EMERGENCE OF WATER RIGHTS IN TWO FARMER DEVELOPED IRRIGATION SYSTEMS IN NORTH SULAWESI, INDONESIA[1]

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INTRODUCTION

This paper analyzes the early formation of locally-defined water rights among Balinese settlers in two recently farmer-developed irrigation systems in North Sulawesi, Indonesia. The traditional rule of farm area based proportional allocation of water was found to be only a starting point in the search for equity in an environment characterized by considerable micro diversity between farms in access to different sources of water, soil porosity and location along canals.

In contrast to communal, highly programmed images of the Balinese subak (water society), the proportional water shares rule was routinely altered through ad hoc competitive acts of "borrowing" extra water by a large number of the farmers in each system. However, what would appear to the casual observer as anarchy was in fact a pattern of individual adjustments in the standard proportional allocation of water which in the aggregate, without central coordination, primarily resulted in counteracting the inherent inequality in the landform of the systems. Through numerous temporary acts of taking extra water and negotiating among farmers, a commonly accepted set of "justifying criteria" gradually emerged at the group level.

This paper analyzes which farmers frequently took extra water relative to the justifying criteria. Actual behavior is tested against the local models for justifying alterations in the standard water shares. The paper concludes that water rights evolve through interactions between water users and their environment and that inter-personal interactions can generate group conceptions of water rights and which can lead toward realizations of the common good, even without centralized control

The two irrigation systems are in the villages of Mopugad and Werdi Agung in the Dumoga Valley of North Sulawesi, Indonesia, The Dumoga valley is a major

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government transmigration area. It is located one degree north of the equator at an elevation of 170 meters. The valley has 30,000 hectares of farmable land surrounded by steep mountains. Average annual rainfall is 1,937 mm with a bi-modal monsoon pattern. Average temperatures vary between 25 and 27 degrees centigrade year round. Soils range from alluvial soils of sandy clay to clay of basaltic and volcanic origin. Farmers in both systems are transmigrants from BalL Differences among farmers in land holdings and wealth is small relative to other more established agricultural settings.

The Mopugad system is a 28 hectare river diversion system, built by farmers in 1977. The system in Werdi Agung was first built in 1970 and served 50 hectares, but was later incorporated in block 18 of a 5,500 hectare government-built irrigation system. Farmers in both system produced two rice crops per year.

There is a considerable literature on the traditional Balinese subak in Bali (see for example, Lansing, 1987; Geertz, 1980,1972). However, very little information exists about subak which have been developed outside of Bali (see Vermillion, 1986). Following Macpherson (1978) we consider water rights to be a form of property. Socially recognized rights contain a "justifying theory" about who can do what with a resource. This study demonstrates the role of inter-personal negotiations in the early emergence of a location specific, group concept of water rights.

NEGOTIATING RIGHTS

The Share as a Starting Point

While anthropologists have often treated the Balinese proportional water share as a harmonious equilibrium derived from centuries of practice, this study found the water share to be only the first point of departure among farmers in working out an actual distribution of water in a highly variable environment.

Membership in the subak or renting water and maintaining channels established a right to a standard share of water based on the size of the irrigated field. The share is formally established by the subak and is not changed permanently unless there is a significant change in the amount of sawah (rice field) irrigated or unless some more permanent exception to the land size basis for a division emerges, due to some extreme physical condition. Subak authorities reported only three such cases in the two systems. The one reported case in Mopugad was where a small plot with high porosity, near a ravine, did not receive any drainage from neighbors. The cases in Werdi Agung were plots next to gullies which had exceptionally high infiltration rates.

Augmenting the Standard Share

In the two systems the process of altering the standard water share division was very frequent and widespread among water users, and is therefore important in determining the actual allocation *of* water. In this study adjustments in the standard share-based division of water are any temporary alterations in the irrigation network which depart from the proportional share rule. Such temporary adjustments are usually made in order to obtain extra water or occasionally to cut of the flow into the one's own field for temporary drying. They are done by various means, including:

- widening one's intake,
- cutting a breach or hole in the channel bund which runs alongside one's field in order to let extra water into one's field,
- blocking the channel below an intake into one's channel or field in order to divert more water to one's field,
- making a hole below or on the side of the temuku (small wooden proportioning device) in order to add to the flow to one's field,
- blocking a neighboring channel below the division point with one's own channel in order to direct water which would go to the other channel into one's own channel,
- closing the water intake of an upstream neighbor's field, and
- re-directing the drainage from a neighbor's field into one's own field.

Implicit in interpersonal interactions among the Balinese is the notion of rukun. This is both a norm of solidarity and a civic process of "mutual adjustment", which has as its purpose "the creation and maintenance of order" (Geertz, 1980, p. 48, 84). Farmers in both systems occasionally used the terms kesadaran (common understanding) and kebulatan (unity), which are close in meaning to rukun, to refer to desired, if not actual, relations among subak members.

In both of these subak rukun is created, approximated, maintained, tested, and sometimes obfuscated by the two mechanisms of mushawarah (direct deliberation) and baku tarik (giving and taking) of water from one another according to the differential need and excuses among irrigators* In Balinese society negotiating with channels neighbors and giving and taking of water should be imbued with the virtues of sabar (patience) and malu (shame).

Intensity of Alterations in Water Distribution

Field work for this study was carried out during the season from June to September 1982 and December to April 1983. We will first describe main events and patterns of water distribution for each season in the two systems. Figures 3 and 4 are maps of the two systems, showing all canals (designated by letter codes) and fields (designated by alpha-numeric codes),

Mopugad

In Mopugad, the first season began with a decision to stagger final land preparation and transplanting three ways. This was done because of water shortages and also because of a desire to allow for the use of exchange labor among farmers who were at different stages of land preparation or transplanting* At week three, the Relative Water Supply (RWS)[3] dropped below 1.0 and all transplanting was completed, farmers of plots C9 and D3 requested there be a formal rotation. During weeks five and six the intensity of borrowing or sealing water escalated considerably. Soils were cracking in plots at the bottom of channels A, C, and D.

The author observed numerous incidences of altering the division of water both in accordance and not in accordance with the official arrangements. There were frequent sabotaging or counteracting of such alterations, sometimes by such methods as making holes where other had checked a channel (especially at channel A, B, and C division points) or by putting holes in small water bridges which were meant to temporarily "private" the drainage of one plot by conveying it across channels to another plot (rather than permitting the usual practice of drainage into a "public" channel). Signs were frequently placed at drainage points or intakes as warnings not to tamper with the division. Occasionally some upper-enders (eg. M2, M6, C12) placed logs or posts along the top of their <u>temuku</u> (traditional water proportioning devices) to witness to lower-enders that they were preventing any inflow above the exact amount permitted. Also the mice were becoming a serious problem by this time.

The RWS continued to decline. Finally the subak decided that the full water flow would be allocated to single plots for twelve-hour turns, starting in order of need and request. The subak head, secretary, and treasurer took turns guarding the water at night. This arrangement continued, although again with numerous exceptional, until well into the ripening phase, when pre-harvest drying began*

Compared with the first season, the second season had more pronounced water scarcity during the land preparation phase. Transplanting was staggered three ways. Some of the lower-enders complained that the upper-enders should have planted less than their whole field in padi (rice) and that the subak should have limited the area to be planted for each field for the season.

