

Final Report on
“The Moral Economy of Water: A Cross-Cultural Study of Principles for
Successfully Governing the Commons”

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Executive Summary

The Research and Writing Grant project that is the focus of this report succeeded in confirming a hypothesis with profound implications for both the theory and practice of irrigation and water management in many of the world's 'developing' countries. That finding has decisively altered the course of my professional career, spawning a whole trajectory of writing and further research whose impact is likely to be felt within a wide body of social theory, including the theories of collective action, of the management of "common-property" and other kinds of natural resources, and, perhaps most importantly, in the emerging field of sustainable or "beyond growth" economics. Its implications are now being pursued in various articles for publication, in a book proposal currently under review, and in applications to further fund the ongoing comparative cross-cultural research, which has become truly global in scope. In this report I want to express my profound gratitude to the MacArthur Foundation for its generous support and hope to show that, in terms of the findings it produced and the influence it promises eventually to have within the broad field of applied social and environmental science, also known as "sustainable development", the money could hardly have been better spent.

The project had to be modified initially due to unexpected expenses encountered in the field and restricted to three sites within a single country, Spain, rather than being truly cross-cultural and including peasant communities in Chile as I had originally proposed. Although it was not possible to do this last year, during the period of my no-cost grant extension, the Chilean research is now underway, financed privately by myself with assistance from my new employer, the Institute of Water and Environment at Cranfield University, and it too shows every indication of confirming the research hypothesis. The fieldwork that the Foundation sponsored in Spain also included a component whose aim was to enlist the collaboration of experts who have done research on successful farmer-managed irrigation systems in other countries—India, Nepal, the Philippines, and Mexico—in the hope of eventually testing the hypothesis there as well. That effort succeeded in establishing a network of participants for a much larger comparative project that hopefully will begin soon, involving individuals in all the respective countries (now also including one expert in Ethiopia), some of whom are affiliated with the International Water Management Institute in Sri Lanka. Although that ongoing research is separate and will ultimately be funded by some other institution, it is a direct continuation of my work in Spain and thus a product of the support initially provided by MacArthur. The sponsoring relationship will therefore continue to be acknowledged, and my gratitude expressed, in all forthcoming publications, not just those that are now in press or under review. I will inform the Foundation about the results of the work underway in Chile as well as the outcome of the long-term global project and provide copies of all resulting published works, which will be a large number produced over a period of several years.

The fieldwork in Spain, like my ongoing cross-cultural research, focused on communities where irrigation water, the resource most vital for local people's livelihoods and well-being, is successfully shared and managed by the water-users themselves in a situation of severe scarcity. Such success, although by no means unique, is a relatively rare outcome compared to the much more familiar "tragedy of the commons." Previous analyses of the three rather famous Spanish systems--Valencia, Murcia and Alicante—had documented that positive result and attempted to explain it by providing detailed descriptions that made these local hydraulic traditions appear to be substantially different from each other. Based on my earlier ethnographic research in the Peruvian Andes, I suspected that underlying similarities between the traditions probably far outweighed their differences, and found the published descriptions to be both incomplete and inadequate, especially in their failure to explain clearly how the systems worked from the individual water-user's point-of-view. My hunch was that the overall success in each case could only be explained by unrecognized similarities in the working rules and operating principles, which together had the effect of shaping people's incentives in the same positive and cooperative way. And I felt that these might well turn out to be the same set of rules and principles I had encountered in my study of successful irrigation communities in Peru. The same criticism and limitation, I felt, also applied to the published accounts of successful systems in the other countries, where I saw evidence that the same basic similarities exist, even in situations where the associated property regimes—communal water vs. 'private' water--seem to be diametrically opposed.

My hypothesis was thus that all of these successful farmer-operated irrigation systems, numbering at least in the hundreds all over the world and including both communal and "market" types, are local variants of a single basic model that I call "the moral economy of water": an optimal system that allows people to share a scarce and vital resource in an equitable and transparent manner that minimizes social conflict. The fieldwork supported in one way or another by the Foundation has already convinced me, as well as the other regional experts who will be participating in the ongoing international project, that this very controversial global hypothesis is probably correct, which is the best outcome that I could have imagined upon beginning the research.

Valencia: a communal system of the **turno** type

My summary of the findings of the Spanish study begins in the locale where the previous research of Glick (1970), Maass and Anderson (1978, 1985) and Ostrom (1990) had made it most obvious to me that the hypothesis was correct and that the underlying commonalities did in fact exist, and where the research was therefore easiest to conduct: Valencia, a city famous for having one of the oldest continuously-operating irrigation systems in the world. Upon reading these earlier accounts (which in each case are extraordinary pieces of observation and/or analysis) it seemed clear that, despite sizable losses of irrigated land due to the rapid growth of the city and a drought-induced decline in the flow of the Rio Turia, Valencia's main water supply, changes that had taken place since the period of the earlier field research in the 1960's, the highest degree of continuity would be found there in terms of both the canal infrastructure and the rules governing the distribution and use of water.

Just as in previous centuries, the canal system today (which makes up the *huerta* of Valencia, literally the "garden", now encompassing roughly 17,000 hectares of cultivated land¹) consists of eight² interlinked branch canals that draw water from both sides of the Turia river, each of which has its own large user group or Canal Community: Quart, Benacher-Faitanar, Favarra Rovella, and Mislata (on the right bank) and Tormos, Mestalla, and Rascaña (on the left bank). Although legally autonomous, the communities are highly interdependent and exhibit an extraordinary level of cooperation and coordination of effort³. That ancient cooperative tradition is manifested publicly in, and partly governed by, the famous Water Court, which has met every Thursday for the last 700 years in the Apostles' Door of the Cathedral of Valencia on the Royal Plaza in the city center⁴. Because all of the elected leaders of the member communities take part in the weekly Court and must ordinarily attend the subsequent meeting of the *Tribunal de las Aguas*, the leadership of the General Irrigation Community, it seemed obvious that my search for participants in the research should begin there, and, thanks to the extraordinary openness and hospitality of the Tribunal leadership, those contacts were easily made⁵.

After conferring at length with the Secretary of one of the member communities (Favara)--a lawyer who, along with his brother and partner, also serves as Legal Advisor to the Tribunal and the entire Huerta organization—I decided to restrict my interviews to the various Canal Community leaders, or *Síndicos* (both the people currently serving and some individuals who had served in the past), and the Water Distributors or *Guardas* (again including both active and retired people). That decision was easily made for a simple reason: the *Síndicos* are legally required to be landowners and irrigators themselves, while the *Guardas* are not required to be but in fact usually are. Although some might argue that the selection may have biased what was in any case never going to be a representative sample of the entire huerta membership, it solved the key problem of getting access to individual farmers, the people in whom I was most interested. Such access would otherwise have been nearly impossible in a city whose general user community is of enormous size (current population 785,700, including at least 25,000 "comuneros", or small-garden irrigators) and spread out over a vast area. In this way I was able to find rather easily the 30 experienced irrigators who I needed to talk with; and I ultimately found their involvement in the everyday operation and maintenance of the canal system to be a distinct advantage rather than a drawback in the study.

The Huerta's leaders are clearly strongly supported by the vast majority of its huge membership, forming an organization that is highly accountable and said to be virtually free of corruption. These particular individuals had no reason to distort or exaggerate in the information they gave me about irrigation, which officially lies within the public domain and is theoretically accessible to anyone, and they therefore had nothing to hide. Because they congregated once each week in the same place for most of an afternoon—on the main plaza in the door of the city's Cathedral—it was relatively easy to arrange and carry out lengthy interviews with 30 individuals of approximately two hours each, as well as several day-long "field trips" with various Water Guards, during a three-month period. Because I had anticipated that this research would be much easier than my work in Murcia and Alicante, it was actually done during the final three months, rather than the first, of my year in Spain.

The earlier work of Glick (1970), although historical and largely focused on the city during previous centuries, had emphasized the extraordinary continuities that had persisted in the local tradition up to the present day and, upon beginning my interviews, it proved to be easy to document, for example, that proportionality (in the land-to-water ratio, as well as in other important variables) was a basic principle serving to define individual water rights, as Glick had already shown for the Medieval and later periods. That principle had also been said to be vital in governing the system in the exhaustive accounts of Maass and Anderson (1978) and in the clearer and simpler analysis of Ostrom (1990), but there were other principles that had not been mentioned whose existence I had either inferred from their descriptions or had encountered in my fieldwork in Peru, ones that in my view had to be there if the accounts were to be made complete and to really make sense from the water-user's point of view. For example, a basic uniformity in the watering frequency, although not explicitly mentioned, had to exist, along with some degree of uniformity in (or control over) the watering technique of individual farmers, if there was to be any true proportionality among peoples water rights.

It should be emphasized that these earlier studies had together provided an extraordinary level of detail in their analysis of how Valencia's system operates (just as in the other two cases). But this was done primarily by describing as precisely as possible the activities and responsibilities of the *Guardas*, or Water Distributors, as well as the other Tribunal authorities. It was clear that the traditional distribution system shared by the communities, despite their legal autonomy, was a cyclical rotation called a **turno**,⁶ where farmers took turns in using a given canal flow whenever it arrived, watering their fields to their satisfaction consecutively in a fixed contiguous order. But the frequency with which the rotations came varied throughout the year according to the available river flow, and there was great deal of variation in both the flow of the canals and the actual duration of each person's turn, so that these were not fixed according to the day of the week and the amount of time given to each farmer⁷.

