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The Wet and the Dry: Traditional Irrigation in Bali and Morocco

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The comparative perspective is of central importance to effective analysis in human ecology. The present paper compares "traditional" irrigation systems in two quite disparate settings: east central Morocco and southeastern Bali. Bali, which has a tropical climate and a plentiful water supply, displays a highly collective approach to the organization of irrigation facilities. Morocco, which is essentially an arid country, displays, on the contrary, a much more individual, property-based approach to water regulation. The internal organization of these two regimes is described and their connection with more general cultural and ecological factors is traced, in an attempt to demonstrate that patterns of adaptation are susceptible to the same pattern of analysis as other aspects of social and cultural life. The contrast between the strongly group-oriented Balinese approach to water control and distribution and the highly individualistic Moroccan one is said to extend in an overall way to the two societies as a whole.

INTRODUCTION

The pioneer studies made by the anthropologist Julian Steward in what he later came to call cultural ecology were expressly comparative, either as between different sorts of hunting-gathering bands or different sorts of irrigation civilizations (Steward, 1955). More recent studies have tended to lose this dimension, however, and concentrate on monographic analysis of single societies in the conventional anthropological manner. Yet, as Steward realized, any

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attempt to discover broader generalities in the relationships between natural processes and cultural ones demands an at least implicitly (and, preferably, explicitly) comparative perspective. Any long-established adaptive regime considered only in itself tends to take on the look of not only inevitability but also optimality. The doctrine that whatever is is right is no more attractive in anthropology than it is in ethics. But it comes only too easily to hand when one looks too fixedly at a single case.

A comparative approach in human ecology restores the sense that things could quite easily be otherwise than they are, which is not the same as saying that they could be anything at all. It prevents the cultural aspects from decaying into a mere reflection of the ecological and the whole enterprise into another exercise in reductive materialism. When generally similar adaptive regimes are viewed in generally unlike cultural contexts, the recognition that those regimes are multiply determined is very difficult for even the most monomanic of theorists to escape. The original intent of Steward's program was to integrate physical and biotic variables into cultural analysis, not to segment them off as extrahuman determinants of culture within which unconditioned laws would then be sought. By dramatizing the fact that cultural presuppositions stemming from sources whose connections with adaptive constraints are (to the extent they exist at all) very distant can have a profound effect on adaptive responses, comparative analysis tends to keep that intent in the center of attention. Single case studies may, of course, do that as well, and a number have. But the proposition that landscape, weather, rice, or pigs make the man can be rendered much more readily plausible when there are no contrast cases to challenge inferences from the exhaustively detailed immediate instance.

In this spirit, partly polemical, partly constructive, partly, I must admit, merely wistful, I will discuss here "traditional" irrigation in two settings—east central Morocco and southeastern Bali—about as different from one another as two settings can be. And I will attempt to show how the equally radically different ways in which water is handled in the two settings leads to some general insights into the again strikingly different cultures situated in them.[2]

SOME GENERAL CONTRASTS BETWEEN MOROCCO AND INDONESIA

Whatever Morocco and Indonesia have in common—Islam, poverty, nationalism, authoritarian rule, overpopulation, clean air, spectacular scenery, and a colonial past—the one thing they do not have in common is climate.

[2] The fieldwork on which this article is based was carried out in Indonesia during 1957-1958 and in Morocco during 1965-1966 and 1968-1969. Also, it should be noted that all vernacular terms, Balinese or Moroccan Arabic, are given in the singular form only, plurals being indicated by English endings.

At base, the contrast is almost Lévi-Straussian in its simplicity: wet and dry.[3] The annual rainfall in central Java, the classical heartland of Indonesia, averages around 2000 mm (i.e., about twice that of Chicago), while in parts of Sumatra and Borneo it gets up over 3500 mm. In the Fez-Meknes-Marrakesh triangle, the classical heartland of Morocco, it averages about 500 mm (i.e., about half that of Chicago), while in the South, Pre-Sahara, it drops as low as 50 mm a year.

Further, not only are the annual mean totals near the opposite ends of the world scale, but also the rhythmicity with which rain falls is also out near the extremes. In Indonesia, year-to-year variation is very small, as is variation in the shape of the rainfall regime from one year to the next. In Morocco, not only is year-to-year variation in rainfall enormous, but also is the within-year shape of it. To be a weatherman in monsoon Indonesia, all you *do* need to know is which way the wind is blowing; in Morocco, to be one you need to be able to penetrate the mind of God.

In the Balinese area studied, the annual rainfall over a 10-year period varied between about 2200 mm and about 2500 mm, with a coefficient of variation of 5.8%. In the Moroccan area, over a similar period, the variation was from 350 mm to about 900 mm, for a coefficient of variation of 29.4%. Where the monthly Balinese totals over the same period—how much it rained in July, January, or whenever—were also extremely consistent, almost invariant, they were astonishingly unpredictable in Morocco. In January 1959 there were 15 mm of rain; in January of the following year, there were 190 mm. There was more rain in July (i.e., mid-summer of 1959) than in February (i.e., mid-winter) of 1961, though those two yearly totals happened to work out nearly identically.

