

INSTITUTIONAL ARRANGEMENTS FOR RESOLVING THE COMMONS DILEMMA:
SOME CONTENDING APPROACHES

by

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Abstract

This paper seeks to demonstrate that private ownership or central governmental control are not the only means for solving the "tragedy of the commons." Evidence from Netting's study of the institutional arrangements developed in a Swiss alpine village and McKean's study of the institutional arrangements developed in several Japanese villages illustrate how "communal ownership" of grazing, forest, and waste lands enabled peasants living in harsh environments to achieve effective regulation over delicately balanced commons. Access to the commons was tightly controlled in both settings. Village councils passed intricate regulations controlling the specific timing and amount of use that villagers could make of the communally owned land. Given the environment and economic activities, private ownership would not have enabled peasants to make as effective use of the land as communal ownership. Central public control could not have reflected the detailed knowledge about the commons held by villagers. Successful regulation over several centuries establish the stability of communal ownership patterns. The implications of these two empirical studies for our understanding of the relationship between institutional arrangements and the capacity to solve the commons is discussed.

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The Problem

Many of the world's resources share important characteristics that enable scholars to classify them as common-pool resource systems. All common-pool resources produce a finite flow of "use-units" per unit of time. When the common-pool resource is a ground water basin, the use-units are acre-feet of water pumped per year. For a grazing commons, the use-units are the number of animals fed per season. For an air shed, the use-units are the quantity of different pollutants emitted into the air per year (see Erickson-Blomquist and E. Ostrom, 1984, for detailed discussion of the concept of a common-pool resource).

When the number of use-units jointly consumed by those sharing access to a common pool resource are considerably less than the "sustainable yield" of the system, few problems exist related to the role of institutional arrangements. However, as the number of use-units consumed or withdrawn from a commons approaches the sustainable yield, serious problems may emerge. Unless some form of regulation is achieved, all participants face incentives to increase their use of the resource. All participants following a strategy of increased consumption bring about a deterioration or eventual destruction of the capacity of the resource to continue production of beneficial use-units.

The "tragedy of the commons" is created when these incentives remain unchanged **and** those affected continue to follow strategies destroying the very resource potentially capable of yielding valuable use-units for future generations to come (Hardin, 1968). Most policy proposals intended to avert the tragedy of the commons involve recommended changes in the set of institutional arrangements. Institutional arrangements are defined as the rules in use by a community to determine who has access to the commons, what use-units authorized participants can consume and at what times, and who will monitor and enforce these rules (see E. Ostrom, 1985). What type of institutional change is recommended, however, depends on the intellectual approach adopted by the analyst.

Contending Arguments

Vastly disparate intellectual approaches are currently taken to the study of institutional arrangements for regulating common-pool resource systems. For some scholars, identifying a resource system as having the characteristics of a commons is sufficient to generate a recommendation for imposing the analyst's favored "institutional solution." But the particular recommendations for change vary dramatically since fundamentally different institutional arrangements are posited as necessary for resolving the tragedy of the commons.

One institutional arrangement, presumed necessary for optimal performance by some scholars, is the allocation of full property rights to a set of participants. W. P. Welch, for example, advocates this institutional "solution" when he asserts that "the establishment

of full property rights is necessary to avoid the inefficiency of overgrazing. . ." (1983: 171; my emphasis). Welch is convinced that division of the commons is the optimal solution for all common-pool problems. His major concern is now to impose private ownership where considerable opposition exists among those currently using a commons.

A dissimilar institutional arrangement - the allocation of full authority to regulate the commons to an external authority - is presumed necessary by other scholars. Carruthers and Stoner, for example, make the following analysis for the World Bank:

Open access to exploitable communal resources without public control means eventually losses for all involved, whether it is in the form of less or more costly irrigation and drinking water from underground, overgrazing and soil erosion of communal pastures, or less fish at higher average cost from surface water sources. Common property resources require public control if economic efficiency is to result from their development (1981: 29; my emphasis).

Advocates of either full private property rights or of central, administrative control share the presumption that a particular form of institutional arrangement is necessary to achieve efficient development. That other scholars contemporaneously recommend dissimilar institutional arrangements as necessary to solve the same problem does not appear to deter those convinced that there exists only one optimal arrangement and that they know what this arrangement is. If the "superior" institutional arrangement is not present, advocates presume that it should be imposed on participants. Relevant policy questions then become how to get the change accomplished with the least opposition from those involved.