The previous analyses of the complex process of dividing the river flow among the various canals in a carefully-coordinated manner (physically done by the *Guardas*) were so exhaustive that the system had been made to appear so complex as to defy a clear understanding of individual incentives and to largely obscure the water-user's point-of-view⁸. My task was therefore one of simplification and clarification, of putting myself in the "shoes" of the individual farmer, and conducting my interviews as much as possible on that basis: as farmer-to-farmer conversations, relying to some degree on my years of experience living with small "peasant" farmers in another part of the world. Although I did accompany ten of the acting *Guardas* on their rounds (some of the communities have more than one such Water Distributor), observing what they did and asking questions that naturally interested me about how they divided the flow among the different canals (*acequias*), those encounters and my actual interviews with these people and twenty of their colleagues were intended to cut through all the technical details and get down to several fundamental questions, mainly concerning their own individual water rights:

- 1) How were their rights defined in concrete terms—according to what physical and temporal parameters (amount of water per unit of land, duration of watering, frequency thereof, extent of variation in frequency or duration between different communities and different farmers)?
- 2) What were their accompanying duties in maintaining the canal system, as farmers rather than as water officials, and how did those duties relate to their rights?
- 3) How secure did they feel about their rights, and why? How much difference was there between the theory and the actual practice of water distribution and use?
- 4) If they felt very secure about those rights, as the earlier studies clearly seemed to be indicate, exactly why was this true?

5) What, in their opinion, accounted for the extremely low incidence of water theft and other violations of the rules, for the very low level of social conflict between members and the very high degree of cooperation?

The semi-structure interviews were guided by a list of a total of twenty questions that seemed, in my judgment, to potentially cover all of this ground, which are listed (in Spanish) in Appendix 1. Although these questions could be answered quite simply (and often were), and were designed with the idea of eventually using them in a questionnaire, in most cases they set off a rather lengthy discussion where the answer to one question would lead toward some other one on the list, which revealed or referred to another working rule or operating principle, which we would then explore, and so on. In interacting with the participants in such a dynamic manner, I had to take care in order to see that each interview (all of which were done with informed consent, and most of them tape recorded with the person's permission) included all twenty of the questions and thoroughly covered all of that ground.

The interviews in Valencia ultimately confirmed, quite clearly, that the following basic principles exist and are operative from the water-user's point-of-view. This is to say that the principles were recognizable to all the irrigators interviewed and widely understood by them to be crucial in defining their own water rights and in making those rights secure, leading to the efficiency and success of the hydraulic system as a whole. With a few interesting exceptions, of which more will be said below, the agreement among informants was so complete and striking as to be not only convincing, but to suggest that my choice of subjects had been the right one for investigating both how the system physically works and why it works so well from the water-user's point-of-view. At a slightly higher level of abstraction, the central organizing principles of Valencia's tradition are *equity* (or "fairness") and *transparency* in water distribution, as manifested concretely in the manner described below:

BASIC PRINCIPLES OF IRRIGATION IN THE HUERTA OF VALENCIA

- 1) **Autonomy**: each canal community receives its own flow of water during each distribution cycle and has total control over it (although for hundreds of years the groups have voluntarily used their shares in the same basic way).
- 2) **Uniformity** (one of the parameters defining "*equity*" or fairness)
among water rights: everyone receives water with the same frequency and has the same number of turns in a given year;
in technique: everyone irrigates in the same basic way⁹;
- 3) **Contiguity**: water is distributed to fields in a fixed contiguous order based only on their location along successive canals, starting at the head and moving systematically field-by-field toward the tail, then on to the head of the next canal downstream;
- 4) **Proportionality** (the other parameter defining "*equity*")
among rights: no one may use more water than the amount to which the extent of their land entitles them; the land-to-water ratio is the same for each field, person, and allotment;
among duties: people's contributions to canal maintenance must be proportional to the amount of irrigated land that they have;
- 5) **Transparency**: everyone knows the rules and has the capacity to confirm with their own eyes whether or not those rules are generally being obeyed, to detect and denounce any violations that might occur;

- 6) **Regularity and Boundary Maintenance:** things are always done in the same way under conditions of scarcity; no exceptions are allowed and any unauthorized expansion of irrigation is prohibited;
- 7) **Graduated Sanctions:** the penalties for rule violations (the “multas”, or monetary fines) are known to everyone but vary in amount according to the severity of the offense.

It should first of all be noted that the interviews and field visits strongly confirmed my research hypothesis, since these are indeed the same working rules and operating principles I had encountered in my fieldwork in several peasant communities in Peru. They have the effect of defining “equity” or fairness in the sharing of scarce water in precisely the same way. Secondly, many of my Valencia informants--small-scale farmers who, from the point of view of the size of their landholdings and their water needs, could be considered ‘peasants’ (their parents, at least, clearly were)--expressed some degree of puzzlement toward the end of the interviews over how I could have acquired such a high level of knowledge and understanding of the Valencia system without ever having been there before. This reaction of surprise was expressed to some extent, in the form of an approval, in almost every one of the thirty interviews.

In answering them I noted first of all that the previous studies had been highly detailed, although incomplete in terms of explaining exactly how water rights were defined and how they were made so secure from the farmer’s point-of-view. That criticism did not seem to surprise most of the participants, especially the *Guardas*, who often noted that my questions had in some ways clarified their own understanding, or at least expressed it in a way they had not experienced before. I also explained that I had encountered the same kind of system, based on the same concepts of equity and transparency, in a few villages in Peru, ones that were not related in any historical way to Valencia, since there had clearly never been any contact between members of the two communities and no colonists from Valencia or any other part of Spain had ever settled in those particular Andean communities, which are entirely indigenous. This was surprising to most people, since everyone in Valencia is quite aware that their local tradition dates back to the Moors and was put in place by their Islamic forebears, knowledge that of course raised the possibility of a direct historical connection or influence through the Conquest.

Another part of my explanation did not surprise them, however, a response that was quite revealing and worth commenting on here. In each case we talked toward the end of the interview about how the working rules and operating principles interrelated and worked together, forming a coherent system from the individual farmer’s point of view, a subject that will be dealt with further below in discussing the research on Alicante. My summary remark that a concrete “logic” of equity and transparency seemed to govern the local tradition, from what I had previously read, and that in my opinion this was an optimal arrangement that could only be achieved in one way, was a suggestion with which almost everyone agreed. It therefore seemed entirely possible to them, and was not too surprising, that people in different parts of the world could have discovered that ‘tradition’ independently of each other. Indeed, the question of how well the local tradition worked in their eyes, relatively speaking, was on the list of twenty questions that I asked to everyone, and I made sure to do this quite early in the interview and not to do it in any kind of leading way (see Appendix 1). In each case it was asked long before going on to discuss how the basic principles were integrated and worked together in defining individual water rights.

The response to this particular question was striking, and says a great deal about the “moral economy” model on which my hypothesis is based. When the basic principles have been implemented and in place for a very long period of time, as in Valencia, they apparently come to define a kind of mental schema around which irrigation and water use, as well as other aspects of daily life, are organized, what can be called a “culture of irrigation”. Of the thirty people interviewed in Valencia, all but six explicitly described their local tradition as “optimal”, or superior to all others they knew of in terms of

efficiency, equity (or fairness), and degree of internal conflict (as caused by theft, for example), as a tradition that cannot be improved upon. The others said it was either “average” or, most often, “superior”, and tended to point out that no human invention or achievement is truly optimal in the sense of being perfect. But the vast majority of people--83% to be exact--said that Valencia’s tradition was as close to perfect as human beings will ever get in the field of irrigation.

Although I had certainly heard this answer before, the level of agreement was astonishing, coming as it actually did toward the end of my research. And ultimately, for these people, it helped to provide a satisfactory explanation of how I could come to know their tradition so well and, as several of them remarked, to provide a better account of it than any they had come across before. For me this experience demonstrated, quite emphatically, the unique potential of cross-cultural ethnographic research, especially in irrigation and the management of natural resources.

Murcia: a communal system of the **tanda** type

It was striking patterns in the wealth of data provided by earlier researchers (especially Maass and Anderson 1978, 1985) that led me from Peru to Spain’s Costa Blanca and the Valencia region, similarities that were clearly not the result of any direct historical connection between irrigation systems in the two parts of the world¹⁰. This also applied to Murcia, where the study actually began, a city underlain by another ancient canal system of Moorish origin that, at the time of the earlier research, had been about the same size as Valencia, covering approximately 12,700 hectares in 1965 (Maass and Anderson 1978:67). In that study Anderson had documented a much greater degree of structural complexity than he had found in Valencia, complexity that was so impressive on my first visit to the Huerta as to cast some doubt on the validity of the research hypothesis.