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[3] Relative Water Supply is the ratio of water supply (effective rain plus irrigation supply) to water demand (estimated potential crop evapotranspiration plus water conveyance loss), see Levine, 1982.

When rains came in weeks six and seven, farmers from the neighboring Javanese transmigration village of Mopuya wanted to plant sawah, which would be irrigated by the same river as that used by the subak, about one kilometer upstream. The Javanese made holes under the weir. Members of the subak filled them in again. However, one week after the first incident the subak agreed to permit a two-to-one ratio of river water to go down stream for a few days to enable those below to finish land preparation. By weeks eight to ten the rains tapered off and the RWS began another gradual decline.

The official agreement to keep the standard division intact overnight and allow borrowing to be arranged interpersonally in the daytime continued through the rest of the season, despite the high frequency of borrowing and the tensions among farmers around the system. Their attitude was that such direct arrangements between farmers would suffice about as well or better as would formal rotations arranged through the subak authorities.

By the ripening phase eight members had been fined for water theft. This was the first time any fines had been given by the subak for water theft. Normally they were reluctant to fine members but they felt the stealing had become excessive, given the water stress around the system. The fines were set at only Rp, 2,5.00 each, instead of the officially-established amount of Rp. 5,000, because of the difficult economic condition imposed by the drought. Almost all who reported thefts were those ill effected by them, except in a few cases where a subak official reported them due to the extreme water shortage.

Werdi Agung

Because of rainfall in May and early June, water was relatively adequate during the land preparation period in the first study season, compared with the second season. However, in the first season, the rainfall and irrigation discharge dropped off just before transplanting (which was just before our water balance measurements began). The entire system with few exceptions, planted the nursery seedbed all within a week and later transplanted seedlings all within a week (the latter being the first week of June). Soon after transplanting however, the RWS dropped and remained low for three weeks. Thereafter, the RWS remained above 1.0 for the rest of the season, except for a drop during the reproductive phase at week eight (caused by) the scheduled delivery of a large flow of water for land preparation to another section of the Kosinggolan Scheme).

During the week of transplanting borrowing occurred between channels A and B, C and D, and L and K. Because of lack of water as well as labor constraints, H2, Gl, *G5*, and D8 were late in transplanting and this contributed significantly, for several weeks, to the frequency or borrowing and to the tensions at the C/D and G/H channel division points. It was not until week six that G5 was able to finish plowing and transplanting in his last terrace. By this time the reproductive phase was beginning and the RWS, which considered almost entirely of discharge from the main canal (due to lack of rain), was on the decline. This prompted numerous complaints about the water supply and the occurrence of frequent interpersonal borrowing, especially along channels, C, D. E, G, and HL After week nine the RWS rose and remained above 1.0 until pre-harvest drying began. During the last five weeks of the season mice and birds became a serious problem and this kept more people than usual in the fields, to scare them away. Having more people continuously in the fields may have discouraged some water theft during this time. Partial blocking of channels and plot intakes (as compared with full blocking) appeared to be especially common during this period, indicating restraint in borrowing practices at a time when the fields and channels were being observed especially closely.

In latter October water from the main canal was permitted to flow through Gate Eighteen for land preparation. When continuous flow irrigation proved to be enough to soak only about one-half of a terrace per plot, farmers decided to rotate the full flow to individual plots for twenty-hour turns. This made it possible for most farmers to plow about one-half of a hectare per turn.

There was considerable variation throughout the system in broadcasting and eventually transplanting dates. The variation occurred in every part of the system, with no section having entirely scheduled these activities not only according to water availability of the expectations of the timing of future water availability, nut also according to labor constraints and the ownership or not of sawah elsewhere. The variation stretched over four weeks, with early and late planters scattered around the system. In December the irrigation rate did increase. But because of the informal staggering in broadcasting dates, transplanting was likewise staggered. By the last week in December, or week three, almost all the farmers had transplanted and "continuous flow" throughout the block was the norm for much of the rest of the season. To say that continuous flow as used is to say so in a relative sense—in contrast to a formally scheduled, group-level rotation. Interpersonal borrowing continued as an apparently permanent feature of the system.

Figures 1 and 2 show the variations in the levels of intensity of alteration activity and RWS over the two season in both systems. The alteration activity, or intensity of allocation activity, was measured by recording at each field inspection all observed alterations in the standard division of water. Figures 1 and 2 show the weekly average of the total number of alterations observed in each system. Although the level of allocation activity obviously is not dependent solely upon variations in RWS, the two variables do appear to have a. generally inverse relationship.

Figure 1 shows that in the first season a gradual rise in alteration intensity (abbreviated as NALTERS) occurred concurrently with a gradual decline in RWS, through week six. This was followed by a sharp drop in alteration intensity with the occurrence of rain and a sudden rise in RWS in week seven. When the RWS dropped again, the alteration intensity went back to relatively high levels through week ten. Then it gradually declined through the remainder of the season, declining to very low levels of RWS. This direct relationship of both declining RWS and declining alteration intensity during the latter part of the season seems to be because of the especially low levels of RWS. During this period farmers told me, "Dengan air sekecil ini mau bikin apa lagi? ("With water this small what can one do anyway?").

In the second season, a decline in RWS between weeks three and five was accompanied by an increase in alteration intensity. The higher level of RWS between weeks six through nine was accompanied by a drop in alteration intensity for the same period. The drop in RWS during the latter part of the season brought about a gradual return to roughly the same levels of alteration intensity as occurred during the latter part of the first season.

In Figure 2 we see a nearly perfect set of inverse variations between alteration intensity and RWS during the first season. The second season however, it not so straightforward. A parallel dropping and rising of both variables occurred from week two through six. From week six to fifteen the expected inverse relationship prevailed, but with quite pronounced fluctuations in alteration intensity and an average level of alteration intensity which was much higher in this latter period than in the first season.

The scattered nature of the staggering may have contributed to there being more numbers of plot-level alterations throughout the system (as compared with a situation where crop stages and levels of alteration intensity might be more homogenous within the system). Another partial explanation for the high levels of alteration intensity in the second season was the making of new terraces at scattered locations (eg., E5, K4, A2, H2, R2, F3, as mentioned above). Terracing and transplanting at these locations occurred after week six and prompted a considerable amount of water borrowing.

When greater staggering of plating occurs, especially within quaternary groups, it is more likely that would-be- borrowers whose fields are in a stage when water adequacy is urgent, will have neighbors whose fields are not in such as stage. Therefore a farmer tends to feel less inhibited form borrowing form neighbors whose fields are not at a stage of critical water need, such as the vegetative growth or ripening phases. When all of the plots pass through the critical water need phases simultaneously, farmers are relatively more reluctant to borrow from neighbors than would be the case if the neighbors fields were not at a phase of critical water needs

EMERGING PATTERNS OF WATER ALLOCATION

Emergence of Common Criteria for Augmenting the Standard Share

Farmers in the system held the view that as long as one had talked to his neighbors at the outset of the season about the general timing of planting and the acceptability of borrowing water, one need not seek permission each time before borrowing water. When farmers in either system talked about their water needs in comparison with others, the stage in the cultivation season was a frequently mentioned as were comparisons about differential water supplies.

Through regular occurrences of farmers taking or "borrowing" extra water and frequently engaging in inter-personal persuasion, debates and negotiation, farmers gradually developed a commonly recognized set of justifying criteria for farmers to augment their supplies beyond the standard proportional share system. This set of criteria constitutes a common repertoire of rationale.

