investigator: William Wright Kelly, Social Security Number 030-40-8076
Dissertation Advisor: Robert C. Hunt, Assoc. Professor, Brandeis University
Submitting Institution: Brandeis University  Department: Anthropology
Address: Waltham, Massachusetts, 02154
Make grant to: Brandeis University

Endorsements:

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Dissertation Advisor:
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Section A: Abstract.

This dissertation research will investigate the operation of a multi-level canal irrigation system in rural Japan during an annual cycle of planning and use. It will combine data on the resource characteristics of the water supply, the physical network of water delivery and drainage, and the social structure of administration and allocation. The methods to be used are documents study, interviews with officials, and extended observation of the irrigation system itself through an annual cycle of operation. Fieldwork will be conducted in Japan from September, 1975, to February, 1977. Because irrigation is widespread in rural Japan, an ethnography of an irrigation system will expand present knowledge of rural Japanese social structure by complementing the existing community and kin group studies.
I. Research objective

The objective of this dissertation research is the case study of a multi-level canal irrigation system in rural Japan. The resulting ethnography will combine data on the resource characteristics of the water supply, the physical network of water delivery and drainage, and the social system of administration and allocation.

II. Present state of knowledge.

Irrigation is one of man's most significant technical developments. In arid environments of the world, agriculture is not even possible without human modification of water resources (cf. Trewartha 1961). In other parts of the world, such as monsoon Asia, where the water supply is too seasonal and variable to be reliable to cultivators, irrigation and drainage works are necessary to assure adequate yields (cf. Hanks 1972; Wickizer & Bennett 1941). For monsoon Asia, it has been shown further that improvements in water control can bring dramatic increases in agricultural productivity (Yamada & Lusanandana 1969:159-63).

Anthropologists have conducted research in a number of societies with irrigated agriculture, although at times they have paid little, if any, attention to the irrigation system (e.g. Betellete 1965:105) and at other times have approached irrigation only as it impinges on community structure (e.g. Gallin 1966:79-87; Lewis 1971:128-47; cf. Bennett 1974:70). Recently, however, the works of Steward (1955) and Wittfogel (1957) have underscored the theoretical importance of irrigation for social structure. Within anthropology, they have generated an interest in, among other issues, the functional relationships between irrigation, political structure, and social stratification, both on the level of total societies and on the level of small localities (e.g. Downing & Gibson 1974). Among macro-level proposals, Wittfogel's argument, that under certain conditions, irrigation supports a centralized, ruling bureaucracy, has been
challenged by Millon (1962), who claims there is no relation between irrigation and centralization. Among micro-level proposals are hypotheses about the role of local elites in water-dispute resolution (Hunt & Hunt 1974:153), about the relationship between allocation principles and ecological characteristics of the water supply (Glick 1970:230), and about the effects of equalizing access to water on irrigation conflict (Pasternak 1968).

At the moment, a major stumbling block to the resolution of these hypotheses is the paucity of data on irrigation systems; anthropology still lacks detailed studies of irrigation systems (cf. Bennett 1974; Netting 1974). In a recent cross-cultural exploration of canal irrigation and social structure, it was possible to find only a handful of anthropological studies of irrigation in sufficient detail to be useful (Hunt & Hunt nd). The research proposed here is addressed to this need for ethnographic data.

In Japan, wet-rice cultivation has been the basis of agriculture for the past two thousand years (Chard 1974; Ishida 1974); as rural Japan is predominantly agricultural, rice cultivation is of fundamental importance in understanding rural social structure (Nakane 1967:58). However, for much of the country, the availability of a proper water supply for rice cultivation is rendered highly problematical by conditions of water scarcity or flooding (Noh & Gordon 1974:3; Trewartha 1965:78; Kensetsushō 1973:18). Over the centuries, these conditions have led to the construction of thousands of irrigation systems; currently about 50% of Japan's cultivated acreage is irrigated (Eyre 1955; Nōrinshō 1972:9).

Despite their importance, irrigation systems have seldom served as units of analysis for investigators of rural Japan. In English, there is only the brief and largely normative report of the Twelve-Gō system of Okayama by Eyre (1955; cf. Beardsley et al. 1959:132-3). Japanese geographers such as Horiuchi (1963) and Takeuchi (1965) have described technical and administrative aspects of irrigation systems, and legal sociologists such as Watanabe (1954) have reported on water rights, but studies which integrate ecological, technical, and social structural
data for a single system are lacking.