The Huerta lies 50 km. inland from the coast on the middle plain or *vega* of the Segura river. The canal infrastructure consists of a giant weir (the *Contraparada*) that diverts nearly all of the river’s flow into two enormous and lengthy canals on either side of the river (called Aljufía and Barerras [or “Mediodia”]). These supply canals feed into a long series of secondary and tertiary canals (*acequias mayores* and *menores*, and *laterales*), whose outer extremes are interlaced among, and feed into, a corresponding web of small drainage canals that in effect form a kind of mirror image. The small drains (*azarbetas*) for collecting excess or runoff gradually grow larger as they join together and constrict as a group into very large and lengthy drainage canales (*azarbes* and *meranchos*), which ultimately combine into a single large canal (the *azarbe mayor*) that leads back into the river. The question of how this elaborate and ingenious design emerged historically as the canal system gradually expanded will forever remain a mystery¹¹. But its overall purpose and effect are extraordinary: to use the relatively clean river water (the “*aguas vivas*”) once in order to irrigate the widest area possible, then collect the runoff from that first irrigation in the drainage canals in order to use the recycled water (the “*aguas muertas*”) to irrigate again, then again (after collecting it once more), and in some cases even a fourth time before finally passing the remainder—still a substantial flow, but of highly contaminated, dark brown water—into the channel of the Segura River.

Already knowing about this major difference when I arrived, I soon became aware of some recent changes whose impact on water supply and demand had been enormous, and which made the contrast between the systems to be studied seem even greater: 1) the explosive and uncontrolled growth of international tourism in the region, now extending on an alarming scale all along the adjacent Mediterranean coast, and 2) the impact of the Tajo-Segura Pipeline, the biggest hydraulic project ever carried out in the history of Europe. The latter project had brought a huge amount of storable water into the region from the other side of the country, a stream that had originally flowed westward through Portugal and poured largely unused into the Atlantic. The greater complexity and the very dynamic hydrological situation made studying the famous Huerta of Murcia difficult to say the least. Accompanied by a local research assistant who was from the city and who knew the area fairly well¹², I wandered for weeks through the labyrinth of canals and dispersed user communities, which are still in place but which only operate together today very sporadically, at most a couple of times a year,

partly because of an ongoing severe drought. The drought had reportedly set in everywhere several years earlier and was of great concern even in Valencia, but in Murcia it had helped to create a real local crisis. I soon discovered, however, that the scarcity of irrigation water (as opposed to the failing rains) was in fact largely man-made, created through a massive fraud that the national government had perpetrated on the local people, who were angry about it to say the least.

The huerta landowners and irrigators (the *hacendados*) had contributed financially to one of the storage dams needed for the Tajo pipeline, and the project had been justified economically partly in terms of the great benefits it was expected to bring them: additional water to alleviate the prevailing yearly scarcity. But it turned out to actually rob them of an enormous amount, namely most of the flow of their own Segura river. In effect, this was now being shared along with the pipeline water with the large agribusinesses and massive tourist housing complexes that had sprung up along the adjacent coastal area during the years since the project was finished. The local farmers' only salvation had been to drill a large number of wells (some of them legal and some not) that tap the generally saline groundwater lying beneath the huerta (this quality is a basic parameter that varies significantly between the communities). Although the total number of wells is unknown, the local Canal Communities—numbering 42 in all, and here known as Communities of Irrigators, in accordance with Spain's Water Law of 1985—financed them and established them on their own, investing in them communally and, fortunately for me, operating them in a manner that in each case was 'traditional', having been modeled on the earlier *tanda* system. In stark contrast to this local community autonomy, which has been maintained only through real effort and struggle, the provisioning and sale of the pipeline water is under the control of a separate river basin authority, the Hydraulic Confederation of the Segura River, and (unlike the pipeline water itself) is dirty business indeed. Upon starting the research I attempted unsuccessfully to interview the President and some other leaders of the organization, only to find toward the end of the research that warrants had been issued in Madrid for their arrest, for large-scale trafficking in a thriving "black market" for both pipeline and well water.

Although the structure and basic layout of the canals have remained the same since the 1960's, the system today is spread out within a major urban center that has grown rapidly (pop. 173,000), resulting in the steady loss of agricultural land, a total of 5,600 hectares. Now less than half the size of Valencia's huerta, with 7,125 ha., and roughly half the size that it was during the 1960's (nearly 13,000 ha.), Murcia nevertheless still has a total of 14,214 very small farmers (*hacendados*), whose activity is coordinated and channeled through the 42 separate Irrigator Communities (*Comunidades de Regantes*), the groups of water users whose property is spread out along each of the many canals. The communities vary greatly in size but are legally autonomous and led in each case by an elected representative called a *Procurador* (a "procurer"). Together these local officials elect, and are led by, a group of officials who make up the *Junta de Hacendados*, the leaders of the huerta's General Irrigation Community. Equivalent in nearly every way to Valencia's Tribunal, this organization also includes a select group who meet once each month in an informal Water Court called the *Consejo de Hombres Buenos* (the Council of Good Men), an ancient ritual that is held indoors but still theoretically open to the public.

The importance of irrigation in the city and region is comparable to the vital role it plays in Valencia; the ancient Moorish tradition is a central theme in the narrative of local history and farming forms an integral part of many people's identity, especially for the "older generation".¹³ Whereas Valencia is famous for its oranges, the *huerta* of Murcia is known throughout Spain as the vegetable garden for the nation and for much of the European continent. This legacy, of course, made it all the more surprising to find that the city's farmers had been the victims, rather than the beneficiaries, of the *Transvase del Tajo-Segura*, a vast linkage of pipelines, tunnels, aqueducts, and storage reservoirs that had been completed in 1979.

Because the water affairs of the Huerta are directed by one organization with a central office in the heart of the city, my research began there, as in Valencia, and fortunately I was shown the same hospitality from the very beginning by the *Junta*. Accompanied by my Research Assistant, a graduate

student in Geography at the University of Murcia, I was first given a day-long tour of the canal system and the entire huerta by the President, the Secretary, and a couple of the Irrigation Community leaders. The tour was actually led by one of the Junta's *Vocales* (Spokesmen and Advisors), a man who, like his father before him, operates the main canal gates and oversees irrigation on a daily basis, driving around in his truck and checking the various gates that should be open and inspecting the carefully-measured flow (when the water does come and is available) as it is diverted throughout some major portion of the canal system¹⁴. During the course of the tour, as he noted which of the irrigator communities had supply canals and used river water (the "*aguas vivas*") and which of them had drainage canals and used recycled water (the "*aguas muertas*"), I became aware of a third kind of variation that had to be covered in the research.

Traditionally, the Murcia irrigation cycle was called a *tanda*, a cyclical rotation among all the water-users in each community and along each canal, but here each person's "turn" was, with only a few exceptions (i.e., within 4 of the 42 canal user groups), fixed precisely according to the day of the week and the hour it began and ended, with watering time varying in direct proportion to the amount of land each person had a right to irrigate¹⁵. The general cycle or *tanda* for the entire Huerta was composed of the smaller cycles for each community, which were carefully coordinated in a manner established by local tradition. Fortunately, the working rules for each community and the procedures for coordinating them were officially recorded long ago and have since been collected and published in a book that is now freely available, the *Ordenanzas y Costumbres de la Huerta de Murcia*, published in 1994. That document and an extraordinary number of other books and papers covering the histories of both Murcia and Alicante (both published and unpublished) were found in the Murcia Regional Archive and the Municipal Library.

The general *tanda* traditionally took 23 days to complete for all the lands on both sides of the river, which received the river water simultaneously. This allowed all of the communities to irrigate in their internal *tanda* at least once, and often nearly twice, since most of them had 14 day internal cycles. After that interruption the water would pass to other municipalities lying below Murcia (the huertas in the *Vega Baja*) and above it (those of the *Vega Alta*) before returning again to the Huerta. Naturally, these interruptions varied in length throughout the year with the fluctuations in river flow, but, with only a few exceptions, the *tanda* formerly prevailed thereafter, regardless of whether a person irrigated from a supply canal with "live water" or from a drainage canal with "dead water". There are, however, four major secondary or branch canals, generally located in the huerta's upper reaches, that have no closeable gates and are always open. As long as enough water is flowing through the respective main canal, which nowadays is not very often, this gives the community members the luxury of a continuous flow. Their use of water had traditionally been unrestricted and fairly spontaneous, so that in these cases a fixed cycle or *tanda* had never existed at all. Our brief tour of the system, now in a situation of extreme water scarcity, confirmed that this absence of prior organization (which I already knew about from the earlier account) was significant, as one would expect. Thus I was careful to include such communities in my search for people to interview and include in the study sample.