One gets the same picture with all the other climatic measures—temperature (a constant 80 F in Bali year round, a 55 F mid-summer/mid-winter swing in Morocco, and similarly for diurnal variations), wind, sunshine, and so on. The same contrast could be extended throughout all the established metereological parameters: constancy, regularity, homogeneity in the one place; inconstancy irregularity, and heterogeneity in the other.

Without going into the reasons for these systematic differences, nor into other environmental contrasts (soils, relief), it is clear that they are going to provide rather different sorts of habitats for agrarian man to live in. Bali is, of course, largely paddy country; central Morocco, largely wheat and olive (and, on the pastoral side, sheep) country. The thousands of small, squared off, carefully irrigated mud diked rice terraces sunk like ancient ruins into the sculptured

[3] For a general review of the Indonesian climate and natural setting, see Dobby (1954); for one of the Moroccan, see Martin *et al.* (1964).

landscape of the former, the thousands of narrow, little, medieval-like dirt-farming strips scratched on the baked surfaces of the latter can almost stand as paradigm images (and, in tourist posters, often do) of the two countries.

One can carry these contrasts forward in many directions–population density, cultivation methods, settlement patterns, trade.[4] But so far as our focus here is concerned (irrigation), the main difference is that there is a great deal of water in Bali, most of the time, and there is a great deal less–indeed, from the farmers' point of view, an absolute water shortage–irregularly distributed, both temporally and spatially, in Morocco.

Speaking generally, in south Bali irrigation is widespread to the point of being universal; in central Morocco it is confined to well-demarcated, commonly very constricted localities, micro-environments in the micro-est sense of the word. Where Bali, from this point of view, is a kind of giant outdoor aquarium, or, rather, a multitude of little aquariums pressed tightly up against one another, Morocco is–again from *this* point of view–a collection of scattered (or anyway discontinuous) oases, garden spots in a dessicate landscape.[5]

Balinese irrigation is a huge, homogeneous, very precisely calibrated, multi-leveled, extraordinarily effective system. Moroccan irrigation (and, again, to re-emphasize, the overwhelming bulk of Moroccan agriculture is not irrigated at all) is a small-scale, quite heterogeneous, broadly at best, calibrated, single-level, but, at best, moderately effective system. These general differences in long-established irrigation regimes are determinately related to similar differences in technological, sociological, and cultural patterns in such a way that two quite contrasting ecosystems with quite different properties are created. Environment is, therefore, and long has been, more than a passive, residual, limiting sort of factor in shaping Moroccan and Balinese life.[6] It is and has been an active, central, and creative one.

THE BALINESE *SUBAK*

The defining feature of the Balinese irrigation system, something which

[4] For an attempt to pursue some of these matters for Indonesia generally, and Java particularly, see Geertz (1963).

[5] It needs continually to be remembered in what follows that irrigation plays a role in only a small proportion, though the most productive, of Moroccan agriculture. In particular, nowhere does irrigated agriculture form the exclusive or even nearly exclusive basis of the subsistence regime, but is always set in a broader context of rainfull farming and/or pastoralism. The implication of this fact in a general assessment of the Moroccan adaptation is profound, but it cannot be pursued here.

[6] Balinese irrigation, apparently organized along lines extremely similar to the present, is mentioned in inscriptions dating as early as 896 (Goris, 1954). For a description of Moroccan-introduced irrigation patterns substantially identical to those described below in medieval Valencia, see Glick (1970).

makes it, if not wholly unique, certainly unusual, is that it is organized into a separate, independent, completely autonomous social form, called the *subak,* and unusually translated well enough, if awkwardly, as "the irrigation society."[7] A *subak* is, first and foremost, a differentiated, corporate, self-contained social organization, devoted specifically and exclusively to irrigated farming, mainly (though not exclusively) of paddy–a kind of "wet village," as opposed to the "dry" one in which people reside. Indeed, this idiom is commonly employed by the Balinese to refer to it.

In spatial terms, a *subak* consists of all the rice terraces irrigated from a single major water canal (*telabah gde*). This canal runs down the steep volcano-to-beach slope of Bali from a single mud and stone river dam. (Southern Bali is laced with very deep cut gorges plunging down this slope every thousand yards or so, and it is across them that these dams, one every three or four miles, are thrown.) The dam (*empelan*), which is usually five or ten miles, sometimes even more, upslope from the *subak* it serves, is the property of the *subak* as a corporate body. So also is the canal, which, often aided by underground tunnels, overhead aquaducts, and reservoirs, runs off from it to the fields proper.