Much of our information on irrigation practices in Japan comes from community studies in which the hamlet (buraku) is often the unit of analysis; in these studies, irrigation is of interest for its functional contribution to hamlet organization. Most commonly, irrigation is said to promote hamlet solidarity through the cooperation needed to run a complex water-flow system (e.g., Fukutake 1972:82-4; Johnson 1963:220; Nakane 1967:43, 74; Yoneyama 1967:341). Others argue that hamlet integration declines with participation in large-scale irrigation systems (e.g., Befu 1962:293-307; cf. Ramseyer 1969).

However, the community study provides only a partial view of irrigation because in Japan, the technical and social structures of an irrigation system can cross-cut settlement patterns in complex fashion. An irrigation network may be smaller than a single hamlet (e.g., Cornell 1956:129; Plummer 1964:75-77) or may embrace tens of hamlets (e.g., Befu 1962). Paddy fields of Niike hamlet, for example, are linked to one of three separate irrigation networks, each with a different water source and administrative structure. Depending on the location of his fields, a Niike cultivator may be involved in all three networks. One of these, the Twelve-Gō irrigation system, to which approximately half of Niike's fields are linked, has four levels of administration, each with successively larger memberships (Beardsley et al. 1959:132-3; Eyre 1955).

In such a situation, it is difficult to maintain that irrigation bears a fixed and simple relationship to hamlet solidarity. To understand that relationship clearly—and to understand the technical and social structure of irrigation itself—the irrigation system must be adopted as the unit of analysis.

III. Description of project and methodology.

A. Definition of project.

The research proposed is a synchronic case study of a multi-level canal irrigation system on an alluvial plain in rural Japan. As a synchronic investigation, it will examine a particular system during an annual cycle of planning
and use. It will not be concerned with the origins and development of the
system; such work is important but constitutes a separate project. Nevertheless,
because water is a resource whose availability varies annually, local records
of past years' rainfall, water flow, water table, etc. will be used to place
the observation year in the perspective of the recent past.

The proposed unit of analysis is a multi-level canal system. Canal irri-
gation in Japan, in contrast to pond-ditch networks, tends to serve a wider
area and involves, in the same physical network, a number of water user groups
with separate claims. Furthermore, among canal systems, one may broadly distin-
guish between single-canal systems, which serve in series a small number of
groups (e.g. Yoneyama 1967:225), and multi-level systems, in which canals sub-
divide and water is allocated at several levels to groups of successively smaller
memberships (e.g. Eyre 1955). The latter systems are of particular import because
the "multi-level" characteristic implies that lines of potential cooperation
and conflict among water users are redrawn at each level. If in fact the system
of resource utilization generates shifting patterns of cooperation and conflict
among its users, this will contrast sharply with the reports by community
ethnographers of rural Japan that emphasize fixed lines of alliance and
contention (e.g. Johnson 1963; Nakane 1973).

The proposed locale of the study is an alluvial plain. The reason for this
is simply that although there is some irrigation in the diluvial upland areas
(Cornell 1956; Embree 1972; Plummer 1963), multi-level canal systems are generally
limited to the broader, alluvial plains. A number of possible sites exist--
including the Tsukushi Plain in Kyūshū, Okayama Plain, the Ōmi Basin in Kinki,
the Mikawa Plains in Tōkai, and the Senpoku-Sendai Plains in Tōhoku-- but the
system will not be selected until arrival in Japan. Selection will depend on
consultations with my advisor in Japan, the availability of adequate records in
the local area, and the willingness of local people to cooperate in the study.
B. Framework of research questions.

Given the aim of producing an ethnography of a canal irrigation system, data will be collected for the following categories:

**ecological context**: source river characteristics; water shed area; geological features; water and nutrient requirements of local rice varieties; soil, yield, drainage, acreage of paddies in study area; features of growing season.

**physical system of irrigation**: physical network of canals, ditches, water gates, lifting devices, etc. which divert, deliver, and drain water; locations of water allocation; techniques for measuring and allocating water.

**water rights and allocation principles**: (for each level in the system) nature of water rights, holders of rights, basis of claim; relation of water rights to land ownership; obligations associated with water rights (water taxes, labor).

**administrative structure of irrigation**: jurisdictions, responsibilities, and structures of formal and informal irrigation cooperatives within system; functions of other irrigation groups and roles, e.g. advisory councils, water guards; embeddedness of irrigation administration in political administrative structures.