My original intent, as indicated in my proposal, was to talk at length with 30 farmers and irrigators who represented the full range of significant variation in local circumstances. I ultimately decided on a purposive sample of 10 of the 42 canal communities that included all three basic types: those with a *tanda*, including users of both "live water" and "dead water" (8 communities, 4 on each side of the river), and those without a *tanda* (2 communities, located on either side of the largely empty river channel). Again, due to the great size of the huerta, I encountered the same problem in getting access to individual farmers that I later did in Valencia, since the canal communities averaged several hundred users in size, varying from about 100 to over 2,000 people. And I solved it here in the same way. The community leaders (the *Procuradores*), who often play the role of local Water Distributor, are again required to be farmers and experienced irrigators; thus I chose them as well as a few of their assistants, the *Guardas* or *Vigilantes*, again including both active and retired individuals. Unfortunately, it turned out not to be possible in the time available to locate and "chase down" three

such people in each of the ten communities, as I planned at first, and in the end I had to be satisfied with only two, reducing the total sample size to 20 individuals.

With such a miniscule sample, I had to take every precaution to ensure that the largely qualitative data were reliable, by cross-checking the basic facts provided by the two informants from each community. In the end I did not see this as problematic, however, because people's accounts did largely agree on the local 'facts' and because I was doing qualitative research that was designed to divulge basic principles that, theoretically, should be known to everyone. In effect I was trying to put together the pieces of a puzzle, and to "fill in the holes" in the accounts of previous researchers who had provided a tremendous amount of reliable information. Although much time had passed in the intervening years, this advantage made possible a study that would otherwise have simply been unmanageable in such a sprawling and increasingly metropolitan community. The specific canals were chosen rather arbitrarily from an official list, an inventory of the separate irrigator communities including their membership and their areas under irrigation, which was given to me by the President of the *Junta de Hacendados*. His Secretary then looked up the names and gave me the contact phone numbers for each of the *Procuradores*. In examining the list I first noted which of the different categories of known variation each of the communities fit into, with the President's help, then picked ten names essentially at random, but in a way that included what seemed to be an appropriate number of communities of each type. The President was entirely cooperative and did not interfere with the process or influence my choices in any way.

It was in Murcia that I decided how to conduct the interviews, as farmer-to-farmer conversations covering the same range of themes that I did later in Valencia and using the same twenty questions as an interview guide (see Appendix 1). Despite the dramatic changes that had already taken place, in what was clearly a slowly deteriorating local situation, the results of the interviews in Murcia were in some ways similar to those in Valencia, and they did effectively confirm the research hypothesis. That is, they confirmed to my satisfaction that my interpretation of the published data from the 1960's had been correct from the water-user's point of view. The same set of basic principles had, according to all of the people interviewed, *traditionally* been at work and was responsible for making the local system both efficient and successful. Equity had been locally defined, in concrete terms, in the same way as in Valencia; the system had achieved that fairness and, with the active involvement of the individual water-users in a situation of transparency, had ensured that this would continue.

The fact that it did not continue in some local situations was due to the theft of most of the Huerta's water, which had induced a chronic scarcity that in effect destroyed the fixed *tanda*, transforming the cycle into a variable *turno* for all the communities somewhat like Valencia's, a flexible one that had only been completed for the entire Huerta two times during each of the previous two years (2001 and 2002). The majority of the communities, those that had an internal *tanda* organization, continued to irrigate according to that tradition, but the general cycle would terminate and be interrupted as decided upon by the Hydraulic Confederation, which ultimately has control over both the river water and the water of the Tajo pipeline¹⁶. When the Huerta's water was again released the general cycle would be taken up again wherever it had left off, with all the communities using whatever wells they had during the period in between.

Thus there was plenty of change going on, with the general cycle being interrupted constantly and now being stretched out and highly intermittent, and lot of conflict was said to be occurring in certain areas as a result. Yet no cases of water theft had been denounced and sanctioned by the Water Court in recent years, according to all ten of the community leaders. This was a striking continuation of a pattern that, according to them, had prevailed traditionally and had in fact been documented earlier by Maass and Anderson: the remarkably low level of social conflict that I wanted to explain. A lot of disorder was said to prevail now in some areas, but it seemed to be confined to the few canals and communities that had never had a *tanda*, or fixed turn of their own, as well as those communities that did not have enough additional water from wells to "take up the slack" when the supply of river water ran out (This flow had traditionally been continuous, but shared in alternation with the communities of the adjacent Upper and Lower Vegas).

According to my informants, there was a surprising amount of continuity in all the other communities of the Huerta, including those toward the lower end that used the *azarbes*, the biggest and longest drainage canals. This was only made possible by the wells that had been drilled and the widespread use of gasoline-powered pumps to help lift the water up out of the canals, which can now be done even when the level of the canal water is very low, as is usually the case when there is any water at all, whether from the local wells, the river, or occasionally from the pipeline. But the persistence of local tradition was remarkable nonetheless.

The response of the *Procuradores* and *Guardas* in these areas to my questions was much like what I experienced later in Valencia, expressing a recognition of the principles in each case and also often showing some degree of surprise. As I had inferred or understood, the individual turns here were simply fixed at a certain point in the cycle and had an exact duration, a number of hours and minutes that was strictly proportional to a person's land. This meant that people got much less during droughts when the canal flow was low, and they had to make do with what they got during that fixed time by only irrigating a portion of their total land. But the turns always came in a contiguous order from the head to the tail of a given canal and community (or set of consecutive communities, as in the case of a very long supply or drainage canal), as set out in the published Ordenanzas, and this had continued up to today. There had only been a couple of general tandas for the whole Huerta ("*riegos generales*"), supplemented by the separate cycles of the local wells dispersed along the canals. But in these areas, apparently including the vast majority, the 'traditional' arrangement of equity and transparency had prevailed.

This continuity revealed in people's answers was significant and quite surprising in view of all the changes that had taken place. The overall pattern seemed to suggest that, where equity and transparency had been maintained for centuries and a local "culture of irrigation" been established long ago, people had been able to pull together and continue to cooperate in spite of the drought and in the face of a major public scandal that had seriously jeopardized the livelihood of everyone. Local tradition, which the users all had in common, had made them able to respond to the challenge cooperatively and overcome a common threat. Where this "moral economy of water" (my term) had not existed and a fixed order never been established, as in the canals that had not had a tanda and the areas where irrigation had nearly ceased because there were not enough wells, chaos seemed to be slowly prevailing. Some communities thus appeared to be surviving the crisis relatively unscathed, while others were not and seemed at least to be in a state of flux. But an extraordinary degree of cooperation had persisted and, most importantly, the participants in each case agreed that, up until the time the pipeline was built and the rains began to fail, *this had formerly prevailed throughout the entire huerta*.

A curious phenomenon happened in the interviews, a dynamic that I did not consciously intend to create but emerged nonetheless. It is important to note that this did not reflect the classic nostalgia for a bygone age that farmers today seem so often to display, a longing for a "golden era" in the past that in fact never existed. Rather, it was a genuine pattern in the answers that closely fit the data provided by Maass and Anderson in the 1960's. As I began to ask about people's water rights and how these were traditionally defined, a before-and-after account emerged spontaneously in the conversations with nearly every informant, simply in response to the specific questions I used as an interview guide. I never explicitly asked the participants to compare how things were today with how they had been "before" or traditionally; that question was not on my list. But in nearly every case people did this on their own, making a distinction that was clearly crucial if they were to give an honest answer to my questions. With extraordinary regularity, when asked about the basic principles previously listed for Valencia, by means of basically the same set of questions but perhaps given in a different order, the answers would be some version of "traditionally yes, but today no".

When I asked people about how their water rights were defined, as well as their duties, how secure they felt about those rights and how well they thought the system worked, etc., people either gave the same positive answers that I was given in Valencia, affirming the continuity that I had thought might

still exist, or, in the cases where things had apparently deteriorated, they made this negative before-and-after comparison. It is important to note that this included the aforementioned *Vocal*, a man with twenty years of experience in overseeing the entire system, who was my key informant and the person interviewed most extensively of all in the research¹⁷. But in either case people confirmed the existence of the traditional *tanda* system. Without exception, and in every case without any prompting by me, things were either said to have remained the same or a clear distinction was drawn between the remarkable way the system had worked “before”—before the pipeline took away nearly all of their water, before all the corruption began and before the wells were drilled¹⁸—and how it works today. In view of everything I had learned about what was going on behind the scenes, this strong confirmation of the research hypothesis was surprising.

Alicante: the famous “peasant” water market

Of the three Huertas included in my research Alicante was the most unique, a “garden” of only 3,700 hectares that, according to the earlier research, had distinctive features dating back, not to the Islamic tradition that the huerta had in common with the other two urban communities, but to more recent events that had occurred toward the end of the Medieval period. As the earlier studies had noted (Maass and Anderson 1978, 1985; Ostrom 1990), the ‘modern’ irrigation system was born when the Tibi dam was built, in 1593, to store the Huerta’s water by creating Europe’s first major reservoir, a pioneering achievement that had doubled the amount of water available and increased the area that could be irrigated within the Huerta’s boundaries some 12 km. below. Up until that time the huerta’s *Sindicato del Riego*, an general irrigation community formed by three Canal Communities or member user groups (Muxtamiel, San Joan de Alicante, and Campello), had maintained a traditional *tanda* organization similar in some ways to Murcia’s, except that it was highly inequitable, having no basic proportionality between water and land. In fact, it was a feudal system based on water as private property, belonging mainly to the local landed elites, where the water was not attached to the land.