This repertoire includes reference to soil water retention characteristics, access to different forms of water sources, channel position, having intakes frequently closed by others, and having fish ponds. When these criteria are applied to the physical complexities in the systems the potential for discord and differing conceptions is considerable. Such criteria do not simply determine water allocation. They are used as a basis for negotiation and for testing the relative merits or levels of tolerance of two or more farmers. In negotiating about altering the standard share division, farmers refer to different criteria to fit their own circumstances. The criteria gradually became socially recognized less through formal decision-making than inter-personal assertions and tolerant responses.

A Model of Justifying Criteria for Augmenting the Standard Share

We will now examine the question of who in the two systems altered the standard division of water often or not often, relative to fellow water users* This will provide answers to the following question:

> *Are -patterns of altering the standard division of water based more on personality differences, nepotism, abuse of being in strategic position or factions, or are they based more on water-related physical inequalities around the system?*

During participant observation the author saw indications of opportunism among water users. Nevertheless physical inequalities, such as relative soil infiltration rate, channel position, the availability of alternative water sources, or forms of land use with high water demand (such as new terracing or tending fish ponds) were clearly at the hub of the rhetoric of water allocation. We will also see if these are also central to the practice of altering the division of water.

We will first identify the irrigated plots in each system whose farmers take extra water more frequently than their fellow water users. It was not possible either by regular observation, informant accounts, or farmer interviews to obtain reliable estimates of absolute frequencies of how often each farmer took extra water during a given season or other time period. However, key informants could readily make a two-way, rank-order comparison between farmers who often or did not often take extra water. Informants who generally were the more articulate farmers in different parts of the systems, grouped **farmers** into either category, relative to other farmers they were comparing. Discussions with other farmers and data on locations and frequencies of altering the division of water were used as a check to assign farm plots to these relative categories. The rank order was considered to be consistent form season to season, although the actual levels of borrowing varied over time.

Informants associated borrowing water "often" with generally borrowing water more frequently than the peak water demand periods of land preparation and the restoring of water to fields after drying for weeding or for the application of chemicals. To "not often" borrow water meant typically to borrow water only at these intermittent, high demand periods, or even less often.

In Mopugad-, because of the smaller number of plots (thirty-four), the frequent forms of borrowing near the top of the system in ways that affected most of all the plots, and the fact that comparisons could naturally be made by informants at this level, comparisons were made across the whole system as a single comparison group. However, in Werdi Agung, because of the larger number of plots (seventy-eight) and the more segmented or self-contained patterns of borrowing, comparisons could be made confidently only within the different channels where most of the borrowing took place. These eight allocation interaction groups were channels A/B, C/D, E, F/P/R, K, L, G/H, and J,

In Figures 3 and 4 we can see the distribution of plots whose farmers adjusted the division of water "often" or "not often" relative to other farmers in their "comparison groups". As can be seen, the darkly-shaded plots, which are those labeled often, do not group together in either the upper or lower section so often channels in either system. Factors other than mere channel position are involved in the predisposition to take extra water more or less often than one's neighbor, Based upon farmers' statements and personal observation, a model was constructed of the incentives and disincentives (which became justifying and non-justifying criteria) that farmers indicated were relevant to the predisposition to often or not often add water, relative to channel neighbors. The model is meant to explain to what factors we may attribute the differences in relative frequencies among farmers of adjusting the standard proportional division of water.

The model is presented in the form of a decision tree diagram for clarity of presentation. Figure 5 shows the model for Mopugad. The three factors on the left are those identified by farmers to be the predominant criteria for needing to borrow water often; The occurrence of each of these three incentives is classified in such a way as to approximate how the farmers themselves usually posed them. The first incentive is whether or not one's farm water infiltration rate is higher than the average infiltration rates of others along one' channel (or allocation comparison group). The second criteria is whether or not one's field is in the lower end of the channel, defined here as the lower third of the channel (in terms of distance). The third criteria is whether or not the field, during the present and/or previous season, has had a form of land use with a particularly high water demand (e.g., land leveling, new terracing, or keeping fish ponds).

In Mopugad twenty of the fields had at least one of the incentives and fourteen did not. Of the fourteen cases not having one of the incentives, ten of them in fact did not take extra water often, as the model predicts. However, the behavior of four of the "often" cases was unexplained by the model They did not have any of the criteria in the model and yet were frequent takers of extra water, These were plots (11,131, M6, and Al.

Sixteen of the twenty cases which had incentives did not have either disincentive and pursued a pattern of relatively often taking extra water. Four of the twenty cases were constrained by disincentives and did not relatively often borrow water. The first disincentive listed is that the field's dependence on water from the channel is less than its dependence on other sources (e.g., neighbor's drainage, ground water recharge, or other surface sources). The second disincentive refers to incidences where a plot automatically obtains the benefits of the frequent borrowing practices of a channel neighbor, because the common methods of borrowing which the neighbor uses generally add water to the flow to both plots. Of the four which were so constrained, one had low channel dependence and three were "free riders" of other borrowers. The model "explained" the borrowing patterns of thirty of the thirty-four plots, or eighty eight percent.

The model for the Werdi Agung system is shown in Figure 6. Fifty-seven of the cases had at least one of the incentives and passed to the disincentives in the model Eighteen cases did not have any of the incentives and fourteen of them did not often borrow water. As can be seen, nineteen cases were constrained by low channel dependence from often borrowing water. This reflects the prevalence of groundwater recharge and alternative water sources in the lower portions of the system, in contrast to Mopugad which generally lacks return flow lower in the system, Six others were free riders and did not often borrow water. There were thirty-two cases which had incentives but no disincentives. Of these, twenty-five were frequently borrowers, as the model predicts, but seven were not. The model successfully explains the relative borrowing patterns of eighty five percent of the cases.

Of the eleven unexplained cases in Werdi Agung, seven had justifying criteria and no disincentives but still did not often take extra water. Two of these, Zl and A2, had high infiltration rates but were at the top end of channels, where the flow is relatively high and stable. Most of the unexplained cases were not those who "often" took extra water without apparent reason, but those who did not often take extra water, despite qualifying under the justifying criteria.

In Mopugad. four cases (Bl, Cl, M6, and Al), or twelve percent, were frequent borrowers without having apparent justifying criteria. In Werdi Agung four cases (J2, L2, Kl, F2) or five percent, were frequent borrowers without having a reason which is specified in the model

The **Push,** Pull and Balance of Flow

The proportion of inspections wherein a given plot had standing water is a measure of what could be considered a plot's relative water adequacy. This measure is a rough approximation whose value is not so much as an absolute level as it is an ordinal ranking to be compared with other fields in the system. The values for these observation plots roughly represent the relative levels of water adequacy of their respective neighboring plots.

After observing the operation of water allocation over two planting seasons, the author tabulated the total number of occurrences of each type and location of observed alteration in the standard division of water. This was done in order to obtain indications of the spatial biases or the directions of net gains and losses of water allocation among plots—as a result of patterns of adjustments.