The fields proper, the terraces, are contiguous and form a clearly bounded domain. (Like "dry" villages, *subaks* are individually named.) All people owning land, which they do in simple freehold fashion, in that domain are members of the *subak.* This membership is completely independent of any other social characteristic–residence (all *subaks* have people from various villages, and any one individual with much land at all will belong to several *subaks*), caste, kinship position, and so on.

Thus, the *subak* is at once a technological unit, marked out by the collectively owned dam and canal; a physical unit, an expanse of terraced land with a defined border around it; and a social unit, a corporation consisting of people owning land in that expanse, serviced by the dam and canal. It is also, as we shall see, a religious unit.

As the main canal approaches the fields, it usually is split by very ingenious bamboo water dividers into two smaller canals, and subsequently those smaller canals are again divided into halves or thirds by a second rank of dividers, a process which may, in large *subaks,* be repeated a third or even fourth time.[8]

[7] For other descriptions of the *subak,* see Grader, 1960: 268-288; Liefrinck, 1886-1887: 1033-1059, 1213-1237, 1557-1568, 17-30, 182-189, 364-385, 515-552; Geertz, 1959: 991-1012; and Geertz, 1967: 210-243. *Subak* terminology varies over the island; that given here is the Klungkung one.

[8] In general, *subak* increase in size as one moves from the top of the drainage area downard toward the sea. The very highest are extremely small; those near the strand, large and sprawling. A full description of the interaction of landscape, *subak* structure, and political organization will be presented in a monograph on the traditional Balinese state now in preparation.

The final result of this before-the-terrace distribution is the creation of between six and twelve separate inlets to the terraces as a whole. Each such inlet defines a distinct subsection of the *subak* as a whole called a *tempek,* which, if the *subak* is a water-village, would be the water-quarter or hamlet, and indeed is sometimes thus referred to. This pre-terrace organization can get very intricate, but the essential point is that this dividing and redividing and thus water allocation by *tempek* is fixed and unchanging (or, at most, very, very gradually and marginally changing), embodied in hallowed custom, which here in fact is actually written down in palm-leaf *subak* constitutions (*awig-awig subak*). The technical grid, the crystalized canal and water gate structure, gives thus the form of the whole system, its skeleton. Alterations are occasionally made, but they are not done either easily or often.

After the water reaches the terraces proper it is further divided into halves, thirds, or fourths, occasionally sixths, to create yet smaller subunits (*ketjoran*), water neighborhoods, so to speak, which may consist of anywhere from six to seventy or eighty terraces and which is again named. And finally, within these subunits, smaller dividers, capable, given the mere rivulets they are by this stage faced with, of divisions as fine as a tenth, segment the water out into terminal canals defining the elementary unit of the *subak,* called a *tenah.*

Within any one *subak (not* between them, of course) such final *tenah* units represent, in theory, and given the technical precision involved, pretty much in fact as well, exactly the same share of the water supply, whatever that may be either in general or from moment to moment, the overall grid being very carefully arranged to produce such a result.[9]

This, then, is the physical structure of the *subak*. But it is, as I say, also the social structure, because the organization of the *subak,* and thus of wet rice agriculture generally, parallels this technical pattern with virtually perfect and explicit exactitude. The structure of the *subak* as a corporate body, as a social system, and as a cultivation regime is given by—or, if that is too deterministic a way to put it, is congruent with—the structure of the *subak* as a physical mechanism for moving water between rivers and fields.

The best way to see this is to look briefly at cultivation as such. The actual ploughing, planting, weeding, and harvesting of terraces is organized and carried out by the individual terrace owners, independently of the *subak* structure, *except,* and this is, as we shall see, a critical point, *with respect to timing. When*

[9] A *tenah* is, in fact, at once a water measure, a land measure, a seed measure, and a rice measure. A *tenah* of land is the amount a *tenah* of water irrigates; a *tenah* of seed, the quantity needed to plant that much land; and a *tenah* of rice, the yield thereby produced. For more of this, see Geertz (1967).

to plant is not a matter of individual choice: everyone in the *subak* must plant at the same time.[10]

As for irrigation proper, a technically complex matter here, it is wholly a collective *subak* matter. The upkeep of the various works, from the large main dam down to the smallest canal, is carried out by work groups of *subak* members, the details of whose formation, mode of operation, and compensation we can ignore here. The structure of the work group is socially extremely complex, and it is tiered like the grid itself into larger and smaller units devoted to tasks at different levels of the *subak*. The main point is that these are not mere ad hoc groups, but official arms of the *subak*. The opening and closing of water gates is similarly a *subak* matter. Thus, except for work entirely confined to the individual terrace, and even indirectly there, cultivation is regulated, paced, if you will, by the *subak* as a set of larger and smaller groups of its members organized into work groups under appropriate officials.