The vast majority of the water flowing at that time in the Montnegre River and ultimately into the Huerta’s *Acequia Mayor* (Main Canal) far below--now referred to in the literature as the “old water”--was in the hands of a small group of elite families, feudal landlords and successful merchants who rented out their fields and their water to local peasant farmers who themselves had only small plots in the huerta and had very limited water rights, if they had any at all. This private ownership was quite unusual in the region at the time, when communal *turnos* or *tandas* prevailed almost everywhere else. The local landlords asked for the help of King Felipe II in coming up with the money they needed to build the Tibi dam, which he provided by giving the landlords the collateral for a large loan that financed the dam’s construction. Thus there was no basic proportionality between land and water at first, indeed quite the opposite with the “old (i.e., feudal) water.” In approving and supporting the loan, the King endorsed the “old water” as a legal form of private tenure while explicitly recognizing it as exceptional--a favor reportedly done in return for political support that the King had previously received from the Counts and other wealthy landowners of Alicante.

The building of the reservoir was also financed directly with money and other capital provided by the landlords themselves and other owners of the “old water”, including the small landowners of the huerta. Thus the project involved both local and borrowed capital, with much of the former being given in small amounts by peasant farmers who wanted in on the expansion¹⁹. The dam immediately doubled the amount of water available for irrigation, and made it possible to release this flow in a carefully-regulated manner into the river. This improvement in turn allowed the authorities to double the size of the Huerta, using the extra water--known in the literature today as the “new water”--to give even more water to previously irrigated lands and to put new lands under irrigation, ones that had been cultivated before but whose owners had not had any rights to the “old water”. The “new water” was given to those farmers and other members of the huerta who had contributed money for the dam’s construction, and divided proportionally according to the amount of cultivated land each person owned. This created a basic proportionality between land and the “new water” that did not exist for water of the other type, and in the former case the land and water remained firmly tied to each other.

The flows of both waters were regularized and made constant when they were released (at 150 l/s.), but it is important to note that for a very long time this was done in two separate *tanda* cycles. The “new water” remained attached to the land and was distributed in a *tanda* equivalent in many ways to Murcia’s, a cycle based on the principles of equity and transparency. Previous studies of the huerta (Maass and Anderson 1978, 1985; Ostrom 1990) had been quite vague on this point, but I managed to clarify the arrangement and confirm that these principles governed the distribution and use of the “new water” in my research. The “old water,” on the other hand, being detached from the land, was regularly sold and transferred in a separate *tanda* within the Huerta in single allotments, so the those people’s rights were “rented out” to the poorer peasant landowners, most of whom had some property and also had some rights to the “new water”. Over time, however, ownership of the private “old water” had gradually become concentrated in fewer and fewer elite hands, ending up in some cases in the hands of wealthy people who no longer owned any cultivated land at all. Such wealthy owners were now part-time water agents and speculators whose interests were served publicly by hired water brokers who participated in the weekly water sales. Soon after the dam and reservoir were built, this curious unbalanced relationship between communal and private water was institutionalized through the formation by the *Sindicato* of a formal public Auction (or *Subasta*), which was formerly held every Sunday in the main plaza of the “suburb” and user community of San Juan de Alicante, a few miles from the city center.

It is important to note that the new water was extremely scarce and far from sufficient to irrigate whatever amount of land a new-water owner (generally a peasant) had, a ratio or proportion that was the same for everyone: today it is 4 minutes of water per hectare of 150 litre-per-second flow (Alberola 1994:74). The old water rights, by comparison, were independent of the land and defined in terms of *shares*, which today are worth 45 minutes each at the same flow rate (a person could own several of these, and often did). With the duration of each person’s turn fixed in this way under a *tanda* system, the flows became steadily less adequate to meet local farmers’ needs as time went on and the two stores of water in the reservoir gradually diminished. This had the effect of interrupting the cycles, often somewhere “in the middle”, and increasing the amount of time before they were taken up again. The price of old water was deliberately manipulated by the brokers and big landowners they represented in order to take advantage of this contraction, as well as the bigger disruptions induced by periodic droughts, as Maass and Anderson (1978) had observed. Fortunately, certain mechanisms were in place to limit this behavior, especially the separate auctioning every week of a large number of shares owned by the *Sindicato*, which were sold in order to help pay its operating expenses. This had the effect of limiting both the going price and the capacity of the big water-owners to engage in such speculation.

Even though the Sunday auction was overseen by the *Sindicato*’s elected leaders, it was evidently somewhat chaotic, extremely subtle in its dynamics of communication, and no doubt difficult for an outsider to understand. The basic institutional arrangement became even more confusing, however, when the two regulated flows of water began to be mixed together and stored overnight, a result of the construction of a Pantanet, a small regulating basin and storage reservoir in 1874. This was later followed by another one twice as large in 1954, which finally enabled the local farmers to do away altogether with nighttime irrigation, which before had remained a necessary burden for many people. But when the first regulating dam was built, the equal and regulated flows of “old water” and “new water” had been mixed together indistinguishably and delivered to the huerta in a single double flow²⁰. Keeping track of the two kinds of water, when they were being exchanged so widely, and accounting for them quantitatively, thus became a bookkeeping problem rather than a problem of separate vigilance and separate control over the two flows. To facilitate this, and to keep track of all the weekly selling and swapping, printed scripts were issued for various time/flow amounts, ones that had to be claimed by the water-users as representations of their rights before each irrigation round (they were actually a form of currency). This script could then be freely bought and sold, either privately or in the weekly public Auction²¹.

The main problem with the earlier studies of the Huerta is that they had depicted this Sunday auction, and the informal water-trading that went on during the Thursday market day, as a thriving and wide-open market in both kinds of water, which I strongly suspected could not have been accurate. Based on what I had learned in my prior historical research in Peru, such an unregulated and unstructured market would simply have been unworkable, given the prevailing scarcity of “new water” (see below) and the remarkably high degree of inequity in the ownership of the “old water”, which for a long time had remained quite abundant whenever it was available. As in Valencia and Murcia, the highly-detailed descriptions of Maass and Anderson (1978,1985) and Ostrom (1990) did not really make sense from the point-of-view of the small farmer and the “new water” owner. They must, I thought, have left out some basic and important information, and this turned out to be true.

The main purpose of the auction had been to sell the abundant surplus generally enjoyed by the owners of the “old water” to the owners of “new water”, who desperately needed it. Far from being a well-functioning free market, the Alicante auction was speculative and highly exploitative, having its origin in the feudal system, as my key informants in Alicante all agreed. From a functional point of view it did work quite well and was amazingly efficient; a very complex series of transfers occurred each week of very small amounts of water that were delivered on time and in the proper amounts, and accurate records were kept of it all. Perhaps more importantly, there was hardly ever any water theft, as the earlier researchers had shown quite clearly; but they had been unable, in my opinion, to account for this in a situation that had in fact been characterized by a great deal of conflict of interest between the owners of the two kinds of water. In any case, the vast majority of water traded each week, as it turned out, was in fact the old water, while tiny shares of new water were only occasionally sold.

All of this trading was only possible, as I suspected from the beginning, because the circulation of private water in effect rested on the back of a traditional *tanda* cycle, a set of rules and principles that governed the distribution and use of the “new water”. Any old water that a person purchased would be delivered to him during his normal turn in the “new water” cycle; it could not be acquired whenever he wanted it. This is to say that the transferred water, when it was purchased and delivered, always served as a supplement to a person’s normal turn, and was subject to the same rules and constraints in use. Thus the allocation and transfer of the “old water” were mainly governed by the rules and principles governing the “new water” round, and only secondarily by the “law of supply and demand” and the price of the resource on a given day. The transfers were a part of, and were structured by, the *tanda* of communal water. And this cycle, as it turned out, was basically the same communal tradition that had been established much earlier in the huertas of Murcia and Valencia.

The earlier published accounts had made it appear that water sales had the effect of redistributing the total supply, spontaneously but adequately, to meet the changing demand. The price of water, though restricted in the range over which it was allowed to fluctuate, varied widely during each cycle, but it had supposedly ensured this outcome. Yet it was striking that virtually all the transactions had gone in the same direction, from the old water owners to owners of the new.²² New water allotments were said to have frequently been sold; but it was difficult to see why, in a situation where they were far from adequate for even a tiny plot of land, any peasant farmer would actually sell them—in effect renting out his water right—unless he wanted to get out of agriculture altogether, in which case he would ultimately have to sell his land. Furthermore, it seemed clear that this could not have been a system based on fixed *tandas* but rather one of flexible *turnos* or turns, with so many water transfers of water going on all the time. Furthermore, the earlier authors had carefully documented the same striking characteristic noted in Valencia and Murcia, the very low incidence of water theft and other instances of water conflict, but this seemed impossible to explain in such a flexible and yet highly exploitative system. Why did people not steal water more often; where did the incentive to obey the rules come from? None of this was clear, and something was obviously missing from the accounts of a system that had supposedly worked remarkably well.