In contrast to those who wish to impose their particular preferred institutional "solution" to common-pool resource problems,

other scholars presume that the optimal institution for coping with various environments and forms of economic activity will be generated by the economic system itself. Left to themselves, individuals who are dependant upon common-pool resources for essential inputs to their economic activities will work out a system of property rights that achieves regulation over the commons. Institutional arrangements are presumed to be determined by economic activities. Netting (1976: 137) expresses this view when he states:

My contention will be that, in the absence of decisive legal or military controls from the larger society, the system of property rights in the peasant community will be directly related to the manner in which resources are exploited, the competition for their use, and the nature of the product produced — more specifically, land use by and large determines land tenure (my emphasis).

Netting's approach differs in two important ways from that taken by Welch and Carruthers and Stoner. First, Netting presumes that when relatively isolated sets of individuals live in a slowly changing environment, they will be able to devise institutional arrangements well matched to their problems. Secondly, Netting presumes that communal ownership, rather than full private ownership or central control, is an optimal institutional arrangement for resolving some types of common-pool resource problems.

Radically different policy stances are implied by these contending approaches. Analysts, who presume that the optimal institutional arrangement for solving a class of problems will not be selected by those involved, are willing to impose their preferred solution on those involved. Analysts, who presume that the optimal arrangement for solving a class of problems will emerge in the situation, rarely advocate imposition of institutions by external

authorities. The latter are either more interested in the explanation or how systems have come into being than in recommending any policy, or they presume that individuals left to themselves will eventually develop optimal rule structures.

A thesis to be pursued in this paper is that the presumption that one best form of institutional arrangement exists for all common-pool resource problems can be empirically falsified. A second thesis is that the presumption that land use or economic activity determines institutional arrangements is unclear and in its strongest interpretation empirically raise.

To develop these arguments I will first consider two competing hypotheses for solving common property problems — one of which states that individual property rights are necessary for solving common-pool resource problems and the other which states that central control is necessary. Then I will state several alternative hypotheses in an effort to capture the meaning of statements asserting that economic activities determine institutional arrangements might take. Third, I will discuss two case studies of the rules systems which have evolved in long isolated, agricultural villages for regulating uncultivated commonly owned land. The environmental and economic conditions of i wo *cases* are quite similar. For several centuries, both systems have achieved regulation of delicately balanced forest and grazing commons utilizing institutional arrangements that are neither private ownership nor control by a central authority. The existence of these two success stories negates the necessity for full private ownership (or, for central administrative control) to effectively regulate fragile common-pool resources. The land tenure systems which have

evolved in these two systems include radically different intergenerational transfer rules as well as different rules for controlling entry into and exit from the community sharing the commons. Given the similarity in environment and the difference in rules, the two cases provide evidence to challenge the strongest variant of the hypothesis that environmental and economic conditions determine institutional arrangements. Environmental and economic conditions may, however, affect the choice of institutional arrangements.

If neither private ownership nor central public control are necessary, and if different rule configurations enable individuals to achieve regulation of delicately balanced common-pool resource systems, then individuals jointly using a commons may be able to exercise real choice in the design of their institutions. The last section of the paper will discuss an approach to institutional analysis which focuses on the role of choice and design in the constitution of rule configurations for regulation common-pool resource problems.

Statements of Impossibility or Necessity and Empirical Evidence

Impossibility theorems and necessity theorems play an important role in the development of a coherent and cumulative social science. To achieve some levels of cumulation, social scientists need to eliminate some theoretical statements as not having empirical validity. As long as some theoretical statements cannot effectively be eliminated as being empirically invalid, work can proceed in many

different directions at once without cumulating. Theoretical statements that X is related to Y are difficult to challenge effectively with empirical evidence. An empirical study which fails to show a relationship between X and Y may do little to challenge scholars' faith in the proposition.

On the other hand, two types of theoretical statements can always be clearly confronted with empirical evidence. They are:

1. It is impossible for Y to occur if X occurs.
2. For Y to occur, X must necessarily occur.

In regard to Statement 1, finding a single case in which Y occurs when X is present is an effective challenge to the empirical validity of the statement. In regard to Statement 2, finding a single case in which Y occurs and X is not present is an effective challenge of the empirical validity of the statement.

Advocates of imposing institutions on participants assert or imply statements of necessity similar to Statement 2. Welch's statement quoted on page 3 in regard to full property rights is crystal clear in this regard. We can reformulate Welch's statement into the following form.

H1 For the inefficiency of overgrazing to be avoided, it is necessary to establish a system of full property rights.

Finding a single case in which the "inefficiency of overgrazing" has been avoided without the establishment of full property rights to the grazing commons effectively challenges the empirical validity of H1. To examine the empirical validity of H1, we need a definition of full property rights and how this institutional arrangement differs from other arrangements. Welch distinguishes among three types of property rights: common, usufruct, and full ownership.