**the system in operation**: actual behavior in an annual cycle of operation. For example, potential lines of conflict of interest are suggested by the distribution of water rights and network of canals; this final category includes which disputes actually occur: on what levels they arise, whom they involve, how they are resolved, and to whose satisfaction they are resolved. Do intra-system disputes interfere with cooperative action against other systems or governmental agencies? And, given the administrative structure, to what extent is actual control placed in the hands of, or assumed by, a few persons, as has been observed for "common-interest" associations such as Agricultural Cooperatives (Norbeck 1967)?

C. Methods.

The bulk of research will be the long-term observation of the system, including attendance at meetings, observations of water allocation at all levels,
questioning of water users and non-users, and other activities associated with
the participant/observer mode of anthropological research. My wife and I will
live in the area for the duration of the observation period.

While activities at each level of the system must be observed, special
attention will be paid to two particular sets of fields, one in the upper section
and the other in the lower section, as location is often a factor in differential
participation in irrigation (Efu 1962:74; Gibson 1974:10). For each set of fields,
the following will be studied: distribution of water to each paddy; paddy ownership;
other holdings, residence, and other characteristics of cultivators; nature of
cooperative activities and water use conflicts; and patterns of decision-making
and conflict resolution.

However, in a complex, literate society, anthropological observation must be
supplemented by the study of documents. In an investigation of irrigation, data on
the natural and technical features are to be found in climatological records,
geological surveys, and engineering reports. Charters and other records of irri-
gation cooperatives are necessary for the normative aspects of administration.
Population registers and land ownership records provide data on cultivators and
land use. Court cases detail water disputes which reach formal adjudication. The
study of such documents cannot be ignored in research on an irrigation system; thus,
as discussed in the attached budget, funds are requested from the National Science
Foundation for document search, collection, copying, and translation assistance.

An additional category of necessary documents is maps, both those found in
the town offices and the land use and geodetic maps prepared by prefectural and
national ministries. Because certain features of irrigation are not included in
sufficient detail on these maps (e.g., location and type of field intake, discharge
points, inter-field flow points), it will be necessary to hire cartographic assist-
tance in the preparation of one-foot contour maps of the two field sets to be
studied in depth.

Finally, observation of the system will be supplemented also by interviews
with officials of national ministries (relevant bureaus of Nōrinshō and Kensetsushō)
and prefectural agencies (as, for example, river maintenance is the responsibility
of the prefectural government). Interviews will be conducted in Japanese, as will the field observation.

D. Preparations for the proposed research.

Field research: As part of my graduate program, I completed three months of field work in a rural area of northern Maine in 1972; my research, on the structure of lumbering and its consequences for the social organization of local residents, was reported in a series of five papers. Both the topic (the technical and social structure of resource utilization) and the methods required (documents study, interviews, and observation in the local community) have provided training for this proposed research.

Previous study in Japan: From January to August of 1974, I was a Visiting Scholar in the Sociology Department of Doshisha University, Kyoto. My activities included language study and library research on rural social organization and irrigation in Japan. I have recently completed a paper based on that work (Kelly n.d.).

Language study: My language study, including eight months study and residence in Kyoto, is summarized in Section F of this application. This summer I will complete an intensive, fourth-year course in Japanese before beginning fieldwork.

Fieldwork arrangements: At present, arrangements are incomplete, although I have been in correspondence with my former advisor at Doshisha (Prof. Kikuji Itô) and with Dr. Toshinao Yoneyama, a research professor at Kyoto University. Dr. Yoneyama has expressed an interest in the project, and I am hopeful of securing sponsorship for my work with Kyoto University.

IV. Significance of proposed research.

Increasing attention within anthropology to "irrigation's impact on society" (Downing & Gibson 1974) has underscored the paucity of ethnographic data on this form of resource utilization. Current comparative work in irrigation (e.g. Kappel 1974) has been forced to rely on, for the most part, community studies and other reports which often provide only incomplete information on irrigation
practices. Future comparative work must proceed from an improved data base of case studies which deal directly with irrigation as the unit of analysis and which combine materials on its natural, technical, and social features. This dissertation research is intended as one such case study.

Among irrigation societies, Japan is an especially appropriate choice for research. With a long tradition of record-keeping, even at local levels, one can find the detailed information on population, land holding, and land use which is necessary for a case study. As part of monsoon Asia, its irrigation systems must contend with problems of water superabundance, flood control, and drainage (cf. Geertz 1963:28-37; Spencer 1974); as such, it offers an instructive contrast to irrigation in the arid environments of Mesoamerica and the Middle East, which have been more frequently investigated. Moreover, in terms of improving water resource utilization strategies for developing societies in South and Southeast Asia, Japan is an appropriate model because it shares with these societies not only common water supply problems but also many features of agricultural organization—e.g., labor-intensive cultivation practices, small field size, family-organized farming groups, wet-rice cultivation.