Regarding alterations at channel division points, Figures 7 and 8 indicate the relative frequency of occurrence of alterations, the direction of net gain from the alterations, and the proportion of all observed alterations which were net gains. Data on the sample plot's proportion of inspections having standing water is included in parentheses at each observation plot, Circles are placed with arrows at each channel division point to designate the direction which had a net gain from the set of observed alterations. The numbers beside each channel division point indicate the proportion of all alterations (at that location) which represented a net gain in the direction the arrow points. Squares were place at locations where an approximate balance in the direction of gains and losses was observed in both directions, The symbols are in two sizes, each representing the relative frequency of occurrence of the alterations at the given location. A large circle indicates a location whose frequency of occurrence ranked in the upper third of all observed alterations (including all those at the channel division and plot intake levels).

In Figure 7 we see that without exception the net bias of channel division alterations is in the direction of the lower end of channel C. This is where the largest group of plots are which had the lowest relative water adequacy (i.e., the lowest proportion of inspections with water covering the plots). There are only slight biases away from channels A and D. These channels each have lower-ender with rather low relative water adequacies as well The strong bias away from channel B corresponds with a relatively favorable set of rankings of water adequacy along channel B. Clearly, the observed directional biases in the alterations at the channel division points in Mopugad represents a pattern aimed at roughly counteracting the unequal distribution of relative water adequacy created by the physical characteristics of the system.

In Werdi Agung (Figure 8), there is not a single case where the observed pattern of channel division alterations acts to exacerbate or take advantage of the inequalities in relative water adequacy between the plots. The biases in net gains all point in directions where the water adequacies are relatively low (compared to the alternative directions). Where relative water adequacy is approximately the same in either direction, the direction of net gain is toward plots whit relatively higher direct dependence on the channel, versus other water sources. In the case of channel C/D division point, where the relative water adequacy levels are roughly the same in either direction, there is a slight bias toward channel C However, lower-enders of channel D have a somewhat lower dependence on the channel than do the plots along channel C.

There is a strong bias away from channel F toward channels G and H, which tended to plant the latest in both seasons, have among the lowest proportions of inspections with water coverage, and which have high channel dependence. The level of water adequacy was relatively low at the bottom of channel F (along channels P and R) and was roughly similar to that at the bottom of channels P and R) and was roughly similar to that at the bottom of channels H and L. The bias toward G and H again was in the direction of areas with sole dependence on the channel for water supply (whereas other areas had access to small springs, ponds, return flows, etc.).

Fields R2 and R3 receive supplemental return flow from a small diversion to the right while PI, P3, and P4 obtain much of their water from drainage. Therefore if the alteration pattern were balanced at the F/E/H division point the relative water adequacy would certainly be much worse along G and H—because of its sole dependence on the channel as a water source. Part of the reason for the pronounced bias away from channel F may be because channels P and R are outside of the official subak boundary. Members had expressed the view that these farmers should pay to join the subak and participate more in channel maintenance upstream in order to have a right to appeal for an "adjusted" equal division of water.

CONCLUSION

Emergence of Water Rights

Justifying criteria for augmenting standard shares represent socially valid reasons to obtain the right to augment the standard division of water. In small farmer-built systems, especially where class or ethnic cleavages are not significant, inter-personal acts of temporarily adjusting the standard division of water constitute an evolutionary process whereby socially recognized differential water rights among farmers arise* Although the interactions are normally uncoordinated and incidental they result in a group level search for equity in a diverse physical environment.

Inter-personal Interactions and their Effects on Equity

To the extent to which studies of irrigation systems emphasize descriptions of formal rules and institutions to the neglect of analyzing actual processes and results, an inflated sense of the importance of formal, authoritative modes of organization may be conveyed. At the same time the nature, effects, and capacity of informal interaction and interpersonal adjustments may go unperceived* In neither system would the subak authorities act unless the respective farmer made a formal complaint based on direct observation. Even such complaints would be ineffective without the frequent presence of the farmer at his plot personally to see that water allocation did not get too far out of balance.

In Mopugad, the basic topographical differences between the two systems have the effect of permitting little return flow and causing more pronounced inequalities in water supplies between upper and lower-enders, compared with the subak in Werdi Agung. Despite the basic differences in the configurations of physical inequalities between the two systems, the general direction of the patterns of adjusting the standard division of water, in both systems, is aimed towards counteracting these physical inequalities.

We have seen that the intensity of allocating activity tends to vary inversely with RWS* However, it was not the case in these systems that such activity ever dropped off entirely or was restricted only to conditions of pronounced water scarcity. We have seen that the observed alterations of channel division points show a tendency in both systems to favor areas of lower water adequacy.

We conclude that interpersonal interaction among water users in the two study systems is primarily a second approximation for allocating water, following the first approximation of the share-based division of water. The inequalities to which these justifying criteria refer, are not integrated into the simple land size criterion for proportional water allocation. The repertoire of justifying criteria and the interactions among these farmers, in settings not riddled by pronounced fractional or hierarchical adversary relationships, create a more equitable and generally acceptable pattern of water allocation than would a simple reliance on the criterion of land size.