Common property can be used by anyone. . . . Usufruct property confers a nontransferable right to exclude others from its use. . . . Full ownership confers both excludability and transferability (Welch, 1983: 166).

Another variant of the imposed institutional approach presumes that central public control and regulation are the necessary institutional arrangements for efficient development of common-pool resources. Advocates of this approach are particularly articulate in regard to policies for resource development in the Third World. The statement made by Carruthers and Stoner (1981), quoted above on page 3, can also be converted in a hypothesis using the form of Statement 2:

H2 For inefficient development of common property resources to be avoided, it is necessary to establish public control over their development.

Frequent references in Carruthers¹ and Stoner's report make it clear that they mean by "public control" that all major allocative decisions concerning who could use how much of a common property resource would be modeling central, bureaucratic agencies (see, for example, pp. 31, 38, 41).

Having now isolated the major hypotheses of those advocating the imposition of either full ownership or of central, public control to resolve commons dilemmas, let us turn to an effort to isolate a similar hypothesis from those presuming that economic activities determine institutional arrangements. This turns out to be more difficult.

Netting's own argument that economic activities determine institutional arrangements is an important starting point as his study of an alpine village is described below. Netting wants to establish

that communal ownership patterns are not anachronistic holdovers of ancient tribal communism. He is reacting against the presumption that private ownership is the one optimal form of land tenure for all common-pool resource systems. Thus, he desires to demonstrate that communal ownership patterns may be better "adapted" to particular types of environmental problems than private ownership patterns.

Netting makes a convincing argument for why communal patterns may allow more efficient use of some types of common-pool resources than private ownership. He slips, however, from this relatively convincing argument into the assertion quoted above that "by and large, land use determines land tenure." Netting is quite clear what he means by "land use." He identifies five attributes of land use patterns that he asserts differentiates among land tenure systems. Netting is less clear about what he means by "land tenure." He simply makes an undefined distinction between "communal" and "individual" land tenure systems. Netting is even more ambiguous about what he means by the term "determines."

At least three alternative hypotheses relating environmental and economic situations to institutional arrangements can be formulated in any effort to clarify what Netting (and others making similar arguments) mean. The strongest hypothesis would be:

H3a In small, isolated communities with authority to make their own rules, land use patterns characterized by attributes A1, A2, . . . An, will always be found with institutional arrangement characterized by rules R1, R2, . . . Rn, which facilitate an efficient solution to the problems involved in this land use pattern.

H3a is strong in two respects. First, it is a statement of a necessary relationship. Secondly, it asserts that all of the rules

affecting the regulation of land use will be similar in similar land use settings.

A somewhat weaker version of this hypothesis is:

H3b In small, isolated communities with authority to make their own rules, land use patterns characterized by attributes A1, A2, . . . An, will always be found with institutional arrangements containing at least one particular rule - rule i.

H3b has weakened the expectation concerning the similarity of the full set of rules involved in an institutional arrangement. This version of the Hypothesis picks out some particular rule (or subset of rules) as being necessarily related to a particular set of attributes of land use patterns.

A still further weakening of the hypothesis would be:

H3c In small, isolated communities with authority to make their own rules, land use patterns characterized by attributes A1, A2, . . . An, will frequently be found with institutional arrangements containing at least one particular rule - rule i.

H3c states a predicted association rather than a necessary relationship. Let us now turn first to Netting's own study of the institutional arrangements evolved in one isolated, Swiss alpine village.

Communal Tenure in a Swiss Village

Netting's study is of Törbel, a Swiss village of about 600 people located in the Vispental of the Upper Valais region. Netting (1972: 133) identifies the most significant features of the environment as: "(1) the steepness of its slope and the wide range of microclimates demarcated by altitude, (2) the prevailing paucity of precipitation,

and (3) the exposure to sunlight." For centuries, Swiss peasants have planted their privately owned plots with bread grains, garden vegetables and fruit trees, and hay for winter fodder. Cheeses produced by a small group of herdsman, who tended village cattle pastured on the communally-owned, alpine meadows during the summer months, have been an important part of the local economy.

Written legal documents dating back to 1224 provide information regarding the types of land tenure and transfers which have occurred in the village and the rules used by the village to regulate the five types of communally owned property: the alpine grazing meadows, the forests, the waste lands, the irrigation systems, and the paths and roads connecting private and communally owned properties. On February 1, 1483, Törbel residents signed a law formally establishing an association to achieve a better level of regulation over the use of the alp, the forests, and the waste lands.