As one specializing in Japan and East Asia, I intend also that this research will contribute to our understanding of rural Japanese social organization. Irrigation systems are important constituent elements both in the social structure of rural areas and in the articulation of those areas with the "outside world" (Smith & Reyes 1957); however, they have seldom served as units of analysis for either American anthropologists or Japanese sociologists. The social organization of other forms of resource utilization, such as forestry (Bennett & Ishino 1963; Bennett 1958; Ushioi: 1968), has been studied, but our knowledge of contemporary agricultural areas has largely developed through residential hamlet and kinship studies. The proposed research, which will highlight the social organization of water resource utilization, will hopefully complement these community studies.

In particular, an investigation of irrigation may reveal different patterns of cooperation and conflict among individuals and groups than have been reported
by community ethnographers. In a multi-level canal system, individual cultivators are involved in successively larger groups of water users; lines of common interest and conflict of interest shift. While at the highest level, there is potentially a need to cooperate with all other water users in the system, at the lowest level, there is a potential conflict of interest with all other users (cf. Eyre 1955:213-4). If, in actual operation, irrigation generates such shifting patterns of cooperation and contention, this will contrast with the fixed and determinate lines of intra-hamlet solidarity and inter-hamlet contention frequently discussed in the literature on Japanese rural settlements. Such findings will also inform the general issue of how characteristics of natural resources constrain technical development and social organization and, conversely, how the socio-cultural context of resource utilization shapes the forms which that utilization assumes in a particular society.

V. Bibliography.

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Horiuchi, Yoshitake
Hunt, Eva and Robert Hunt
Hunt, Robert and Eva Hunt
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Yoneyama, Toshinao
In, Julian Steward (ed.), Contemporary Change in Traditional Societies,
Section C: Itemized budget for which funds are requested and discussion of budget.

I. Transportation.

A. Transportation to research site.
   i. Boston- Tokyo, Japan: one round-trip, economy class air fare.
      $ 1398.
   ii. Tokyo- research site: estimated round-trip rail fare.
      $ 40.

B. Transportation between research site and Tokyo for interviews with ministry officials: two round-trip rail fares.
   $ 80.

C. Local transportation: estimated rail and bus fare costs for travel within irrigation system area during 18-month fieldwork period.
   $ 500.

transportation sub-total: $ 2018.

II. Microfilm.

A. Equipment purchase to adapt applicant-owned camera for microfilming documents: micro-reel attachment, strobe flash, and table-frame for camera.
   $ 400.

B. Microfilm purchase and developing costs.
   $ 150.

microfilm sub-total: $ 550.

III. Xerox-type photo copying.

400 sheets at $0.35/ sheet
   $ 140.

photo-copy sub-total: $ 140.

IV. Typewriter purchase.

purchase of portable, manual typewriter (estimated cost; to be purchased in Japan)
   $ 150.

typewriter purchase sub-total: $ 150.
V. Maps and mapping.

A. Purchase of available maps of irrigation system area and water shed. $ 120.

B. Photo-transcription and reduction of area maps in town offices within irrigation system. $ 150.

C. Funds to hire cartographer/surveyor for mapping of two field sections within irrigation system. 240 hours at $ 4/hour $ 960.

maps and mapping sub-total: $ 1230.

VI. Document transcription and translation.

Funds to hire assistance in document search, transcription from cursive script, and translation of legal codes, court cases, and population registers. 150 hours at $ 4/hour (translation plus transcription): $ 600. 150 hours at $ 3/hour (translation only): $ 450.

document transcription and translation sub-total: $ 1050.

Total (Items I-VI): $ 5138.

Total funds requested from National Science Foundation: $ 5138.

Effective date: September 1, 1975
Discussion of budget.

Funds are requested for the above six categories in order to significantly increase the potential social scientific contribution of the proposed dissertation research.

Transportation. The basis of this research will be the actual observation of water use in an irrigation system, and thus travel funds to the research site are required. Moreover, because, in Japan, ministries on the national and prefectural levels involve themselves in local-level irrigation affairs, additional transportation funds would be used for two trips to Tokyo and the prefectural capital to interview officials of the relevant bureaus. One trip would be made during the winter of 1975 and the other, following harvest in the fall of 1976.