All of these points turned out to be moot, however, as soon as I went to Alicante to begin the research and arrived at the Sindicato’s office. I then discovered, to my astonishment, that the water market had been abolished in 1983, when the Sindicato had gone bankrupt after a long period of internal struggle

and decline. The scarcity and intermittency of both kinds of water had apparently increased to the point that neither kind was really worth very much for irrigation, and both of them had hardly ever been available. Furthermore, a long history of embezzlement of Sindicato funds had been discovered, which in the end had the effect of causing the organization to simply fall apart and be unable to pay its debts. The Sindicato had since been reorganized and given a new and much steadier supply of water--the outflow of Alicante's municipal Wastewater Treatment Plant—to replace the outflow of the Tibi reservoir, which has declined so much that its importance today is largely symbolic²³. The dam does continue to operate, but only on the rare occasions when there is enough water in the lake. The Huerta's leaders are now struggling, with little success, to reestablish a communal tanda system for the Huerta. This is now substantially smaller, at roughly 3,000 hectares, due to a loss of arable land through urban growth. Although water theft itself remains quite rare, there is a great deal of conflict among the members, as indicated by the persistent inability of the water-users to agree on a new set of rules for operating the system.

As soon as I got over the shock of this discovery, I set to work on the new research plan that obviously had to be drawn up. My objective, as laid out in my original grant proposal, had been to reveal in detail how the market system had actually worked from the farmer's point of view, and to test the hypothesis regarding the basic principles that made it effective (i.e., to test the "moral economy" model). Rather than give up on that goal and try to trace the effects of another bewildering series of ongoing changes in a contemporary study, as I had been forced to do in Murcia, I stuck to them and turned the Alicante research into an oral-historical and archival study. After asking the Sindicato leaders how many local farmers and water distributors were still alive and were old enough to remember the details of a system that had been disbanded twenty years earlier, I assembled a list of ten people who I planned to interview intensively and use as key informants. Fortunately, all of them were retired, and they were quite willing to talk to me. However, as I gathered those data and got people's answers to basically the same series of questions, but now explicitly about the way things had been "before", I became aware that my real hope of answering the key questions lay in the Sindicato's archives. These written records were extensive, reasonably well organized, and located in a back room of the Sindicato's office.

After talking with and interviewing both the current President and the Secretary of the Huerta organization—now designated an Irrigator Community under Spain's 1985 Water Law--I was kindly given free access. I also made extensive use of numerous studies and documents that had recently been published, including one excellent historical study by a professor at the University of Alicante (Alberola 1994), and closely examined some important documents that I had found earlier in the Murcia Archive. But the most important sources of all turned out to be the Sindicato's own records and its Newsletter, which had been published weekly over a period of more than twenty years during the mid-20th century.

After giving the matter much thought, I focused my historical research on answering several basic questions:

- 1) In general terms (or perhaps over certain specific years), what had been the relative frequency of sales of allotments of the "old water" versus the "new water"? If the tiny allotments of new water had in fact been only rarely sold in the underlying tanda system, this would make a huge difference in terms of how the "market" had actually worked.
- 2) If a person bought additional water for his field, when had it arrived—with his regular turn or at some other time, or perhaps in a separate allotment? If it had always come during a person's normal turn in the tanda, and the water had only been available with the same limited frequency that everyone else was bound to, then these institutional constraints (along with the sporadic rains) must have helped to determine both the supply and the demand for the "old water". A market that thus rested on a communal foundation had been a strange kind of market indeed, one where the law of supply and demand, and the water price, could not have functioned in the normal way.

- 3) Leaving aside the old water purchases, and the inadequacy of the communal supply (i.e., of the new water), how had individual rights to the new water been defined, in concrete terms?
- 4) How secure had the users of “new water” felt about their rights, how certain had they been they that they would get their fair share when the water did come? Why?
- 5) In a situation of such chronic scarcity and inequity, why had people continued to respect the rules? Why had there not been more theft of water; what had dissuaded people from resorting to this, in a situation where there was so much inequity and conflict of interest?
- 6) Why had small landowners sometimes sold “new water”? If they had in fact ever sold their allotments (thus temporarily “renting” out their rights), why had they done it; what had been their objective or motive--to make money, or was it something else?
- 7) How had the motives of the small farmers and the big landowners differed from each other with respect to water use and especially water sales? Relatively speaking, how important had it been for each of them to make money by selling water?

The results of my research confirmed my suspicions about the famous water market of Alicante, now of course extinct, and again strongly confirmed my research hypothesis. After going through countless documents and doing the ten interviews, several major points became clear. First of all, the vast majority of the water sold had indeed been the “old water”, bought by peasant farmers in the face of a desperate state of need. Sales of new water had rarely occurred and had in fact rightly fallen into a different category, since they were not primarily done in order to make money but for some other, more pressing reason. The sales had simply been a way of getting some compensation for a right that was temporarily, or sometimes even permanently, passed up for some other reason, such as an illness or a desperate need for cash.

Secondly, any water that someone purchased had been delivered on the same uniform schedule, in the same fixed order, as that person’s normal turn in the *tanda* of new water. People could transfer their shares of old water, or parts thereof, which came from the same large flow, but the traded water had not been freely available on demand. Rather, its delivery had been governed by the basic operating principles of the traditional *tanda* system, the one that for four centuries had governed the distribution of the “new water.” And, despite certain differences of detail, these principles turned out to be the same set that I had confirmed for Murcia, ones that ultimately had been derived from the same Islamic tradition. The local *tanda* for new water had actually been more like the *turno* of Valencia, since each individual’s turn would vary greatly in length according to the amount of additional “old” water they had purchased, and these transfers had been adjusted for by the *Guardas* in a complicated manner. The script or water currency had made it possible to keep accounts of all this and to ensure that it all had added up in the end. But both the accounts of my key informants and the wealth of documents I ended up examining strongly confirmed that the basic *tanda*, which in the end had taken the form of a single coordinated round for all three communities, was governed by the same set of principles that I found in Valencia and Murcia: the principles of equity and transparency, as they were defined above.

Without such an underlying transparent foundation, and an equitable set of underlying communal water rights (meager though these may have been), the “market” in individual allotments and the weekly sales of old water could not have taken place effectively over such an extended period of time, and order in the system could never have been maintained, particularly the very low level of infractions and other manifestations of social conflict. The “market” thus rested on a “moral economy” foundation, and that of course was the hypothesis that originally inspired my research.

The project sponsored by the MacArthur Foundation was therefore successful in every way, at least as regards the research done in Spain. Its findings turned out to have theoretical and policy implications that I will be exploring for years to come, both in writing and publishing and in carrying out the

ongoing comparative international research. I will forever be grateful to the Foundation for supporting a proposal and a hypothesis that most people considered highly controversial in the beginning, to say the least. Since the time that I initially applied for financial support, those ideas have gained wider and wider acceptance among my colleagues in various academic disciplines all over the world. Thanks to the Foundation, I am now poised to take both the research and the theory behind it to the global level, where they belong. And, in the fields of international water policy and ‘sustainable development’, both the future and my own career look very promising indeed.

Publications Resulting from the Sponsored Research

Articles and book chapters:

To date I have only produced one forthcoming article, a chapter entitled “*Scarcity, Equity and Transparency: General Principles for Successfully Governing the Water Commons*”, that briefly reviews the results of my research in Spain. It will soon appear in a book edited by Ellen Wiegandt of the Kurt Bosch Research Institute in Sion, Switzerland and called, *Mountains: Sources of Water, Sources of Knowledge*, soon to be published by Kluwer Press as part of their series Advances in Global Change Research. Now finished and in press, the chapter was written and accepted for publication before the research was carried out, and it largely follows the lines of argument presented in my original proposal to the Foundation, which merely laid out the research hypothesis in a convincing manner based on my own reading of the comparative literature. Since it closely follows the text of my proposal, and simply notes in each case that my hypothesis has now been confirmed successfully through fieldwork--but without providing any of the relevant details--there is no need to discuss it further here. Copies will be sent as soon as they become available.

Books:

I also have a book proposal now under review, which bears a similar title to that of my original proposal: *The Moral Economy of Water: Scarcity, Equity, and the Illusion of Creating Wealth*. Although it will ultimately be more global in scope, the proposed manuscript is a compilation (with revisions) of four articles that were previously published on my work in Peru; three chapters on the peasant communities that I originally studied as seen from both contemporary and historical perspectives, and a fourth that is a critique of the water privatization law (modeled on Chile’s 1981 Water Code) that the World Bank has been strongly promoting during the last decade in Peru and the other Andean countries, as the basis for widespread water reform. The latter chapter, previously published in the journal *World Development*, presents a viable and superior alternative for revising the existing water laws in those countries, as well as in other countries throughout the developing world, one that is based on indigenous principles of management and the “moral economy” model.

Other chapters yet to be written will summarize the results of my fieldwork in Spain, in much the same manner as I have done here but in greater detail, and present the results of the upcoming comparative work on successful irrigation systems in eight other countries, as previously mentioned. It will show that the moral economy model is indeed basic to successful systems throughout the world, an optimal solution that has been worked out independently by local people (generally peasants and indigenous people) as a solution to the problem of having to share a water scarcity. Another chapter will present a plan for improving existing irrigation systems throughout the so-called Third World through participatory development projects that discuss and promote the moral economy model. The final chapter will examine some of the major theoretical implications of the confirmed research hypothesis.