The law specifically forbade a foreigner (Fremde) who bought or otherwise occupied land in Törbel from acquiring any right in the communal alp, common lands, or grazing places, or permission to fell timber. Ownership of a piece of land did not automatically confer any communal right (genossenschaftliches Recht). The inhabitants currently possessing land and water rights reserved the power to decide whether an outsider should be admitted to community membership (Netting, 1976: 139).

The boundaries of the commonly owned lands were well established long ago as indicated in a 1507 inventory document.

Not only was access to well defined common property strictly limited to citizens, who were specifically extended communal rights, but written regulations specified in 1517 that "no citizen could send more cows to the alp than he could feed during the winter. . . ." (Netting, 1976: 139). This regulation, which Netting reports is still

enforced in modern times, specified severe fines for any attempt by villagers to appropriate a larger share of their grazing rights. The rules regulating the use of irrigation water intricately enumerated a rotation system based on sun and shadow movements on the surrounding mountains. Timber for construction and wood for heating was marked by village officials and assigned by lot to groups of households who then were authorized to enter the forests and take out the marked logs.

Regulations also stated the responsibilities of those with access to the commons to provide labor inputs related to the cleaning of springs, the maintenance of an extensive irrigation system, the construction and maintenance of roads and paths, rebuilding avalanche-damaged corrals, and redistributing manure on the pasture lands. A codification of these regulations signed in 1531 included 24 separate statutes regulating such diverse activities as: "immigration to or emigration from the community, Hunting on the alp, stock damage to private plots, the spread of cattle disease, dispute settlement, participation in village government, alp pasturate rights, and compulsory communal house building" (Netting, 1976: 139-140).

In addition to a detailed system of communal land rights, private rights to land are also well developed in Törbel and other Swiss villages. Not only are most of the meadows, gardens, grainfields and vineyards in Törbel owned by separate individuals but complex condominium-like agreements have been worked out for the fractional shares that siblings and relatives may own in barns, granaries, or multi-storied housing units.

The inheritance system in Törbel ensures that all legitimate offspring share equally in the division of the private holdings of

their parents and consequently in access to the commons. "Törbel siblings usually decide among themselves the composition of each share before drawing lots for them" (Netting, 1972: 140). Family property is not divided, however, until the surviving siblings are relatively mature. Prior to the nineteenth century, population growth was held in check by high infant mortality and occasional epidemics. As childhood death rates declined, the average age at the time of the first marriage tended upward. Some children in each family unit were expected to remain single and to care for their parents. Other children emigrated and sold their holdings to those who remained. Thus, internal population controls and external emigration were major factors holding down severe population pressures on the limited land resources of the village.

Netting's argument that "land use by and large determines land tenure" is grounded on two factors: (1) the long history of private ownership of land coexisting with communal ownership of other lands and (2) the difference in the patterns of land use for those lands owned privately and those lands owned communally. The first factor - simultaneous use of both private and communal ownership - is crucial in enabling Netting to eliminate the alternative hypothesis that communal ownership is simply an anachronistic holdover from ancient tribal customs. Netting's argument: is that for at least five centuries these Swiss villagers have been intimately familiar with the advantages and disadvantages of BOTH private and communal tenure systems and have carefully crafted particular types of land tenure matched to particular types of land use.

Historical evidence is entirely consistent with the assertion that both individual and communal rights in

resources have been present for at least 500 years, and that they have regularly associated private control with meadows, grain fields, gardens, vineyards, and buildings, and community tenure with the alp, the forests, certain waste lands, and access routes (Netting, 1976: 140).

To make the second part of his argument, Netting identifies five attributes of land use patterns which he associates with the difference in land tenure. These are listed on Table 1.

Table 1

| Attributes of Land Use | Land Tenure Type | |
|--|--|------------------------------|
| | Communal | Individual |
| A1 Value of production per unit area | Low | High |
| A2 Frequency and dependability of use or yield | Low | High |
| A3 Possibility of improvement or intensification | Low | High |
| A4 Area required for effective use | Large | Small |
| A3 Labor- and capital-investing groups | Large (voluntary association or community) | Small (individual or family) |

Netting argues that communal forms of land tenure are optimal when the value of production per unit of land is low, when the frequency and dependability of use or yield is low, when the possibility of improvement or intensification is low, when large areas are required for effective use, and when relatively large groups are required for capital investment activities. (See Runge, 1983, and Gilles and Jamtgaard, 1981, for a similar argument that communal ownership may be optional under certain adverse conditions.)

Netting concludes that communal tenure:

promotes both general access to and optimum production from certain types of resources while enjoining on the entire community the conservation measures necessary to protect these resources from destruction (Netting, 1976: 145).