At the peak of this political-social-technical hierarchy there is the *subak* chief (*klian subak*), elected by the members, and the *subak* council, consisting of all the members, each with a single vote irrespective of size of holding. The council sets general policy within limits of the written constitution and elects the various officials. It can, and does all the time, fine people for infraction. (For severe contumacy it can even take away a man's land, though matters but rarely come to such a pass.) It collects taxes for support of the *subak* and disburses moneys out of them for improvements. It appoints priests to conduct the appropriate rituals in the *subak* shrines. With a miniature bureaucracy, a parliament of the whole, specially focused task groups, police and tax powers, and a ritual encasement, the *subak* is not only a technically developed unit but also clearly a very organic social unit, a corporation, with a form and direction of its own.

Yet, at the same time, it must also be stressed that the *subak* is in no sense a collective farm. On his own land (which he can sell, rent, tenant, or whatever, as he wishes), within the regulations set by the *subak*, the individual peasant is his own master working in his own way, consuming (or selling) his own produce. The *subak* never engages in the actual process of cultivation as such, nor, as I say, of marketing; it regulates irrigation, and that's all that it does. And in order to do so (with results that for Southeast Asia are the most productive in the entire region), it exercises important constraints on the decisions of the individual cultivator. But the actual process of cultivation within those constraints has always been a matter specifically (and this too is written, like some agrarian bill of rights, into the palm-leaf constitutions) beyond both its competence and its interest. The *subak* is a technically specialized, cooperatively owned public utility, not a collective farm.

[10] Traditionally, this was true only for rice, but with increased population pressure and crop diversification it is increasingly true for nonrice "dry" crops as well. For details, see Geertz (1967).

Since, as south Bali has, in simple quantitative terms, if not all the water it could conceivably use, then about all it can in fact effectively use, it is less the absolute amount of water overall that is at issue than the timing of its application to the fields. For this reason, the very elaborate ritual system, to which I have several times alluded, is as critical in the *subak's* operation as the technical, social-structural, and political aspects of it I have just reviewed.

The focus of this ritual system is a rice-goddess cult, whose precise content we need not go into here, and it is conducted at every level of the *subak* from the individual terrace, through the various subsections of the *subak,* to the *subak* as a whole.[11] At the higher levels there are specific temples, with assigned priests, special ceremonies at special times, and specific altars, gods, offerings, and prayers. These various ceremonies are symbolically linked to cultivation in a way which locks the pace of that cultivation into a firm, explicit rhythm.

Even more interestingly, however, the ritual system not only does this internally within the *subak,* but also reaches beyond the individual *subak* to ensure inter*subak* coordination within a given drainage region—a region, say, ten to fifteen miles wide and thirty-five or so long, fanning out as you descend from mountain to sea. To see how this occurs, it is necessary to give a very generalized and overstandardized description of the cult.

The cult consists of nine major named stages. These stages follow in a fixed order at a pace generally determined, *once the first stage is initiated,* by the intrinsic ecological rhythms of rice growing. This cult is uniform over the entire region and it refracts to all levels of the system from the terrace to the supra*subak,* i.e., concurrent rituals are conducted at all levels. The nine stages are: (1) water opening; (2) terrace opening; (3) planting; (4) purifying the water; (5) "feeding" the gods with holy water and other offerings; (6) budding of the rice plants (about 100 days after planting); (7) "yellowing" (that is, approaching fruition) of the rice; (8) harvesting; (9) placing the harvested rice in the granary.[12]

Now, the "water opening" day, stage one, for the various *subak* in the drainage (i.e., the day on which, amid ceremonies at the dam temple, water is diverted at the river dam into the *subak's* main canal) is staggered in such a way that the higher the *subak* along the mountain-to-sea gradient, the earlier the opening day. *Subaks* at the top of the system begin the ceremonial cycle, and with it the cultivation sequence, in December; *subaks* at the bottom, near the

[11] For general description of Balinese religious life see Swellengrebel (1960). For a description of the rice cult as such, see Wirz (1927).

[12] The Balinese names for these ceremonies are: (1) *Amapeg Toja;* (2) *Njamu Ngempelin Toja;* (3) *Mubuhin;* (4) *Toja Sutji;* (5) *Ngerestiti* (or, more colloquially, *Ngrahinin*); (6) *Membiju Kukung.* Stages, (7), (8), and (9) are all included under the general term *Ngusaba,* plus appropriate qualifiers, and are really, thus, seen as three phases of a single stage.

coast, begin it in April; those in between topographically are in between temporally as well.

The result is that, at any one point in time, the drainage area as a whole shows a step-by-step progression in the cultivation sequence as one moves downslope. When a higher *subak* is flooding its terraces preparatory to ploughing, a lower is clearing its. When a lower is flooding a higher is planting. When a lower is celebrating the yellowing of the rice and thus the promise about a month hence of harvest, the higher is already carrying the sheaves to the barns.

The temporal progression built into the ceremonial cycle (which is set off and continued by a kind of superpriest at a regional river cult temple at the volcanic lake at the very top) is thus laid out on the ground as well, and in addition to pacing the cultivation sequence in each *subak* separately, it also intermeshes those separate sequences in such a way as to provide for an overall sequence for the region as a whole.