Microfilm. In a highly literate society with a long tradition of record-keeping, as Japan is, it is essential to supplement anthropological field work with document study. In this study, such documents as legal codes pertaining to water use, population registers, court cases, climatological records, and engineering reports are important primary sources for data on government irrigation policy, normative aspects of irrigation administration, and those water conflicts which reach formal adjudication. Microfilming by the investigator is the most efficient and accurate method for collecting and preserving such data. Thus, funds are requested to adapt the camera which I presently own for microfilming and to purchase and develop the necessary film.

Xerox-type photo copying. In addition to microfilming of bound documents, document study would be enhanced by funds to photo-copy loose documents in the files of the town offices. Many town offices have Fuji Quick-copy machines for such photo-copying.
typewriter purchase. Given the volume of field notes in anthropological research, a portable typewriter is an essential item of daily use.

maps and mapping. Many anthropological studies of irrigation have been published in the past which have not reported even basic features of the ecological context and physical system; the value of such studies for future comparative work is correspondingly low. Accurate and detailed maps are an essential part of recording natural features, land-use and settlement patterns, and the physical irrigation system—both for one's own and future investigators' uses. Available government maps (both geodetic and land-use maps) should be sufficient for features of the system as a whole and its ecological context; these will be supplemented by photo-reduced copies of the large wall maps found in town offices, which provide additional details of agricultural land use. However, for the detailed study of two field sets within the system, as described in the proposal above, the services of a cartographer/surveyor will be required to prepare maps with such features as types and locations of field intakes, inter-field flow points, field border heights and widths, one-foot contours, etc.

document translation assistance. Japanese proper names, cursive script, and legal and engineering formats present time-consuming difficulties in the use of documents; funds are requested to hire assistance in document search, transcription from cursive script, and translation. Although I would continue to be the principal translator, assistance would allow greater coverage of documents and result in an ethnography of higher quality and accuracy.
Section D: List of other financial aid currently available, applied for, or anticipated during the award period.

I. Financial aid currently available for proposed research: None.

II. Financial aid applied for:

A. Stipend support:

Social Science Research Council fellowship
Japan Foundation dissertation fellowship
Resources for the Future, Inc. dissertation fellowship

B. Research expenses support:

Wenner-Gren Foundation for Anthropological Research grant-in-aid
Section E. Tentative research timetable.

**Position, Mass.** March - July, 1977

- Desertion maintenance
  - Short visits to other systems (time permitting)
  - Study of court access
  - Observation of planning for follow-up year
  - Observation of national level
  - Follow-up interviews with officials at prefectural and provincial level
  - Observation of interviews with farmers and administrators concerning
  - Observation of discussions and meetings (E) (done)

- Focusing season: detailed mapping of these fields
  - Study of actual irrigation of water for this season
  - Emphasis on two selected fields with system

- Operations of system, observation from users and administrators
  - Meetings of cooperation and planning
  - Local conferences and reports: attendance of planners
  - Study of local area and on physical and administrative structure of whole irrigation system
  - Emphasis on actual and administrative feasibility

**Field study of irrigation system**

- Local people
  - Selection of research site and arrangements

**Kyoto & Tokyo**

**Activities**

- September - December, 1975

- Location

- December, 1976

- February, 1977

- December, 1976 - (3 months)

- November, 1976 - (7 months)

- January - November, 1976

- April, 1976 - (4 months)

- May - November, 1976

- December, 1975 - (4 months)

- December, 1975 - (4 months)

- December, 1975 - (4 months)
Section F: Biographical data on applicant.
Resume of: William Wright KELLY

Birthdate: July 27, 1946
Birthplace: Washington, D.C., U.S.A.
Citizenship: United States of America
Permanent address: Indian Field Road, Clinton, New York, 13323, U.S.A.
Current mailing address: c/o Department of Anthropology, Brandeis University, Waltham, Massachusetts, 02154, U.S.A.