Netting positively evaluates the effects of communal tenure for regulating the fragile common-pool resources of the Swiss alpine village. The land has maintained a high level of productivity for many centuries. Land values in Törbel have been among the highest in Switzerland. Overgrazing has been kept within tight controls. The commons has not only been protected but considerable enhancement and development has occurred through the construction and maintenance of commonly owned facilities.

The Netting study is important for several reasons. First, it shows that it is possible for an isolated rural village composed largely of peasants living on a subsistence agriculture to develop their own rule systems for preventing overuse of delicately balanced uncultivated lands owned communally. Netting's evidence is a strong challenge to the empirical validity of either H1 or H2 stated above. It does not appear necessary either to divide commonly owned land into privately owned land nor to place such land under a central, public authority, to achieve development patterns that avoid underdevelopment or overuse of common-pool resource systems.

Communal Tenure in Japanese Villages

In Japan, extensive common lands have existed and been regulated by local village rule systems for centuries. In an important study of

traditional common lands in Japan, Margaret A. McKean (1984) estimates that about 12 million hectares of forests and uncultivated mountain plains were held and managed in common by thousands of rural villages during the Tokugawa period (1600-1867) and that about 3 million hectares are so managed today. While many villages have sold or divided their common lands in recent times, McKean (1984: 2) indicates that she has "not yet turned up an example of a commons that suffered ecological destruction while it was still a commons."

McKean provides both a general overview of the development of property law in Japan as well as a specific view of the rules developed in three Japanese villages—Hirano, Nagaike, and Yamanoka— for regulating the commons. The environmental conditions of the villages studied by McKean have a remarkable similarity to Törbel. The villages are also established on steep mountains where many micro-climates can be distinguished. Peasant farmers cultivated their own private lands raising rice, garden vegetables, and horses. The common lands in Japan produce a wide variety of forest products of value to those engaged in the cultivation of their own lands including: timber, thatch for roofing and weaving, animal fodder of various kinds, decayed plants for fertilizer, firewood, and charcoal.

Each village in traditional times was governed by an assembly. The assembly was usually composed of the heads of each of the households assigned political rights in the village. The basis for political rights varied substantially by village. Rights in some villages were based on cultivation rights in land, some on taxpaying obligations, and some on ownership rights in land. In some villages almost all households had political rights and rights to the use of

the commons. In others, these rights were more narrowly held (McKean, 1984: 26).

Each village assembly established a relatively complex set of rules regulating both the use and enhancement of the commons owned by the village. Boundary rules clearly demarked which lands were held in common and which in private ownership. Entry rules unambiguously specified who was authorized to use the commonly owned land. Ownership of the uncultivated lands near a village devolved from the imperial court to the villages through several intermediate stages involving land stewards and locally based warriors. National cadastral surveys were conducted late in the sixteenth century at a time of land reform which assigned "most of the rights to arable land that we today consider to be 'ownership' to peasants who lived on and cultivated that land" (McKean, 1984: 6). In the earlier systems the owners of local estates had employed agents in each village and authorized these agents to regulate access to the uncultivated lands. As villages asserted their own rights to these lands, they shared a clear image of which lands were private and which were held in common and that those lands held in common needed management in order to serve the long-term interests of the peasant agriculturalists dependant upon them.

In traditional Japanese villages, the household was the smallest unit of account. Each village contained a defined number of households that was carefully recorded. Households could not split into multiple households without permission from the village. Rights of access to the commonly held lands were accorded only to a household unit. Consequently, households with many family members had no

advantage, and considerable disadvantages, in terms of access to the commons. Population growth was extremely low (.025 percent for the period between 1721-1846) and ownership patterns within villages were stable (McKean, 1984: 29).

In addition to delimiting the ownership status of all lands, village assemblies also established detailed partitioning rules (Oakerson, 1978) specifying in various ways how much of each valued product a household could harvest from the commons.

Different villages arrived at different arrangements for guaranteeing an adequate supply of each of these products. For items that were needed regularly and that the commons yielded in abundance, a village might allow co-owners free and open entry as long as they abided by certain rules to make sure that a self-sustaining population of mature plants or animals was left behind. To enter the commons, one might need to go to village authorities to obtain an entry permit, carved on a little wooden ticket and marked 'entrance permit for one person.' The rules would probably restrict the villagers' choice of cutting tools or the size of the sack or container used to collect plants. Everyone would be expected to abide by the village headman's instructions about leaving so much height on a cut plant so that it could regenerate, or taking only a certain portion of a cluster of similar plants to make sure the parent plant could propagate itself, or collecting a certain species only after flowering and fruiting, and so on.