The main ecological effect of this system is to stabilize the demands upon water over the crop year, rather than allowing it, as it would in the absence of such a system, to fluctuate widely. Simplifying somewhat, terraced wet rice growing requires maximum water input at or just after the initiation of the cycle, and then a steadily decreasing input as the cycle proceeds, until, at the end, harvesting is carried out in a fully drained, dry field. If the cycles of all the *subaks* in a single drainage, or, worse, along a single river, were coincident, the result would be that water resources would be enormously overtaxed during the earlier phases of the cycle and about as enormously underutilized during the later ones, especially as, again simplifying somewhat, the amount of water naturally available does not vary greatly over the year. Indeed, as water is the central limiting factor in the *subak* ecosystem, if *subak* cycles were not staggered, wet rice cultivation in Bali could never have attained, and could not maintain, a fraction of its actual extent, which is, as I have said, extremely great.

THE MOROCCAN IRRIGATION SYSTEM

In turning to the central Moroccan pattern, I am going to do something which, at the level of principle, I would prefer not to do: namely, describe it in opposition to something else, the Balinese pattern, rather than independently prior to comparison. As a developed, articulated, and in its own way and own place, not ineffective system, it deserves a more positive characterization, one in terms of what it is rather than in terms of what it is not. But for purposes of exposition it is nonetheless useful to describe it in a kind of negative design way. This is less than ideal, but even the negative design approach can bring out the main features of the system, and in briefer compass, so long as it is remembered that the Moroccan irrigation system is not just a very inferior version of the Balinese. Indeed, it is not a version of the Balinese at all, which could never work in Morocco, but a particular adaptive form, a distinctive ecosystem of its own.

Having said that, the quickest way into the Moroccan system is to say that there is nothing like the *subak* here, no corporate group organization of irrigation at all. Indeed, the underlying principle in Morocco is individual personal ownership of water. This works out in a variety of ways, but underneath them all is the concept that water, like land, houses, clothing, women, children, friends, sheep, sanctity, and anthropologists, is *property,* something that someone owns.

As it is also, unlike land, women, anthropologists, and so forth, not a fixed entity but a fluid resource, this raises some important problems of coordination and even, in an agonistic sort of way, cooperation. But these problems are not met by any version of the public utility method, but by a precise and elaborate system of customary property law, a system of common-law type legal concepts defining individual rights in something which one can possess only as an agency, not as an object, but no less firmly for that.

In any case, rather than deep-cut ravines pouring water down the sides of volcanic slopes every thousand yards, what you have, at least in the area I studied, are irregularly scattered springs, some voluminous, some trivial, and a great many in between, irrigating sharply circumscribed areas—oases, in the broad sense of the term. There are other sources, but the spring sort of irrigation system is, in the region I am concerned with, overwhelmingly the main one, and I shall confine my attention therefore to it.[13]

The particular area involved—a small city plus its hinterlands about thirty kilometers south of Fez—is marked by three fairly distinct subregions. Behind the city, the Middle Atlas mountains rise immediately, and in them the major mode of adaptation is sheep and goat pastoralism. There is some extremely small-scale cultivation, mainly of maize, and even here and there in a favorable locality a spot of irrigation. But, in general, springs are few, scattered, and thin. Northward, toward Fez, the country is rolling prairie, prologue to the great Sais plain which forms the country's bread basket, and on the prairie there is a mixture of large capital intensive farms, formerly French, now mostly nationalized or bought up by members of the Moroccan elite, and hundreds of small strip farms, most of them (as are the large farms) in wheat. Though a few of the capital intensive farms have installed mechanical pumps for irrigation, this area also lacks more than a few scattered springs and depends almost entirely on rainfall for water. Between these two areas, in the piedmont, however, there is a thin band, ten to fifteen miles wide, where a very large number of springs, many of them sizeable, and what is even more important, reliable, exist. It is in this subregion where almost all the intensive irrigation in the area as a whole takes

[13] Elsewhere in Morocco both river-flooding and well irrigation are important, as are such technological inventions as the Persian water-wheel, dams, and the famous covered canals (*gana*). For a general review, see Martin *et al.* (1964).

place, where there are intensive truck farming (vegetables, olives, grain), large villages, small garden-surrounded towns, and relatively dense population (though, of course, nothing like the Balinese).

Given the microenvironmental variation of this piedmont region particularly, each specific system differs somewhat from the next, because the problems it is faced with differ. But the family resemblance among them is for all that overwhelming. Thus, rather than using the ideal-type approach I employed for the *subak,* where there is also some variation, but less fitful in expression, I will describe, and that sketchily, a particularly well-developed specific example from this area, adding merely the remark that other systems in the area I could as well have described would have displayed little kinks of their own, but come, in general, to the same sort of thing.