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MOPUGAD

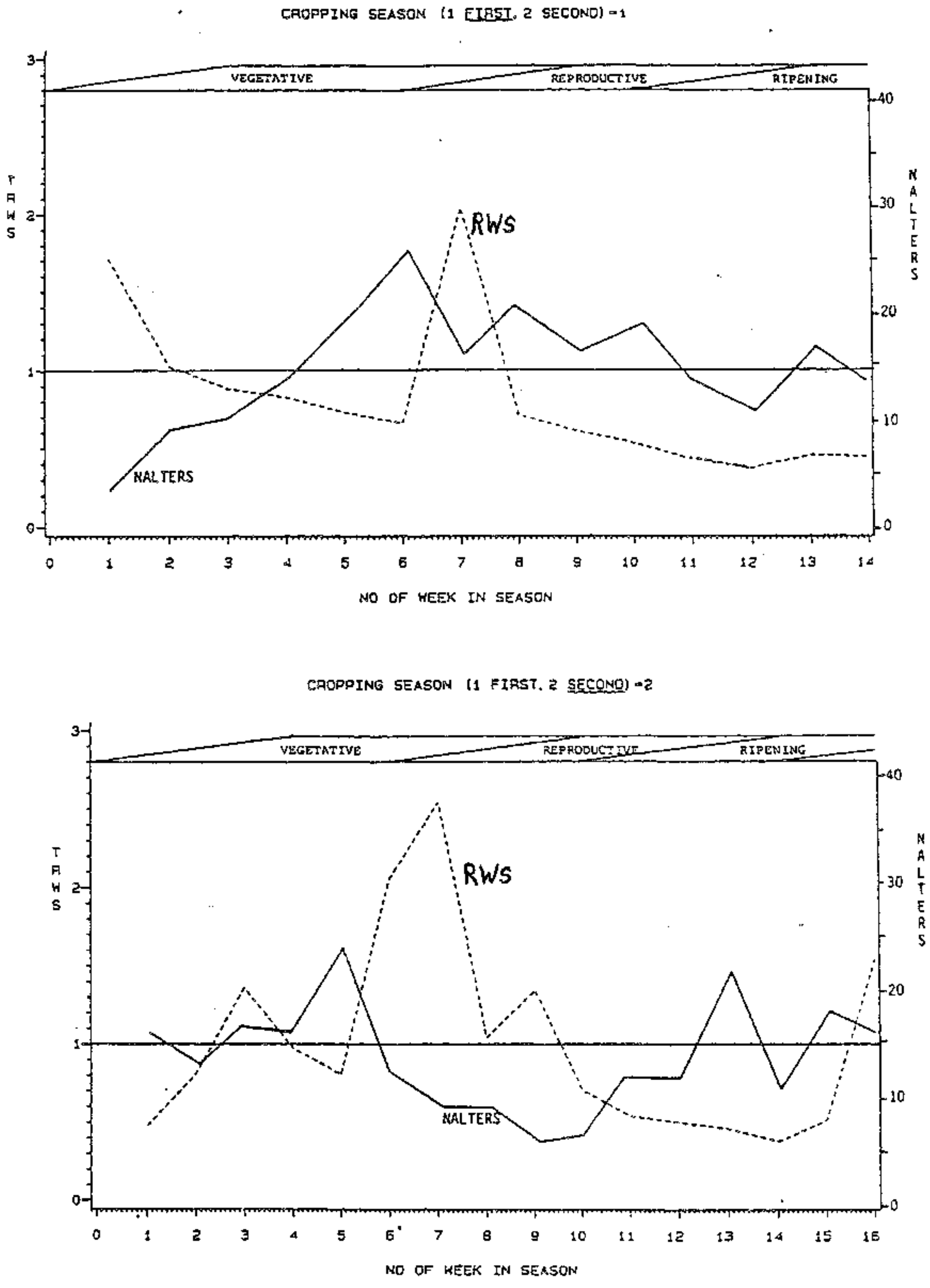

Figure 1 Relative Water Supply And Intensity Of Distributional Alterations, Mopugad System

WERDI AGUNG

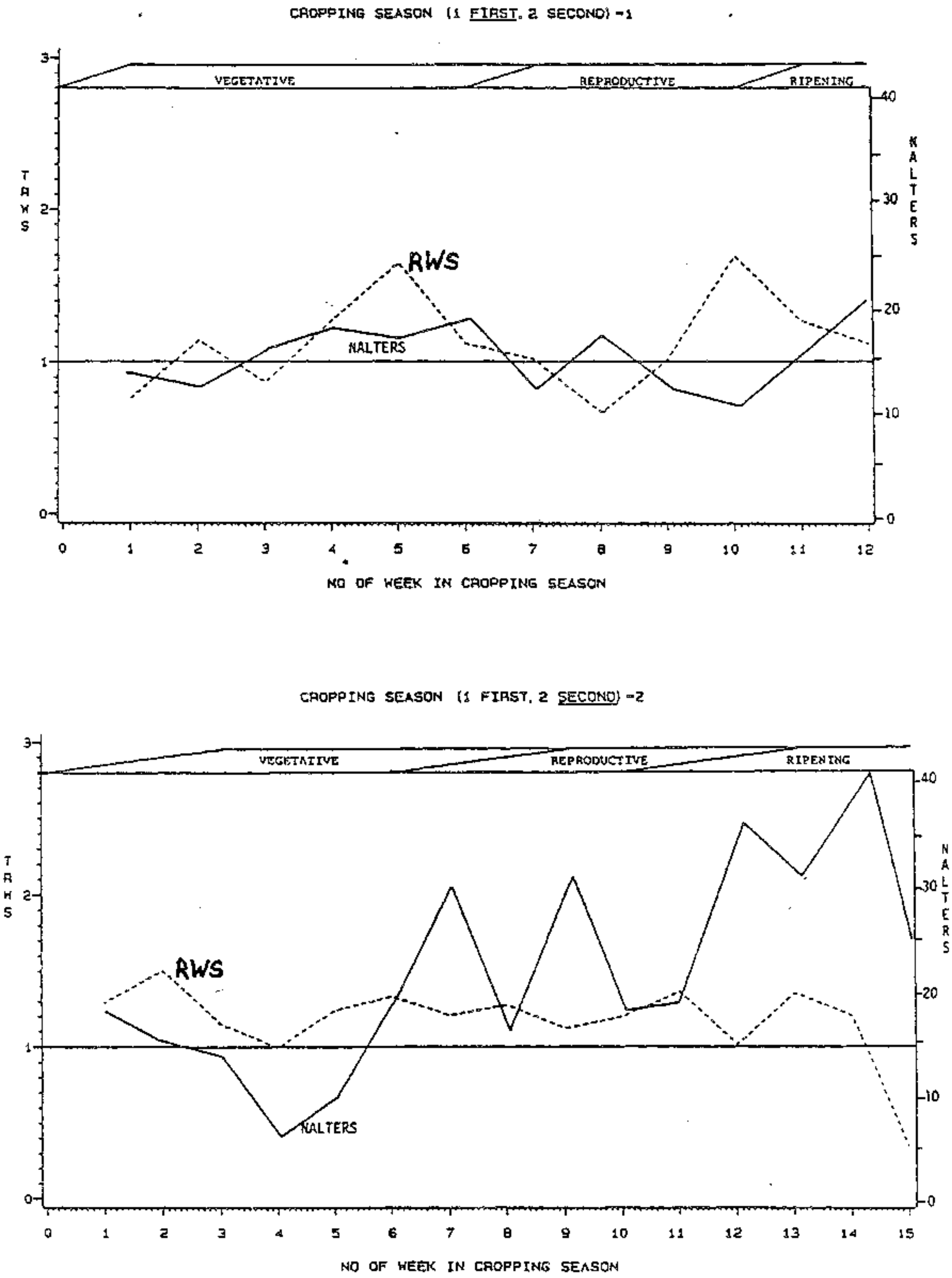

Figure 2 Relative Water Supply And Intensity Of Distributional Alterations, Werdi Agung System