For items that had to be left undisturbed until maturity and harvested all at once at just the right time, or that the commons supplied only in adequate, not abundant, amount, villagers usually set aside closed reserves. . . . The village headman would be responsible for determining when the time had come to harvest thatch or winter fodder or other products, and would schedule the event. . . (McKean, 1984: 33).

The tailoring of village rules to the specific needs of each village and the ecological condition of a particular commons was also extended to requiring input from the villages to enhance and maintain the yield of the commons.

For collective work to maintain the commons - to conduct the annual burning . . ., to report to harvest on

mountain-opening days, or to do a specific cutting of timber or thatch – there were written rules about the obligation of each household to contribute a share to this effort. Accounts were kept about who contributed what to make sure that no household evaded its responsibilities unnoticed. . . . [and] if there was no acceptable excuse, punishment was in order (McKean, 1984: 39).

McKean's study is also strong testimony that it is possible for local communities to devise effective rules for managing their own common-pool resources. The establishment of the rules, the monitoring of behavior, the monitoring of the conditions in the commons, and the assignment of punishment were all conducted in the village. McKean concludes that the long term success of these locally designed rules systems indicate "that it is not necessary for regulation of the commons to be imposed coercively from the outside" (McKean, 1984: 56).

The McKean study compliments the Netting study in several ways. It provides further evidence to reject H1 and H2 stated above. Small isolated villages have been highly successful in two entirely different regions of the world in creating their own communal rule systems for regulating common-pool resources. Since both private and communal ownership have existed side-by-side in both settings for several centuries, communal ownership cannot be attributed to the backwardness of the peasants or their acceptance of a strictly communal value system.

Further, there is a remarkable similarity in the environmental and economic patterns of the Swiss and Japanese villages. The same five attributes of land use identified by Netting as distinguishing between communal and individual ownership appear to have the same relationship in the Japanese villages as in Törbel. Where the value of production per unit area is low, where the frequency and

dependability of use or yield is low, the possibility of improvement or intensification is low, the area required for effective use is large, and a large group is needed for capital investment, a form of communal land tenure is used in the Japanese villages. Private ownership exists in the Japanese villages in relationship to highly productive and dependable land where intense cultivation of small areas can be organized by small, family units.

For all the broad similarity, remarkable differences in land tenure rules also exist. Access to the commons depends in both villages upon the inheritance of private lands with associated rights to communal property, but the inheritance rules are extreme opposites. Equal division among all heirs (the Swiss rule) and no division of household property from one generation to the next (Japanese rule) could hardly be more different. The fundamentally different inheritance systems are complicated by still further differences in the authority individuals have to convey parcels of property. In Switzerland, private land can be sold relatively easily to others in the village. In Japan, any transfer of property among villagers, even among members of the same family, must be approved by the village council. Such transfers are rare.

The capacity of those with citizenship in the Swiss village to purchase private land from siblings or other villagers who emigrate, enables those who have been able to earn money in external jobs to greatly enhance their holdings. In the Swiss system, each heir has access to the grazing commons proportional to the property the individual can devote to raising of winter fodder. A "lucky" individual, who has no surviving siblings, who purchases further land

or who marries a spouse with substantial property, may have substantially larger rights to the grazing commons than his or her parents. In the Japanese system, each sibling must share in a constant and unchanging allocation of private holdings as well as communal holdings. Neither the household nor the individual has much chance to increase private or communal holdings.

The capacity of individuals to exit or emigrate is substantially different in the two settings as well. While emigration from the Swiss villages has been more tightly restricted in some eras than in others, moving out of the village has been a frequently exercised option in the alpine villages. Movement from one village to another was far more tightly controlled in the Japanese villages. Even traveling overnight to another village required prior approval from the village head and domain authorities (McKean, 1984: 25).

In both settings, population growth in the village was substantially controlled but the mechanisms again varied. By accepting late marriages or relatively few births, and relatively easy out-migration, Törbel grew from a population of 350 in 1798 to 580 in 1970. (Törbel started the twentieth century with a population of 571 and peaked with a population of 693 in 1950.) The growth rate in the Japanese villages was also low, but exit was severely limited. Far more extreme measures of birth control were practiced in the Japanese villages including abortion and infanticide. One might presume that with exit so tightly controlled, that an extreme measure by parents to control entry - infanticide - was tolerated or even encouraged. But a system that enables parents to exercise such a control over the entry into the household is a substantially different set of

operational rules than a system that allows exit and encourages late marriage, celibacy, and birth control, but not infanticide. Given the substantial differences in rules relating to inheritance, land transfers, emigration, and the control of parents over entry to the commons, one cannot conclude the full SET of rules related to land tenure in these similar economic and ecological environments were similar. Thus, the two case studies provide evidence to reject H3a, which was the strongest version of the economic activities determine institutional arrangements hypothesis. It is not the case that similar economic patterns are related to a similar set of rules.