The area involved consists of four or five, depending on how you count, clustered settlements, scattered several hundred yards apart down over five miles or so of the foothills to the mountains, just before they flatten out into the prairie. [14] The core of these settlements consists in four Arab-speaking lineages considered each to have descended from one of the sons of a famous seventeenth-century saint who is buried, so they say, in a shrine in the largest of the settlements. There is some tendency for the lineages to be correlated with the settlements, but this is far from absolute. There is also some tendency for them to be both separately and collectively endogamous, but that is not absolute either. In addition, there are other people living in the settlements who are not members of these saintly lineages.

It is unnecessary to go further into social structure here, except to say that though the area—the four or five settlements—is a rather well-defined one in kinship and religious terms (that is, essentially in terms of self-image), it is not as a whole a political unit of any reality, nor, for that matter, are the separate settlements; there is very little corporate quality to any of the social groupings—lineage, settlement, settlement cluster. Conceptually the area is an entity, socially it is rather profoundly not, a paradox, or apparent paradox, which tends to be characteristic of Morocco generally.

So far as irrigation is concerned, the important point is that, although the people of this area draw upon common water resources, they do so in a way about as far from the public corporation Balinese *subak* as it is possible to get and still not fall into a Hobbsean war.

Beginning, as I did with Bali, at the specifically technical level, the first point is that rather than a single irrigation source, the river dam, there are here a multiplicity, the various local springs. One of these, called "Sultan Spring" (*'ayn seltan*), is the most important, because it produces the most water and is the

[14] For a full sociological description of this settlement, see Rabinow (1970).

most reliable, but there are a number of others, large, small, and medium-sized as well. From these springs run canals, here hardly more than crude ditches as compared with the elaborate Balinese ones, whose form and direction can be changed, if not at will, at least relatively easily within a fairly wide range. It is not the structure of the grid that organizes the water distribution here, but rather the water distribution that organizes the grid.

There are, to be less aphoristic, two methods by which fields are irrigated from the springs. In some cases, here mostly the smaller ones irrigating local clumps of fields, there is an order of succession in terms of which individual fields are watered. That is to say, field A is watered until it has sufficient water, then B, C,...,N, and then back to A. How fast the cycle goes around depends upon the amount of water, the number and size of the fields, and, not least, the rhetorical skills of the owners. In other cases, especially in connection with the larger springs, such as the Sultan Spring, water is rotated by the clock among various fields: section A gets three hours; B, three hours; then C, six; D, two; and so on, in a similarly cyclical fashion. Although the second pattern is more complicated, and now that there are clocks rather than prayer times to measure by, perhaps more precise, and probably more flexible, the underlying principle is the same: individual men have defined individual property rights in water.[15]

A man owns his place in the cycle, whether measured in hours or in queue terms, as he owns anything else, and though there are natural constraints on what he can do with these rights–for one thing Bali and Morocco do have in common is that water runs downhill in both places–there are none which stem from any overall community determination of the public utility sort. There is no "water village" here. There are rules; a very great many of them. But they are phrased in terms of individual rights, not collective necessities, as contractual, not civic, obligations.

In the first place, water rights and land rights are here not fused. One can sell either without the other, can own water rights from which one has no appropriate land, and can rent it to somebody who does. One also can–and it goes on constantly–borrow and lend water from one field to another, sometimes several miles away. (For example, a man who owns three hours downstream can as well apply it upstream if he wants and topography permits, and vice versa.) When a man dies, one of his heirs may get his land and another his water. And so on.

Second, there is no superordinate political structure of any significance connected with irrigation. There are a few, quite unimportant officials (*jarri*) to

[15] The timed system in called *l-ma dyal s-sa'a* ("water by the hour") or *b-l magana* ("by the clock"; there is a large clock in the mosque which is the standard, though most men have watches of their own as well); the queue system is called *mubih*. For the same contrast between these two systems in old Spain, see Glick (1970).

keep time and track (though everyone does this for himself as well), but there is no meeting, irrigation head, constitution, fines, taxation, organized collective labor, authorities with sanctioning power, etc. When canals (*sāqiya*) need to be cleaned, open, shut, or whatever, those concerned merely do it themselves; in the absence of elaborate works, most jobs are minor and involve but a few people. On the rare occasion on which a larger task appears, some sort of ad hoc group is formed, or the owners pay laborers to do it. And where there are differences of opinion, which is just about all the time, people merely argue, occasionally even come to blows.

What *does* control this system is an elaborate property law. The simplest way to clarify this fact without getting into the formal details, which are numerous and intricate, of the matter is to give two quite typical examples from, on the one hand, the farmer's viewpoint, and on the other, from the viewpoint, so to speak, of the water.

As a prelude, it is necessary to know that all land plots, even uncultivated ones, and all water units have individual, proper, so to speak, "personal" names (*Ḥariga, Ḥasun,* etc.). In the water case, these units are shares in the output of a particular spring, say, Sultan Spring, determined, as I say, either in temporal or queue fashion; in the land case they are specific fields. For simplicity, I shall represent these named land or water units by letters A, B,...,Z.