Education:

Forrest Sherman School  Naples, Italy  1963-64  high school diploma
Amherst College  Amherst, Mass.  1964-68  B.A. degree (with honors, anthropology major)
Brandeis University  Waltham, Mass.  1971-  Ph.D. program in social anthropology

Work experience (education related):

VISTA volunteer  Brooklyn, N.Y.  1967  community organizer, teacher anthropology instructor, chm., social studies dept.
North Shore Country Day School  Winnetka, Ill.  1968-70  initiator and staff member of experimental educational expedition
Expedition for Cultural Studies  1970-71

Scholarships and fellowships:

1966-68  Amherst College Scholarship
1969  P.D. Smith Traveling Fund (summer research grant)
1971-72  Amherst Memorial Fellowship
1972-75  traineeship, National Institutes of Mental Health
1974  Sachar Research Grant

Fieldwork:

1969 (June-August), East Africa: research in anthropology curriculum improvement
1972 (June-September), northern Maine, U.S.A.: research in the structure of lumbering and its consequences for the social organization of local residential groups

Papers delivered:


Publications:

case chapter in G.N. Appell (ed.), Dilemmas and Ethical Conflicts in Anthropological Inquiry, in press.
Research positions:

1974 (February- August)  Visiting Scholar, Department of Sociology, Doshisha University, Kyoto, Japan.

Language training (Japanese):

<table>
<thead>
<tr>
<th>Institution</th>
<th>Location</th>
<th>Year (Month)</th>
<th>Type of Course</th>
</tr>
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<tr>
<td>Middlebury College</td>
<td>Middlebury, Vt.</td>
<td>1973 (summer)</td>
<td>Intensive first-year course; Japanese Language School</td>
</tr>
<tr>
<td>University of Massachusetts</td>
<td>Amherst, Mass.</td>
<td>1973 (fall)</td>
<td>Second-year course</td>
</tr>
<tr>
<td>Kyoto Japanese Language School</td>
<td>Kyoto, Japan</td>
<td>1974 (Jan.-August)</td>
<td>Intermediate level private class (200 hours)</td>
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<tr>
<td>Boston University</td>
<td>Boston, Mass.</td>
<td>1975 (Jan.-May)</td>
<td>Third-year level course</td>
</tr>
<tr>
<td>Middlebury College</td>
<td>Middlebury, Vt.</td>
<td>1975 (summer)</td>
<td>Intensive fourth-year course</td>
</tr>
</tbody>
</table>
Dr. Robert C. Hunt
Department of Anthropology
Brandeis University
Waltham, Massachusetts 02154

Dear Dr. Hunt:

I am pleased that the National Science Foundation has made a grant to support, in part, doctoral dissertation research to be carried out by William W. Kelly.

A copy of the abstract of Mr. Kelly's dissertation may serve as a report on the grant at the completion of the grant period. We would also appreciate receiving copies of other reports that
FINAL TECHNICAL REPORT TO THE NATIONAL SCIENCE FOUNDATION

Program: Grants for Improving Doctoral Dissertation Research in the Social Sciences

Name of Institution: Brandeis University (Waltham, MA 02154)

Names of Principal Investigators: Dr. Robert C. Hunt, Brandeis University
William Wright Kelly, Brandeis University

Grant No.: SOC 75-17280 (Brandeis IBM #0334)

Starting Date: September 1, 1975           Completion Date: August 31, 1977

Grant Title: An Ethnography of a Japanese Irrigation System

Endorsements:

Principal Investigator:

Robert C. Hunt                        Assoc. Professor
                                            Department of Anthropology

William W. Kelly                        Ph.D. candidate
                                            Department of Anthropology
Scientific Description of Research and Results.

a) Research Objective.

The objective of this project has been the ethnographic and historical case study of a multi-level, branching canal system in a Japanese river basin. Data was gathered through 22 months of field work in Japan for the following categories: the natural environment of the selected river basin; the physical facilities of irrigation in the branching canal network that characterizes irrigation in that basin; the management and operation of the irrigation network; the organization of rice cultivation for which the water is a critical input; and the social and political structures of the wider basin society. Data in all categories were collected with varying degrees of completeness for the time period, 1500-1977.

The descriptive question which the project addresses is: what is the social organization of irrigation in this river basin and how has it developed through time? The analytical problem which the project addresses is: how do factors of environment, technology, and society interrelate to determine the forms of irrigation management found in the river basin over time?

b) Research Activities.

Research was conducted in Japan from October, 1975 to August, 1977, by one of the principal investigators (Kelly). Throughout this period, he was attached to the Institute of Humanistic Studies of Kyoto University (Kyoto, Japan), under the sponsorship of Professor Jiroo Iinuma.

From October, 1975 through February, 1976, Kelly was resident in Kyoto, doing preliminary reading in Japanese agricultural history and irrigation studies. At the same time, through interviews and visits to various prospective sites, he was selecting the area which was to become the subject of the case study.