The evidence from the Swiss and Japanese cases is consistent with both H3b and H3c. (More extensive research would be needed to distinguish between H3b and H3c.) "Communal" ownership was used in both settings to specify some of the rights and duties of participants related to similar types of economic activities. The rather vague reference to "communal" ownership can be translated in both villages to mean the existence of the following two specific rules.

- R1 Any co-owner of "communally owned land" can exclude any nonowner from consumptive use of this land.¹
- R2 No co-owner of communally owned land can exclude any other co-owner from use of this land so long as the use is consistent with R3, . . . Ri, . . . Rn regarding timing and amount of use.

The specific operational rules in use in these villages to define timing and amount of use differed rather dramatically. In the Swiss

1 R1 converts the grazing and forest commons from a free and open access commons into a system of common property (see Ciriacy-Wantrup and Bishop, 1975; Runge, 1983). This system would be characterized as a usufruct property according to the definitions used by Welch above (see page 7).

village, the amount of fodder produced by the commons was distributed to individuals in proportion to the amount of land privately held. In the Japanese village, the amount of fodder produced by the commons was distributed in equal shares to the recognized households in the village irrespective of the amount of private land they held. Each of the villages had developed an intricate array of specific regulations for the use of commonly owned land that varied substantially among them. Different rules were used in the Japanese villages relating to access to the same crop.

An external observer can produce a coherent explanation for why some of the particular rules differed (see, for example, the explanation offered by McKean in the paragraph quoted above at page 18). One type of explanation is that the "strictness" of the rules governing access and use appear to be closely related to the relative scarcity of a particular use unit in the commons. But the "scarcity leads to strictness" hypothesis is not sufficiently robust to explain all the differences among the rules of access and use.²

An alternative hypothesis for some of the differences in rules is that the rule currently in use is the first one adopted in the village

² The rules used in Hirano and Nagaike to determine access and type of distribution for thatch were quite different for example. In Hirano each household was allowed to send one able-bodied adult to cut as much as could be cut on "mountain opening day" and the household retained everything the individual representative cut for it. In Nagaike, cutting was separated from distribution and each household received an equal share of thatch. The two villages reversed these types of rules for fodder. Work parties cut and tied fodder into bundles in Hirano and then these were divided evenly and assigned by lot by each households. In Nagaike, each household kept for themselves the amount of fodder they had cut on mountain-opening day (see McKean, 1984: 34-38).

for which conformance is sufficiently high and the results sufficiently beneficial that villagers were basically satisfied with the equity and efficiency consequences of the rule. Such a hypothesis is fully consistent with a view of the evolution of institutional rules starting with a trial and error process and modified by efforts to improve upon the results from time to time through analysis and design processes. However, I would not characterize the end products of such a process as "determined." Trial and error efforts combined with learning may produce quite different "solutions" to the "same" problems.

Let us ask what is "determined" and what is not "determined." In the Swiss and Japanese villages, certain environmental problems combined with certain production technologies did combine to produce (determine?) certain types of problems that individuals had to solve if they were going to make productive use of their environment. But similar problems do not "determine" the type of solutions that people adopt. Let us briefly review the type of problems that had to be solved in each case and the type of "solutions" reached.

In both the Swiss and Japanese villages, they had to solve the problems of limiting the total amount of use of the commons to less than or equal to "sustainable" yield of the commons. Both village systems limited the use of the commons to those in the village accorded full rights; but the Swiss allocated the flow of benefits proportionally to the amount of private land held while the Japanese allocated benefits in equal shares to recognized households.

Both systems had to solve the problem of granting rights to the next generation. In the Swiss setting, all heirs received an equal

division of their parents land and could then transfer their divided share among themselves and others in the village. In the Japanese setting, no division of the household was authorized except in rare circumstance approved by the village council, and no transfer was allowed within the family or village.

Both systems had to solve the problem of population growth. In the Swiss villages, emigration was allowed, late marriage and few offspring was encouraged, and some offspring were expected to remain unmarried. In the Japanese villages, emigration was very restricted and more severe forms of birth control were exercised.

Both systems had to devise specific rules concerning access to and use of each type of consumption unit from the commons. The variety of rules used in the several villages to accomplish this task is rather wide.