Take, then, Muhammad. Muhammad has four irrigated plots, scattered in various parts of this miniregion.[16] He owns four-what can we call them? waters? One of these, A, is three nighttime hours in Sultan Spring which comes around to him once every six nights. Another, B, is four daytime hours in the same spring which comes around to him every ten days. A third, C, is one daytime hour in another spring which comes to him every twelve days. Finally, for D, he has queue type rights in another small spring whose cycle depends upon how much water there is.

Now, Muhammad waters his four irrigated fields W, X, Y, and Z thusly: W–the four day-hours of B, once every four times they come around (i.e., every forty days) and one night-hour of the four of A every time it comes around; X–one night-hour of A's four each time it comes, the four day-hours of B once every four times they come around, and the queue right more or less as needed and/or available; Y–one night-hour of A's four every time around, the four day-hours of B every four times around, plus the one hour of C every other time it comes around (i.e., every twenty-four days); Z–the same as Y.

This is not only a quite ordinary example, but also a rather simpler than usual one. Further, I have ignored all the borrowing and lending of water, temporary renting in or out of rights, and so on, which goes on constantly.

[16] Muhammad also has nine unirrigated plots. We will ignore them here, though he doesn't, and a full ecological analysis wouldn't either.

Indeed, how Muhammad deploys his resources differs according to time of year, what is planted where, and the like, so this is a rather reduced and too static version of Muhammad's actuality.

If you look at the situation the other way around, from the point of view of a water unit—call it N, a nighttime one which has a six-night cycle—the same complexity emerges. There are seven holders, owners, whatever you want to call them, owning, respectively, 3, ¾, ¾, 1, 1, 1, ½ hr of the total 8 hr. And this, too, is a simpler than average case.

The point of all this, again, is not the details as such; it is what they say, especially against the background of the *subak*, about what kind of system this is, what the social form of it is. It is a system in which individual private ownership of water is the organizing principle, a principle developed to levels of legal complexity which stand in marked contrast to the technical simplicity of the actual system which underlies it.

This whole area covers only a few hundred hectares, lying in three main discontinuous patches in this little cup of hills, but the number of major units of water rights involved in the main spring, the Sultan Spring, alone is twenty-three (ten "days"; thirteen "nights") and these, as we have seen, are then fractionated hour by hour, or even by half-, third-, or quarter-hours.[17] Add in the half dozen or so other springs, one of which at least is also quite large and complexly subdivided, and something of the social intricacy of this system can, I trust, at least be sensed.

COMPARISON OF THE BALINESE AND MOROCCAN IRRIGATION SYSTEMS

On just about every dimension, the southeast Bali and east central Moroccan patterns contrast. Where the Balinese is technologically complex, the Moroccan is almost technologically embarrassing. Where the Balinese is enclosed in a tightly corporate, superordinate group which explicity and firmly enforces regulations, the Moroccan is entangled in an elaborate code of laws which provides as much a framework for disputation, a vocabulary of argument, as anything else. Where the Balinese system is exactly adapted and structurally very firmly fixed, the Moroccan is very generally and loosely adapted and structurally very flexible. Coordination, in the Moroccan system, is not only low in absolute terms, but also, insofar as it exists, it is confined to small well-demarcated systems, or even parts of systems, not extended to large regions, as the Balinese.

[17] There are even 80- and 50- min units on occasion. This hyperfractionation is most likely a recent development, brought on by population pressure and made possible by modern clocks.

Even the religious dimensions, which I have not gone into in the Moroccan case, so contrast. There is nothing like the Balinese rice cult in Morocco. There are mass prayers at times of drought, certain symbolic connections between water sources, sacred places, gardens, and Paradise, too elusive and complicated to describe in short compass, and a highly developed, religiously supported (i.e., by Islam) sense for the objective reality of codified personal law.

So, what our two cases have in common is that physical, social, and cultural factors are integrated into quite distinctive ecosystems, ecosystems with human beings in them. What they differ in is how that system is organized and functions. But, even more interesting, however, is the fact that *this general order of difference within a single cultural dimension--adaptation to the setting--extends in an overall way to the two societies as a whole.*

The Balinese have a passion—that is the only word for it—for organizing everything into specifically focused, highly corporate, structurally articulate, mutually independent, autonomous groups and then seeking to adjust relations among them in terms of a highly developed ritual system. This way of "doing things" runs through the entire society, from kinship and village organization to temple worship and state structure. Similarly, the Moroccan passion for organizing everything in terms of the head-on encounter of individuals within a general, universalistic moral-legal code, which is used as a basis for forming contracts, arguing issues, deciding conflicts, maximizing options, and adjusting opportunistically to passing reality, runs through every aspect of local life there. Had I discussed family life, or the market, or the civil administration, a picture more than a little reminiscent of the one I have given for irrigation would emerge, and not solely because I was giving it.