The unit selected for study was the watershed and drainage basin of the Aka River, which irrigates approximately 13,000 hectares of rice paddy land in
the southern half of Shonai Plain, the coastal plain of Yamagata Prefecture in northeastern Japan. At the end of February, 1976, Kelly moved to Tsuruoka, one of the two large towns on Shonai Plain, to begin actual field work. Through the assistance of Professor Isamu Higashiyama of the Faculty of Agriculture of Yamagata University, he was introduced that month to officers and staff of various agricultural and irrigation organizations, town and village officials, etc. for initial orientation and to locate a family in a farming village within the irrigation area with whom to board.

In early April, Kelly moved in with a family in the village of Nishi-Watamae, where he remained until the beginning of November, 1976. During those seven months, his activities were divided among three areas:

i. participant-observation of contemporary farm village life and agricultural work group organization, including daily observation of paddy activities, attendance at village gatherings, and a one-month period of work (without pay) as a farm hand during the fall rice harvest.

ii. document study of the general history of the Aka River basin area.

iii. interviews with officers and staff and attendance at meetings of irrigation district groups, agricultural organizations, civic groups, etc.

Although specific research interests were in irrigation matters, it was first necessary to gain at least a general understanding of historical developments and contemporary agrarian social relations in the area, and thus the first seven-month period was devoted to such broad goals. It was important, too, to follow in detail a complete cycle of rice cultivation in order to appreciate the context of water demand and water use practices.

In November and December of 1976, Kelly returned to Kyoto. This period was used for reading materials previously collected, meetings with irrigation specialists in Kyoto and Tokyo, and trips to irrigation systems in Nara and Okayama, which provided useful comparisons to the Aka River case.

At the beginning of January, 1977, Kelly returned to the Aka River basin for another seven-month stay, through July, 1977. During this time, he boarded with a second farming family in the adjacent village of Higashi-Watamae. Project
activities in this period included:

i. daily observation of irrigation system maintenance, water allocation, and water use. He travelled around the irrigation district on foot and by bicycle, observing contemporary practices, mapping the network, etc. On-going paddy land adjustment projects were also studied.

ii. study of written materials and documents, including local histories, secondary literature, and primary sources from the feudal period (e.g., annotated maps, papers of village group headmen, water guards, etc.), from the period 1875-1950 (minutes of Irrigation Cooperative meetings, land records), and from the post-WW II period (Land Improvement District records, etc.).

iii. interviews with government officials (in the basin, prefectural capital, and Tokyo), irrigation maintenance men, Land Improvement District staff, etc.

iv. attendance at meetings of irrigation and paddy land adjustment project matters.

Following this, Kelly returned to the United States in August, 1977, to begin the writing of his doctoral dissertation, which will be based on the material gathered in the 22 months of field work.

It should be noted that the above research activities were considerably improved and assisted by NSF grant support, which allowed expenditures in the following areas:

- hiring of assistance in transcribing old documents
- photo-copying & micro-filming of documents and records
- purchase of primary materials, government reports and statistics, relevant research studies, etc.
- purchase of maps
- transportation to and from Japan
- transportation within the river basin, including bicycle rental & bus transportation to Tokyo and Kyoto for interviews with government officials and irrigation researchers
- film & developing costs for photographing of irrigation facilities, basin environment, and irrigation and agricultural practices.

Kelly received stipend support from Resources for the Future, Inc. (1975-76) and the Japan Foundation (1976-77) for living expenses, but needless to say, without NSF support for the above research expenditures, the field work would have been impossible, and deep gratitude for the assistance of NSF is here recorded.

c) Research Results.

The descriptive task of the funded research has been to detail the social
organization of irrigation in the selected basin. It was found that in the Aka River basin, interesting and significant variation has occurred in the degree of centralization of irrigation management or organization, and this variation in centralization provides the framework to describe basin irrigation from 1500 to 1977. Within this time frame, four phases of irrigation management have been identified:

1500-1600: By perhaps 700 AD, the Aka River had built up a small alluvial fan where it enters Shonai Plain from its mountain headwaters. Over the centuries, it ran off of the alluvial fan through the plain rather freely, creating a number of courses. Early cultivators on the swampy plain were unable to control the river directly, so they made do with scattered settlements on natural levees near ponded water in sections of old river courses. Irrigation was supplemental and small-scale, and it was apparently organized through general settlement roles. Although settlement on the plain extends back to the eighth century, 1500 has been chosen as the point of departure because of lack of earlier records.