Conclusions

These *two* studies provide empirical evidence that is quite important to our understanding of the role of institutional arrangements in enabling individuals to solve common-pool resource problems. Given the longevity of these locally, designed rule systems, we know that it is possible for those involved in a common-pool resource problem to arrive at a set of rules that enable them to keep total use within the limits of sustainable yield. We also know that neither the development of fully individual property rights nor allocating control of the commons to a central authority is necessary for the problem of "overgrazing" to be solved. These

studies provide strong evidence against the presumption that all common-pool resource systems will require either private property rights or central control to achieve effective regulation of the commons.

Further, we should have doubts about the empirical warrantability of the strong hypothesis that economic activities determine institutional arrangements. Simple acceptance of a deterministic view of the causes of institutional arrangements can lead scholars to presume that there is a single optimal arrangement that will be generated in response to particular types of economic activities in particular types of environmental conditions. A simplistic acceptance of economic determinism can lead scholars to presume that all institutional change increases general social welfare and that the direction of change in all societies is toward an ever improving economy.³ The institutional rules used when changing other institutional rules may play as large a role in affecting the direction of future changes as the economic activities involved.

3 An important intellectual tradition in economics has attempted to make institutional arrangements endogenous to an economic model rather than simply using institutional arrangements as exogenous factors that help explain the processes and results of economic activities (see Davis and North, 1971; Binswanger and Ruttan, 1978; Hayami and Kikuchi, 1982, etc). The theoretical work has led to some careful empirical studies (see, for example, Feeney, 1982, and Hayami and Kikuchi, 1982) whose evidence is consistent with H3c stated above. In their empirical work and detailed theoretical discussion, these scholars are careful to stress not only factors leading to a demand for institutional change but factors affecting the supply of institutional innovations. An underlying faith is implicitly held, however, that pressures for institutional change, which will leave most participants better off, prevails against pressures for institutional changes which distribute most of the surplus to a small group.

Several additional lessons can be learned from the Swiss and Japanese experiences with the use of locally developed rules systems. One relates to the importance of rules to complement cultural value patterns. All too frequently, analysts of common-pool problems presume that only a change in human value patterns or concepts of morality will lead to the type of behavioral change needed to avoid the tragedy of the commons. Alternatively, it is sometimes asserted that the tragedy of the commons only occurs in modern, westernized cultures. Members of these cultures are exhorted to emulate the "selfless" value systems of other cultures. Without denying the importance of cultural values, it is apparent that Japanese villagers have not been willing to rely entirely on socialization as a means of assuring behavior that avoided the tragedy of the commons. McKean's own conclusion in this regard stresses the point.

The Japanese experience also demonstrates that no rules are self-enforcing. Even though Japanese villagers had a strong community identity and were very concerned about social reputation and bonds with the group, and although they were capable of internalizing as a vital goal the preservation of the commons, even this most cooperative, compliant group of people were vulnerable to temptations to bend, evade, and violate the rules governing the commons. Thus there had to be a scheme of penalties and these had to be enforced (McKean, 1984: 54).

A second lesson relates to time. These systems were not created by one sweeping administrative reform which set up local councils in all communities. The power of local villages to regulate their own common property was wrested from feudal lords during an epoch of struggle. Trial and error methods could be utilized as villagers became more and more aware of the consequences of the rules in use. One can only bemusedly speculate on the type of findings that an

evaluation team might have expounded in 1603 upon examining the first two years of a Japanese village's efforts to regulate its newly acquired commons. No doubt considerable confusion still existed about exactly who could use and for what purpose. Such a team might even have strongly urged that national authorities be asked to take over responsibility before the irresponsible villagers destroyed their valuable common property.

A third lesson relates the ease and capacity of monitoring behavior and performance. These villages were small, the commons they managed were located nearby, and the local managers of the commons could directly observe how the rules they were using affected the yield of the commons. The rules in use were understood by the participants.

Moreover, the villagers - certainly village elders and kumi chiefs, and probably heads of all households - thoroughly understood the direct relationship between the rules and the preservation of the commons. These people lived with the seasons and natural cycles and knew their commons very well. Every time I asked about the reason for a particular rule, my informants explained the rule in terms of environmental protection and fair treatment of all the villagers. There was always a sophisticated and sensible explanation, and never 'well, we've always done it that way.' Even if the village elders were the prime repositories of accumulated scientific knowledge of this sort, this information circulated regularly through the village. Obedience to the rules was almost certainly based on an appreciation of the value of the rules, and not merely on compliance to avoid penalties (McKean, 1984: 45).

The combination of sufficient time to learn how to create successful rule systems and the capacity to monitor the results at relatively low costs are probably major factors in the long-run success of this system.

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