Balinese social integration comes down to a matter of adjusting the relations among a sizeable number of differently based but similarly organized, highly corporate, cross-cutting membership groups—*subaks,* lineages, hamlets, castes, temple groups; Moroccan integration comes down to mediating relations among a field of competing individuals, each with a somewhat different basis of power and each scrambling to make his way within the general rules of the game by his own wit and resources. The pluralistic collectivism, as I have called it elsewhere, of Bali, is matched, as a pervasive theme, by, to have another phrase, the agonistic individualism of Morocco.

This is not geographical determinism. It is an argument that the kind of sociocultural analysis that applies to kinship, village politics, child raising, or ritual drama applies equally, and not just in these two societies, to human transactions with the environment. In the formation of Balinese and Moroccan civilization, environment is but one variable among many—or, better, one set of variables among many. And it is one whose actual force must be empirically determined, not a priori declaimed.

But it is one variable, or set of them, and the familiar split between nature

and culture which renders the former a stage upon which the latter performs cannot any longer be maintained. As a chameleon tunes himself to his setting, growing into it as though he were part of it, just another dun rock or green leaf, a society tunes itself to its landscape, mountain-side, river fan, or foothill oasis, until it seems to an outside observer that it could not possibly be anywhere else than where it is, and that, located where it is, it could not be otherwise than what it is. This is an illusion, of course, though certain kinds of Marxists and certain kinds of Romantics are habitually taken in by it. What this illusion arises from is the fact that an established society is the end point of such a long history of adaptation to its environment that it has, as it were, made of that environment a dimension of itself. If a people live in a place long enough the quality of it enters into the substance of their life.

To connect the restless irregularity of much of Moroccan life, the tense expectancy and aggressive opportunism of it, to the uncertain, capricious climate is not, therefore, to yield to a vulgar materialism, for it is in part that climate which projects the aura of irregularity and tension, at least to anyone with a sensuous imagination, in the first place. Similarly, the dogged, deliberate, unwavering–as they themselves say, "straight-line"–quality of Balinese peasant life, moving along one foot after the other in its fixed furrows, is not a mere product of the hanging monotony of the wet heat, but more a kind of comment on it, as it, the heat, in turn is upon that life. The environments of societies such as the Moroccan or Indonesian are no more external to them than the storms in *Lear* are external to the play or the moors in *Wuthering Heights* are external to what passes between Cathy and Heathcliffe.

Though perhaps more apparent in so-called "traditional" civilizations, this sort of infolding of setting and society is hardly confined to them. It used to be thought that, although environment might shape human life at primitive levels, where men were, it was said, more dependent upon nature, culture-evolutionary advance, especially technical advance, consisted of a progressive freeing of man from such conditioning. But the ecological crisis has divested us all of that illusion; indeed, it may be that advanced technology ties us in even more closely with the habitat we both make and inhabit, that having more impact upon it we in turn cause it to have more impact upon us. It is not just the Balinese, looking out at the perfected geometry of their rice terraces, or the Moroccans, looking out on the ad hoc irregularity of their irrigation ditches, but us, looking out on the nervous, smoky confusion of our streets, who see the image of themselves.

REFERENCES

Dobby, E. H. G. (1954). *Southeast Asia* (4th edition). University of London Press, London.
Geertz, C. (1959). Form and variation in Balinese village structure. *American Anthropologist* **61**: 991-1012.

Geertz, C. (1963). *Agricultural Involution.* University of Chicago Press, Berkeley.

Geertz, C. (1967). Tihingan: a Balinese village. In Koentjaraningrat, R. M. (ed.), *Villages in Indonesia,* Cornell University Press, Ithaca.

Glick, T. F. (1970). *Irrigation and Society in Medieval Valencia.* Harvard University Press, Cambridge.

Goris, R. (1954). *Prasasti Bali,* Vol. 1. Kirtya Liefrinck-van der Tuuk, Bandung, Bali.

Grader, C. J. (1960). The irrigation system in the region of Jembrana. In Swellengrebel, J. L. (ed.), *Bali: Life, Thought and Ritual,* The Hague and Bandung.

Liefrinck, F. A. (1886-1887). De Rijstcultuur op Bali. *Indische Gids.*

Martin, J., Sover, H., Le Coz, J., Mauver, G., and Woin, D. (1964). *Geographie du Maroc.* Hatier, Paris and Casablanca.

Rabinow, P. (1970). The social history of a Moroccan village. Unpublished doctoral dissertation in anthropology. University of Chicago.

Steward, J. (1955). *Theory of Culture Change.* University of Illinois Press, Urbana.

Swellengrebel, J. L. (1960). Introduction. In Swellengrebel, J. L. (ed.), *Bali: Life, Thought and Ritual,* The Hague and Bandung.

Wirz, P. (1927). Der reisbau und die reisbaukulte auf Bali und Lombok. In *Tijdschrift voor Indische Taal-, Land- en Volkenkunde,* G. Kolff and Co., Batavia.