Taking the position that water is a basic kind of material wealth or “natural capital”, one that is inherently scarce and *not* created by humans, the chapter will argue that the communities examined in the book give abundant empirical evidence of the fact that, when faced with such a resource scarcity, people are quite capable of coming up with an effective and sustainable solution, a set of rules and

principles for rationing water and sharing it on a long-term basis. Contrary to what Hardin argued in “the tragedy of the commons” many years ago, people are quite capable of exercising mutual restraint, of agreeing together to cut back on their consumption of a scarce resource that is absolutely vital for human life. They have done in irrigation systems of very different scales in hundreds, perhaps even thousands of communities throughout the world.

I will then go on to argue in the final chapter that real material wealth, like water, is *not* created by humans, as the dominant ideology of capitalism would have us believe, but that its accumulation and consumption are processes ultimately governed by the First and Second Laws of Thermodynamics. This is undeniably true in a global system where a choice was made to base the economy almost entirely on the consumption of fossil fuels and other nonrenewable resources, which from a scientific and materialist point-of-view had the effect of creating a closed system of production, exchange, and consumption. Pursuing the analysis further, I will argue that the “moral economy of water” presents us with a model of, and for, achieving sustainable life in a limited world, that the basic principles I have encountered in my research are in some ways suitable for establishing the foundations of a sustainable, “beyond growth” economics.

Journal articles

A second article will soon be forthcoming—“*The Moral Economy of Water: General Principles for Successfully Governing the Commons*”—which will document my work in Spain and thoroughly demonstrate that the research hypothesis was correct in those three cases. Actually a modification and refined version of the text of this report, it will present the hypothesis that the model is not just widespread but in effect global in its distribution, and bring the actual research up to date, including the fieldwork in Chile that is now underway. Since most of its content has already been presented here and its significance discussed, there is no need of repeating a summary here.

Another article that is an outgrowth of the sponsored research, in the sense of pursuing its theoretical implications, has been written in two versions. One of them, entitled “*A State of Denial: On Poverty, Global Warming, and the Illusion of Creating Wealth*” has been offered for publication to **Harper’s** magazine in the U.S.. The other, a more thorough and scholarly discussion of the same ideas and the same data (mainly the results of my cross-cultural research on “the moral economy of water”) is about to be submitted to the journal **Nature** under the title “*On the Relationship between Poverty, Global Warming, and the Illusion of Creating Wealth*”. Both versions argue several points:

Real material wealth, like water, is scarce and not created by humans. Yet it is commonly confused with money and finance capital, which people do create but whose value is entirely symbolic or ‘virtual’, a characteristic that allows us to, in effect, use this capital to traffic in “value potential” and to trade upon our future. We must disentangle the two forms ideologically in our minds, and stop attributing the basic attributes of finance capital—abstractness, artificiality (since it is a human creation), and the ability to self-reproduce—with real wealth and productive capital, which are not human creations since their production inevitably involves the transformation and degradation of forms of energy, raw materials, and scarce natural resources, including human labor. Because of our decision to base the global economy almost entirely on the consumption of fossil fuels and other non-renewable resources (even our agriculture), the global system is effectively closed from an energetic and materialistic point-of-view.

All transformation processes in the economy of real wealth and productive capital are thus governed by the Laws of Thermodynamics, and their effect is inevitably to contribute to the buildup of waste, heat and disorder on the planet. Thus an entirely unnecessary fact of human economic life—our almost complete reliance on fossil fuels—has created the two greatest problems that humans have ever faced in the planet’s history, widespread poverty and global warming, both of which are direct results of economic growth or the steady increase of energy consumption per capita. Under the current arrangement such economic growth is destructive, not creative, and it drives a misguided “culture of consumption” that is built on a mythological foundation: the illusion that humans can create real

wealth. Only a fundamental shift in the way we view economic activity, in the way we frame the problem, will allow us to finally deal with these imminent threats to our existence. We must do away with the illusion of creating wealth, and recognized the true and hidden costs of our affluence and consumption. Although it will not prove to be entirely sufficient, this is certainly a necessary condition if humanity is to stop global warming, achieve economic sustainability, and survive.

¹ This is the overall estimate officially provided by the *Tribunal de las Aguas*, the leadership of the General Irrigation Community. It obscures the fact that a great amount of irrigated land within the system has been lost since the last research was done in the 1960's, a process that was well underway and duly noted then by Maass and Anderson (1978, 1985), who said it could only continue. However, a certain amount of land in the rice-growing area on the southeastern side of the city (as one approaches the coast) has apparently been incorporated during the same period and some of it given permanent water rights, whereas it only had secondary or "surplus" rights before (as some of these lands still do). This is why the overall estimate for the Huerta, although not precise, has not declined but risen slightly.

² One of the local communities, the uppermost, Moncada, is even more autonomous than the others, in ways that I know little about, enough so that it does not participate in either the Tribunal or the weekly Water Court. Thus it was not included in my study or Ostroms (1990), although Glick (1970) and Maass and Anderson (1978, 1985) did speak of it at some length while emphasizing its separateness. The current communities in the Tribunal still total eight, however, because in the late 1970's the water-users in the lower reaches of Quart, the first and biggest canal on the right-hand side of the river, formed their own community and, after convincingly arguing that this was necessary due to their tail-end position, they were accepted into the Tribunal.

³ The *Ordenanzas* of each of the eight Canal Communities, i.e., the rules governing all aspects of internal water allocation and use, as well as external hydraulic affairs, are centuries old but are said to show some degree of variation, at least in the way they were written down. Each community has a copy of its own *Ordenanzas*, but no complete version for the entire huerta has ever been assembled and published, such the one available for Murcia.

⁴ Although I did not find out exactly when the change occurred, the Court formerly did not actually meet on Thursday if no formal complaint had been filed for the previous week and it therefore had no case to hear. In that case a sign would merely be posted to that effect in front of the Cathedral door in the Plaza Royal. The accompanying Tribunal would apparently take place regardless, an informal meeting of *Síndicos* (the Canal Community leaders) and *Guardas* (the Water Distributors for each community) to deal with any problems that had arisen. Nowadays, however, due to the immense importance that tourism has taken on in the city, the Court and the accompanying procession of robed officials to the enclosure at the front of the door of the Cathedral has become a famous public ritual that takes place regardless. This change has had the effect of displaying dramatically and publicly the Huerta organization's most striking feature: there are rarely any infractions of the rules and the Court hardly ever has to carry out any legal proceedings. To my knowledge it did not hear even a single case involving a complaint during the entire three months of my study.

⁵ Here I must express special thanks to two individuals whose participation and rather strong-handed help were crucial to arranging and carrying out the interviews in Valencia: Alfonso Pastor Madaleña, the Secretary of the Irrigator Community of Favarra (also the Legal Advisor for the Tribunal) and Vicente Boluda Naviero, the Tribunal's President, a man with more than 30 years of experience in that position.

⁶ The system is also quite frequently referred to, even in the Tribunal's historical documents, as a **tanda**, the same term that is used to describe the system in Murcia, Alicante, and many other parts of Spain. This is highly confusing, since the latter term does obscure the only significant difference between the two traditions: the fact that the turns in a tanda system are fixed according to the day and the hour and the total time of each turn. In order to maintain the distinction, and following Ostrom (1990) in her fine analysis of the earlier data, I will use the former term here. As we will see in the section on Murcia, the distinction between the two traditions is now quite blurred, since the water for the *tanda* of the Segura river is now extremely irregular and insufficient, so that no one in the *Junta de Hacendados* (Murcia's equivalent of the Tribunal, or Huerta leadership) knows exactly when it will come and the *tanda* will be in effect, and the system has actually only operated fully for one or two irrigation cycles during each of the last two years.

⁷ Although I cannot go into the details here, the flow of the Turia river has been increased through the construction of several new reservoirs for storage and flow regulation, in addition to the Generalísimo Dam that already existed in the 1960's. This increase and stabilization of the flow has made it possible for the size of the Huerta to stabilize, and, although the scarcity of ordinary low water is now the rule throughout virtually the entire year, it has made it possible to do away entirely with the emergency drought procedures that were discussed in much detail by Maass and Anderson. These were said to be problematic in terms of equity, due to the large amount of discretion it gave the Síndicos in prioritizing among crops and cutting back on individual water shares. They are no longer even remembered in any detail by most of the Guardas I talked to, some of who are fairly elderly people, but people do generally know that they were once practiced in the emergency situations that no longer occur. People uniformly asserted that these were rare events and that the adjustments made, although perhaps inevitably creating some conflict, had not compromised the basic principles of equity and transparency.