1600-1875: In the early 1600s, a river control project in the alluvial fan section stabilized the Aka River's channel course somewhat. This was followed by rapid development of a number of branching canals, and by the 1700s, the branching canal network reached its present extent. This period corresponds to the feudal Tokugawa period in Japan, and in the Aka River basin, there was a centralized configuration of irrigation in which matters of construction, maintenance, and allocation were handled through the administrative hierarchy of the feudal domain of Shonai. The important irrigation roles were embedded in more general administrative roles of the domain, and the hierarchical ordering of domain authority gave a centralized cast to irrigation.

1875-1950: In this period, the tasks of irrigation at the various levels of the branching canal network were managed by separate and relatively autonomous organizations. Each had distinct jurisdictions and a fair degree of independence in matters of allocation, facility improvement, and generation of resources. Decision-making assemblies and committees of each cooperative were forums for negotiation and compromise by representatives of local unit interests, and there was little concentration of authority at higher levels.

1950-1977: In the present period, once again there is a centralized operation of the network in the hands of specialist-staffed irrigation districts and above them, the basin association of irrigation districts. However, this time, national and prefectural agencies have planned, financed, and directed capital-intensive construction throughout the physical system. Ministry policy objectives and legislative principles of the national state support a hierarchical ordering of local roles but also considerably restrict local freedom of action in irrigation management.
Through these four phases, then, it was found that irrigation organization in the Aka River basin displays a cyclical variation in degree of centralization, which is defined in the research to be the extent to which there is a hierarchical configuration of irrigation roles-- that is, the extent to which there is a decided imbalance in the relative distribution of authority and a nesting pattern of areal and/or functional jurisdictions. Centralization was selected as the key, dependent variable of irrigation organization not only because of its interesting variation in this case but also because previous irrigation studies have identified centralization as a key feature of irrigation organization. It is hoped that this research will help to refine this concept and provide future comparative studies with a detailed case study from an under-reported society in the irrigation literature, Japan.

The second, analytic task of the research is to hypothesize the natural, technical, and social factors which account for the four-phased variation in irrigation centralization in the Aka River basin. Because our research is still continuing, only the following tentative points can be made here.

(1) There are several factors which do not appear to account for the variation-- water demand, water supply (and the related variable of technical control level), and irrigation role specialization. That is, all three have generally increased linearly through the four centuries, while centralized management has appeared at both low and high levels of water demand, water supply, and role specialization.

(2) The general mode of irrigation in the basin from 1600 to the present, that is, the branching canal network, may be a predisposing condition for centralized management. This is because of the fact that, while from the river down, the canals branch into smaller and smaller canals, from the paddy field up, they nest into larger and larger canals. Thus, centralized control over water distribution is encouraged by control over certain nodal facilities and division points.

(3) It is suspected, however, that the weight of explanation will fall on the relation of irrigation roles and rules to the roles and rules of wider
socio-political structures. In the research, it has been discovered that there are at least four aspects of this relationship which are relevant to centralization of management. The first is the way an irrigation role relates to a socio-political role in the wider society; there may be role separation, role embeddedness, or role complexes. The second is the way lines of authority among irrigation roles corresponds to lines of authority among other social roles. Diagrammatically, the first refers to a-c and b-d linkages, while the second refers to a-b and c-d linkages.

a) irrigation role ←→ c) other socio-political role

b) irrigation role ←→ d) other socio-political role

A third aspect is the goals which individuals pursue in assuming irrigation roles and non-irrigation roles. For example, the water user is also a cultivator and a village resident and, at times, a tenant; he uses water because he grows rice, and he grows rice, at least in part, because he must pay a land rent in rice. And finally, a fourth aspect of the relation between irrigation and wider socio-political structures is 'rule-embeddedness,' by which principles, rules, and operating procedures of irrigation are sanctioned or legitimated by norms, legislation, or traditions in the wider society.

Each of these has been found in the research to support a centralized configuration of irrigation roles in the Aka River basin. What must be done now is to determine how these cumulate with one another and with other social, technical, and environmental factors. Only when this is done can we adequately account for the variation in centralization which we have found for irrigation in this river basin.
Publications


Papers delivered

"Shōnai heiya no nogyō yōsui-shi ni tsuite," delivered at the Annual Seminar of Local Economy, Department of Agricultural Economics, Yamagata University, Tsuruoka, Japan, September 28, 1976 (in Japanese).

"The Development of Irrigation and Drainage on Shonai Plain," delivered at the International Conference of Orientalists in Japan, Tokyo, Japan, June 2, 1976.


Theses


Inventions

none.

Scientific Collaborators

none.

Comments

No continuation of grant is being sought.