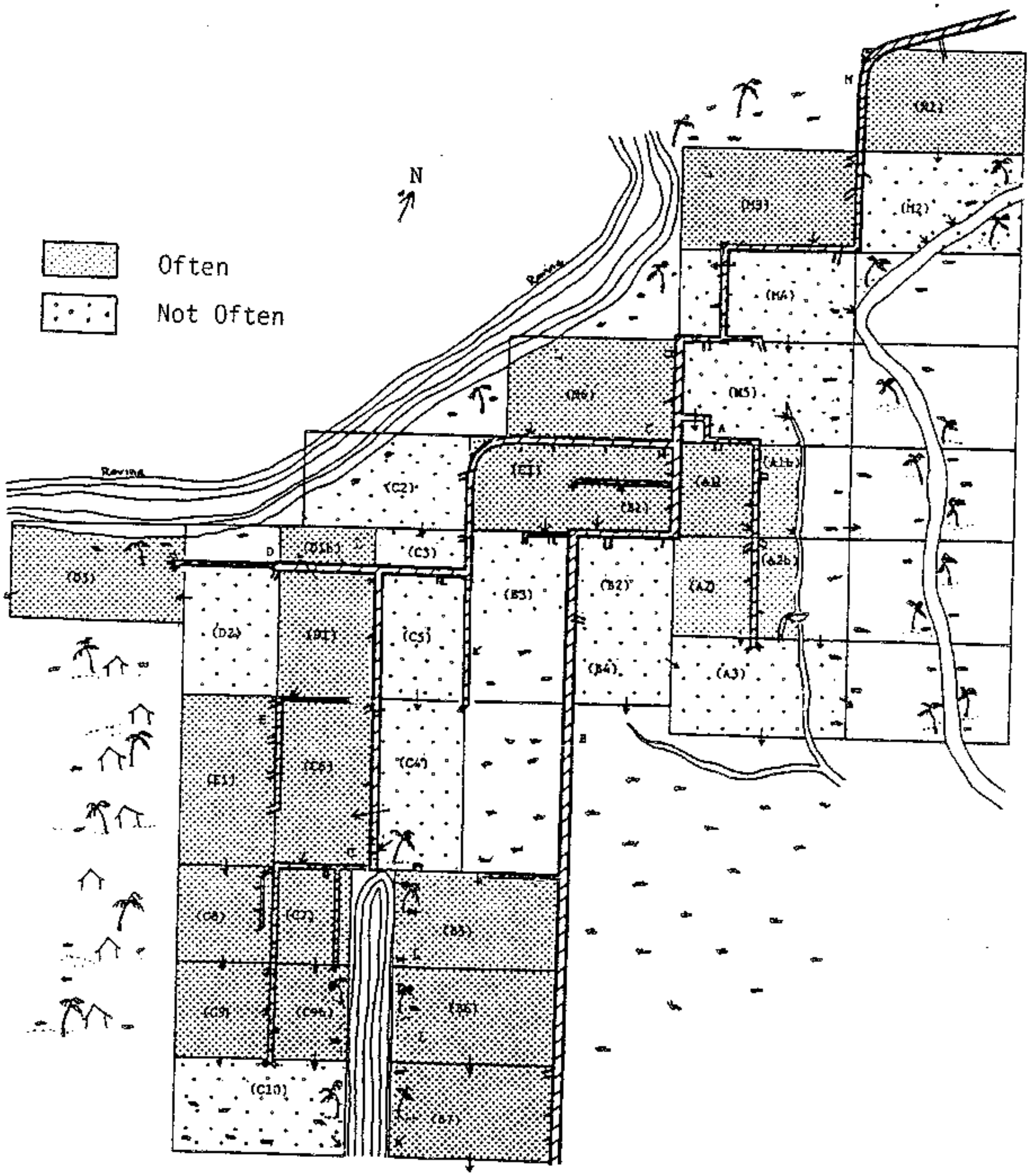

Figure 3 Parcels Which Frequently Added Water Beyond The Standard Share, Mopugad System

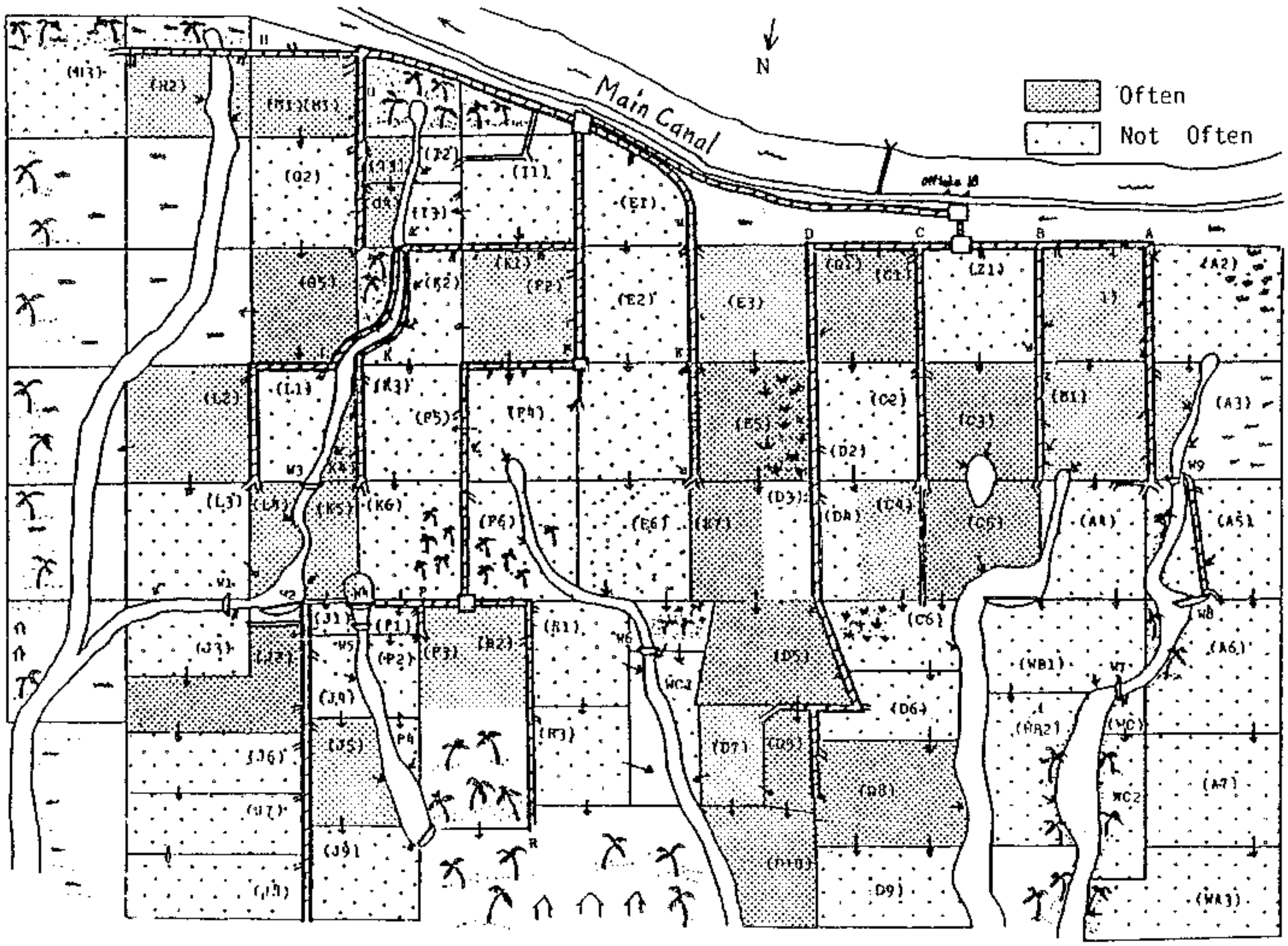

Figure 4 Parcels Which Frequently Added Water Beyond The Standard Share, Werdi Agung System