⁸ Both Maass and Anderson (1978, 1985) and to some extent Ostrom (1990) went to great lengths to describe in detail the procedures followed by all the Distributors during both "ordinary low water", the scarcity that comes with the dry season every year, and real drought emergencies, which involved a rather complicated cutting-back of each individual allotment that left the farmers free to decide what to do with the diminished canal flow. The former also speculated that the contraction of the irrigated area of the Huerta due to the loss of land through urbanization, a process that was already underway during their fieldwork in the 1960's, might ultimately have the effect of enabling the Tribunal to do away with the emergency procedures altogether, so that the regular procedures for sharing a scarcity would be in effect most of the time (due to the sporadic nature of the rains even during the wet season, this would basically mean throughout the entire year). This is exactly what has happened during the intervening decades as the huerta has lost roughly 2,000 more hectares of land, contracting to approximately 14,000. The older Guardas that I interviewed recalled vaguely that special things used to be done long ago during extraordinary droughts, but could not say what these were and had never experienced them. Some of the Síndicos could perhaps have explained to me what they were, but in response to my question of whether they had any effect on the basic principles they invariably replied "no", so that the subject seemed not to warrant the time needed for further investigation. With this one reportedly minor and insignificant exception, things have "always" been done the same way in the Huerta of Valencia, a tradition that, as Glick was the first to show, dates all the way back to the Moors.

⁹ Both Maass and Anderson and Ostrom had indicated somewhat confusingly that farmers were free to use as much water as they liked during each allotment or *turno*, but that they were not allowed to waste water, observations that seemed to contradict each other but cast into question both uniformity of technique and, by extension, the basic proportionality they emphasized so much. In actual practice, the Guardas and the farmers themselves impose an upper restriction on the amount of water that can be accumulated on a given field, limiting it to "cinco dedos" or one hand-width of depth (roughly 10 centimeters). Depending on the crops they are growing, individual farmers may or may not actually use this amount (they nearly always do, by using earthen ridges called *cabellones* to pool the water, much like Murcia's irrigation "a manta") but the opportunity to do so is in any case "uniform". To them, this is by definition an equitable or fair arrangement, provided that the same amount of time passes between such opportunities for each member of the user community, as is the case.

¹⁰ As Ostrom (1990:81) points out, the policies of the Spanish Crown in the Americas were clearly modeled on Castile, to the west, and not on the eastern Mediterranean region of Aragón, which for a long time had been a separate kingdom and whose difference and relative autonomy from the Crown had already been established by the time the colonies were founded, and this was especially true of irrigation. Any direct historical connections between irrigation systems in the two countries would therefore have to be found elsewhere, in Castellón, if any cases of direct continuity and influence in fact existed.

¹¹ This is especially true of the major canal gates, whose precise shape and size serve to regulate the various flows, dimensions that were recorded long ago and have been carefully maintained ever since.

¹² My thanks here go to Yolanda Pérez Vera, a Graduate Student in Geography at the University of Murcia, who served as my guide, my assistant, and even my translator in dealing with "huertano", the least audible and intelligible dialect of Spanish that I have ever encountered.

¹³ This is reflected in the name of the local dialect of Spanish, referred to as “huertano” or gardener. Of course in such a rapidly growing municipality and nation, a serious inter-generational conflict has emerged, with the younger generation less and less interested in carrying on the quasi-peasant household farming tradition. With very few full-time farmers left, time conflicts with urban jobs add steadily to this conflict and stack the deck in favor of the better paid ‘modern’ professions, and the activities necessarily overlap from time to time. But all of these changes are significantly affecting Valencia too (also Murcia), which appears to be handling them much better.

¹⁴ Special thanks here go to the Junta’s President, Sigifredo Hernández Pérez and, most of all, to Benito Avilán Cornejo, the Vocal, people who were generous with time that they had precious little of. Despite all of the “dirty business” going on at the higher level of the Hydraulic Confederation, these men continued to do their jobs as stewards of the Huerta’s water honorably and to fight for the community as best they could. Although I did hear a few of the inevitable complaints (and always lots of opinions), I never heard any accusations about members of the Junta, who seemed able to stay out of the murky affairs of administering the pipeline water that periodically passed through their canals, often in separate purchased flows.

¹⁵ Here the traditional unit of land measurement for irrigation and all other purposes was the *tahulla*, equivalent to one twelfth (1/12th) of a hectare, a term dating back to the Moors.

¹⁶ The problem here, as I discovered in my one interview with a member of the Hydraulic Confederation (an Engineer) is that the water from the Segura River is mixed with the water of the pipeline and the two are stored together in the Ohot Dam, the one that the local irrigators helped build with their monetary contributions, which was completed in 1980. The Confederation, however, only keeps track quantitatively of the amount that supposedly enters the reservoir through the pipeline, and determines how much river water there is by subtracting that dubious amount (which only the Confederation really knows anything about) from the total level existing in the reservoir. In the absence of any independent records to determine the Huerta’s share, a system so absurdly designed is ripe for corruption.

¹⁷ Benito Avilán, who appears to work at least 14 hours a day, is both a Vocal in the Junta and an employee of the Ministry of the Environment. He has been overseeing Murcia’s irrigation system all of his professional life, as his father did before him. Although he was emphatic in confirming my hypothesis about the traditional system as he had known it (and he does farm, but on a very small scale), he tended to emphasize the disruptions and disorder that were prevailing within some of the Huerta communities, mainly the ones that had not had a *tanda* to begin with. These were a source of constant frustration where trouble was frequently breaking out and taking up his time. He was of the opinion that, in a global sense, the *tanda* no longer worked under existing conditions and was not appropriate for the entire Huerta. He was pessimistic about the future and did not even like to talk about the pipeline, a topic that made him furious and was a matter in which he was not involved at all. He simply distributed the pipeline water when it came. Fortunately, soon after the leaders of the Watershed Confederation in Murcia were arrested, the Huerta was given a three-month continual flow of pipeline water and river water, which allowed more than one general “turno” for the entire Huerta, including all of the separate *tandas*, to take place. Although agribusiness and tourism are no doubt still being favored, the situation was said to have improved after the scandal and more of these long and continual allotments were supposed to be forthcoming for next year when I left. Unfortunately, this year (2004-2005) the entire region has been stricken by a “100 year” drought, creating a desperate situation and making the future of the Huerta look grim.

¹⁸ The number of wells that had been drilled and were being operated in each community varied in my 10 community sample from 1 for the smallest community to 8 for the largest. Some wells were clearly much less saline, and thus more suitable for irrigation, than others, which is particularly important in their use for garden vegetables, which have to be watered every 8 days. Use of the wells was restricted to community members who had contributed to the cost of drilling them and purchasing the necessary pump and other equipment. The users had to pay a small but not insignificant amount, and use of the wells was overseen by a Distributor, often by the Procurador himself. They generally took turns in consecutive order from the head to the tail of the nearby canal, and there was always an upper limit on how much an individual could use and how long he could irrigate, determined by the amount of land he or she had. No one could irrigate a second time until each member of the “pump community” had had an opportunity to take their share in a given round. Although they have saved the Huerta as a General Irrigation Community, the wells have also created a serious problem. The *Procuradores* in each case noted that the watertable in their part of the Huerta (the “*capa freatica*”) had dropped by up to 3 meters during the last twenty years.

¹⁹ Many of them instead paid with periodic labor on the project over a period of many years. The relatively high wages for the work came from the project budget but went directly back into it on the other side of the ledger as the project was slowly completed and the loans gradually repaid.

²⁰ For a long time, this doubled flow was split again into two portions for simultaneous use during periods of relative water abundance. The two kinds of water, however, remained indistinguishable and were delivered together. During droughts, when the water would be released from the dam only sporadically, separating the tandas more and more widely from each other, the two flows would stay combined and be used to irrigate the two sides of the river consecutively, so that this could be done as quickly as possible. Unfortunately, as the reservoir silted in and the water supply began to decline early in this century, the “doubled water” soon became the normal operating procedure and has been in effect throughout most of this century (Maass and Anderson 1987:112).

²¹ The rules governing all of this were recorded and published in two documents, the *Reglamento para el Aprovechamiento de las Aguas del Riego de la Huerta de Alicante* (dating back to 1849 but published by the Sindicato in 1930) and the *Reglamento para el Sindicato de Riegos de la Huerta de Alicante* (dating to 1865 but published by the Sindicato in 1961).

²² The challenge of “seeing” how all of this actually worked was compounded by the fact that some new water owners would buy up old water shares and hold onto them, selling them speculatively as the water price rose reliably toward the end of each rotation and in response to droughts. I do not believe that in the auction such a person would say, for example, “I have two minutes of *old water* for sale”; rather, they would simply offer two minutes of water for sale, and my elderly informants agreed that this was the case.

²³ It is important to point out that the Huerta also has several other sources of quasi-private or outside water. As Maass and Anderson noted during the 1960's, a pipeline had already brought the surplus drainage water from the mouth of the Segura River and made it available to the Huerta. Today, however, the Huerta has a more direct connection to the *Tajo-Segura Pipeline* and periodically is able to purchase a substantial flow via the company *Riegos de Levante*. Another company, *Sociedad del Canal de Villena*, also pipes in water from about 70 km. west in the headwaters of the Vinalpo River, but today this is no longer used for irrigation as it was before, being purchased today only for drinking water supply. The Community has been successful in getting these supplies largely because of the economic and political clout of what is now the biggest water user in the huerta, Bonny, S.A., one of the biggest agribusinesses and tomato producers in Europe.