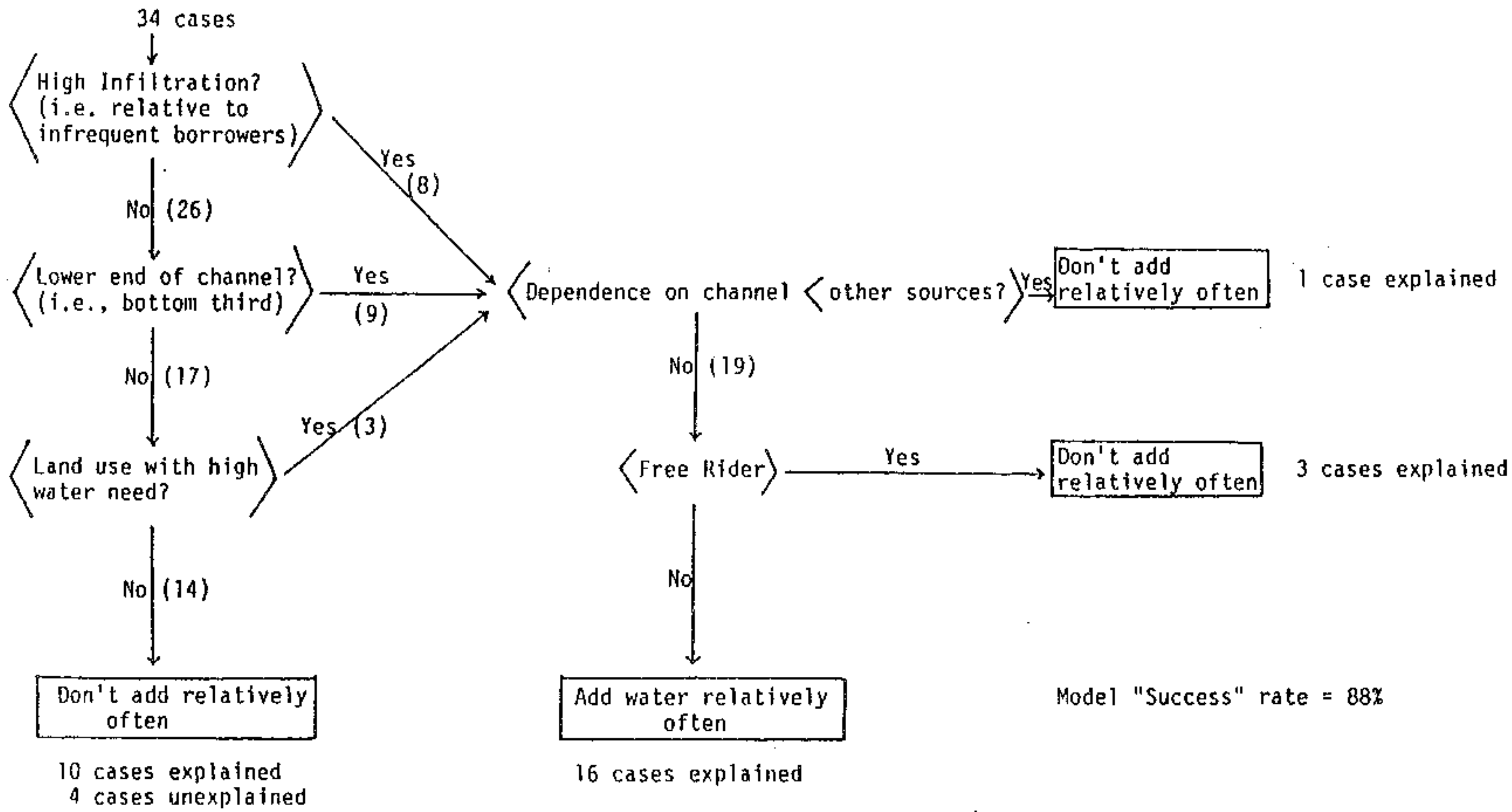

Figure 5 Model Of Common Criteria For Exceeding Standard Water Share, Mopugad System

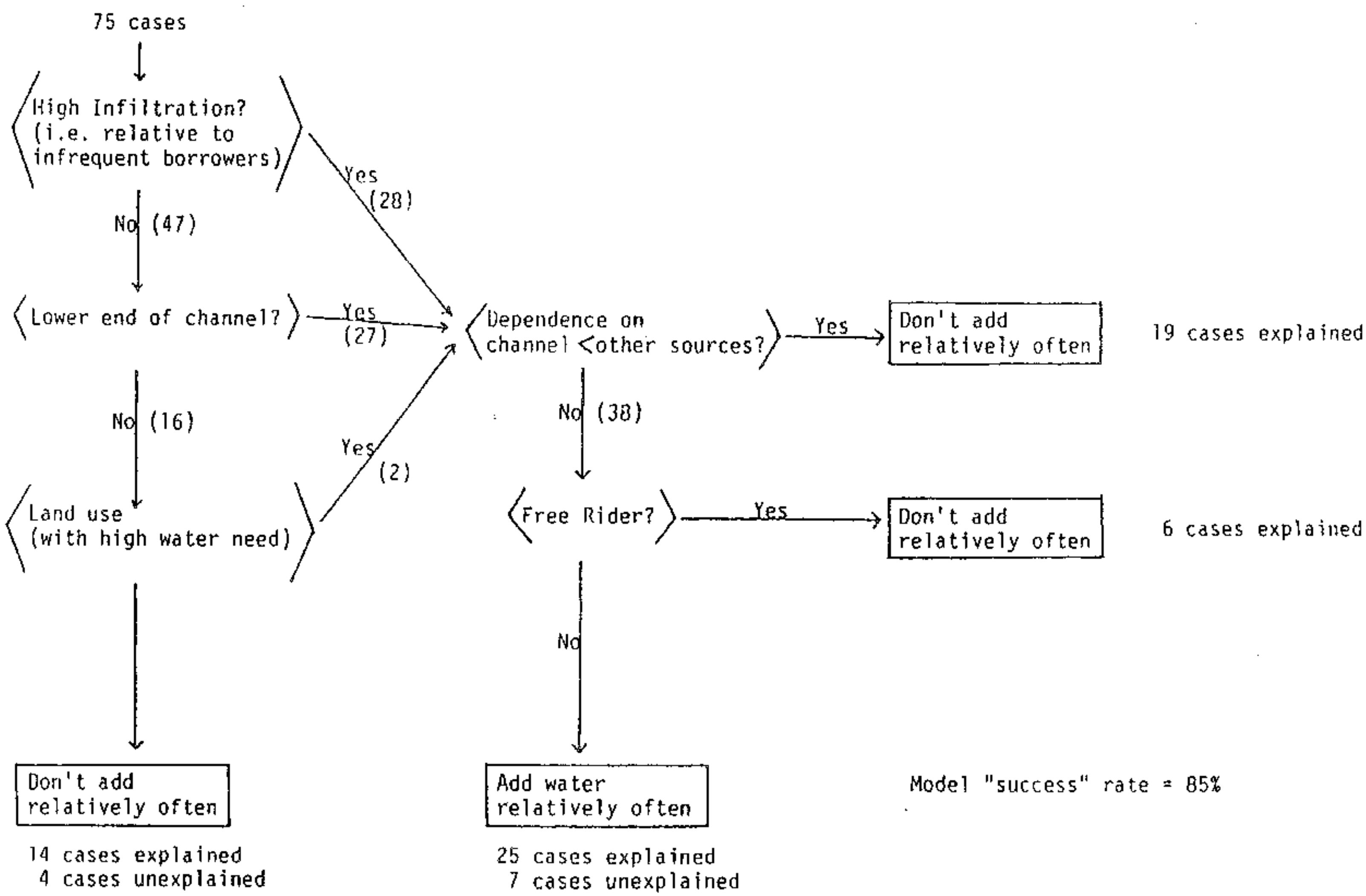

Figure 6 Model Of Common Criteria For Exceeding Standard Water Share, Werdi Agung System

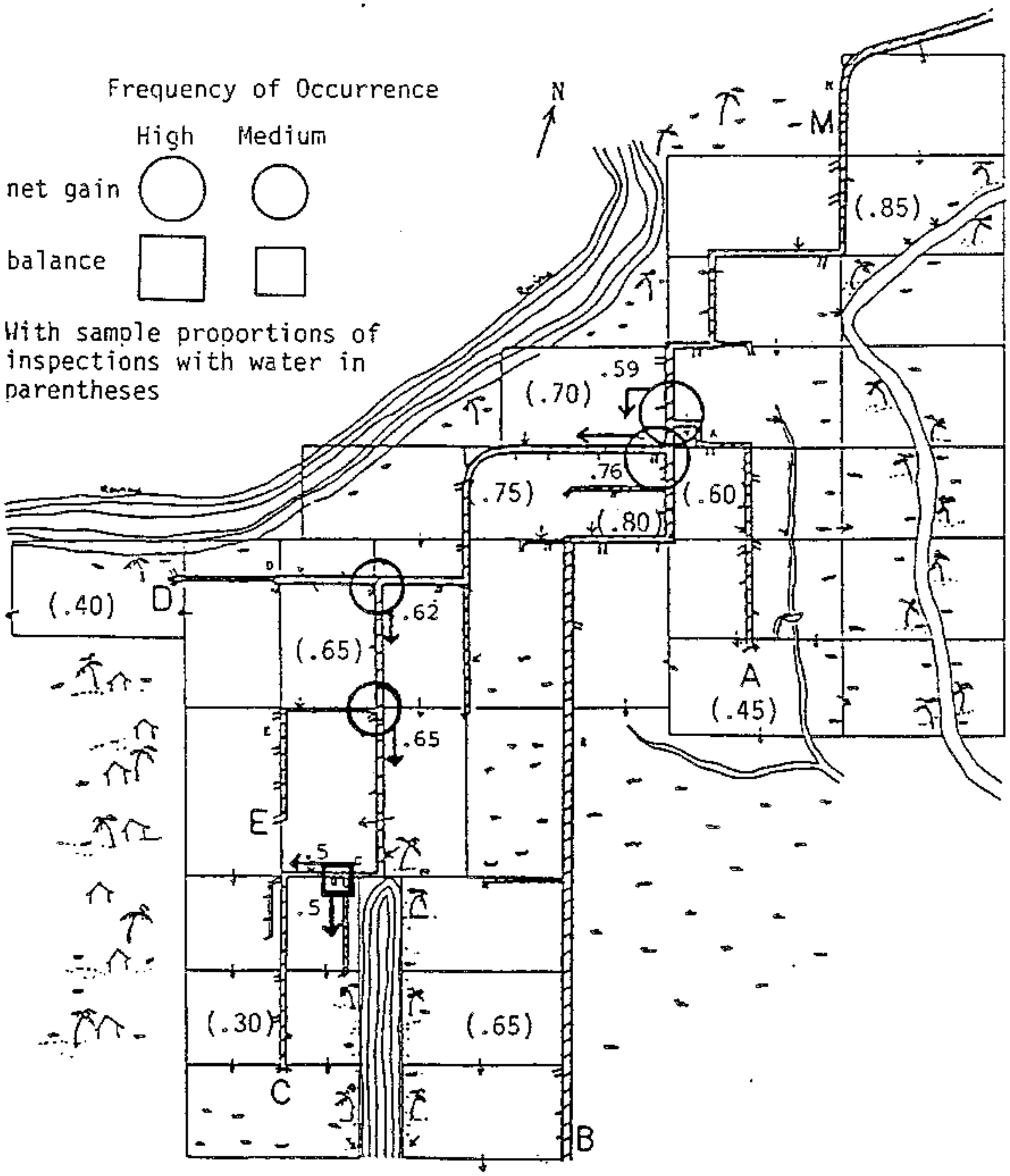

Figure 7 Frequency Of Observed Alterations At Channel Division Points, Mopugad

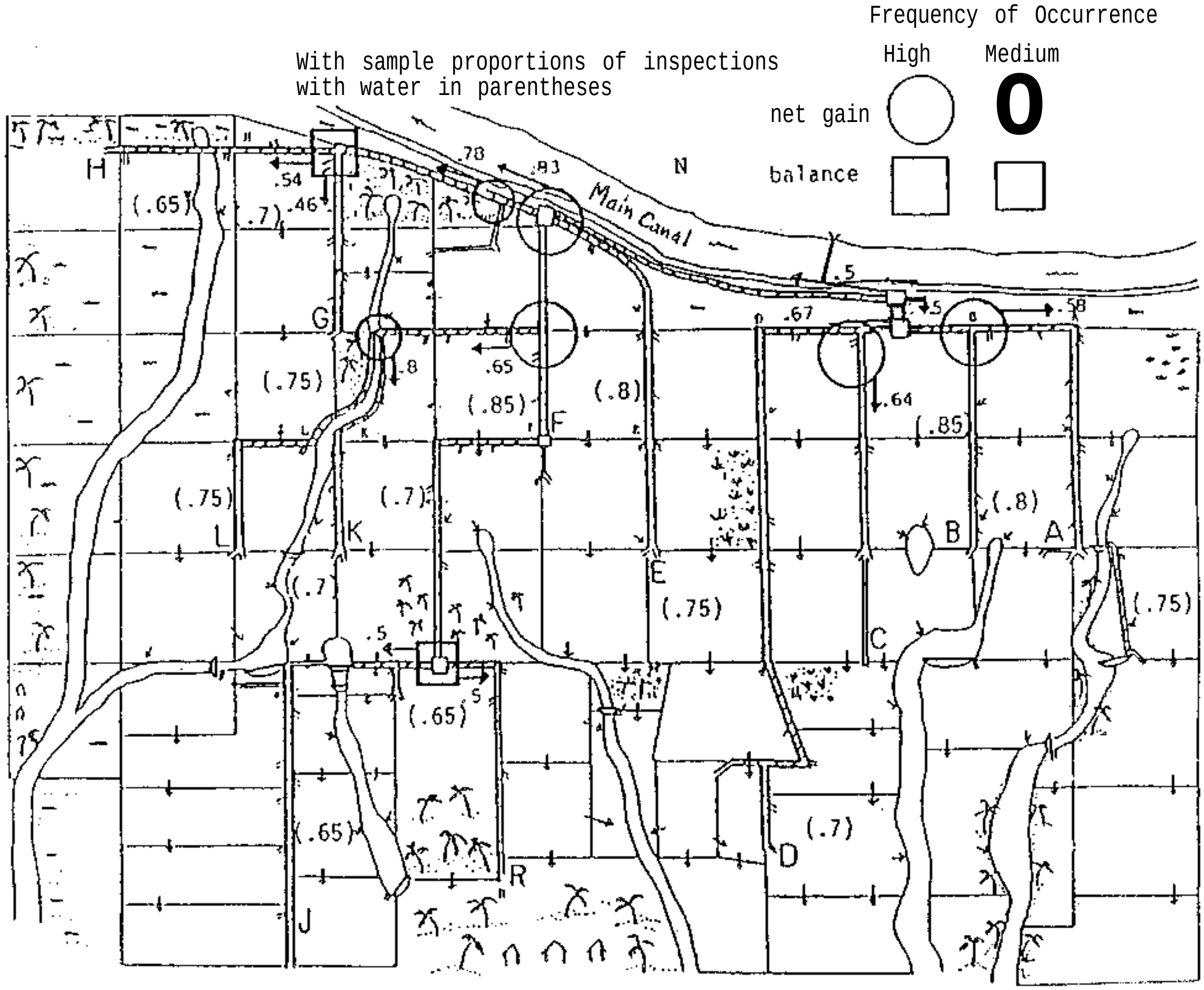

Figure 8 Frequency Of Observed Alterations At Channel Division Points, Werdi Agung