

**Sustainable Development as a “Collective-choice” Problem:  
*Theoretical and Practical Implications of Success Exemplified in  
Locally Managed Irrigation***

A Working Paper (Please do not quote or cite without the author’s permission)

Final Summary Report for the UK’s Department for Environment, Food and Rural  
Affairs  
Programme on  
*Innovative Methods for Influencing Behaviours and Assessing Success*

by Paul Trawick, Joe Morris, Helena Posthumus and Matthew Cook  
Institute of Water and Environment  
Cranfield University at Silsoe

Defra has commissioned and funded this study, but the views expressed in the  
report do not necessarily reflect Defra policy

## EXECUTIVE SUMMARY

### I. Introduction

The objective of this report is to explore the potential of a unique but still evolving body of work, known as “collective-choice theory” or “collective-action theory”, for achieving Defra’s goal of motivating people to produce and consume in a sustainable manner. The theory emerged from the study of a large number of situations throughout the world where local people have been able, on their own, to come up with an enforceable and sustainable agreement to restrain their consumption of a resource that is scarce, shared within a group, and vital to the life and livelihood of each individual member.

The work on collective-choice theory to date, however, has been much more successful in describing this kind of cooperative social action, specifying the general conditions under which it is likely to take place and identifying some of the general features that the resulting “institutions” for mutual self-restraint seem to share, than in explaining how it actually happens, a weakness that is specifically addressed in this report. Results from recent studies applying the theory to sustainable farmer-managed irrigation systems in various parts of the world have identified a set of more basic commonalities that have the potential to increase the explanatory power of the theory while also widening its range of application<sup>1</sup>.

This is of interest because of the possibility that the rules and principles upon which successful local systems of water management are based could be “scaled-up” and applied to other sustainability problems at higher levels of social organisation. Before attempting this, however, recent advances in research on decision-making in other fields--cognitive psychology and anthropology--must be integrated into the theory in order to strengthen it even further. The revised theory will then be used in examining two typical cases where successful collective action has been undertaken recently by local farmers in the UK. In the end, “collective-choice theory” proves to be indispensable in explaining the success of all the local efforts at sustainable development examined in this report, in ways that reveal how Defra and government might play a stronger role in either expanding such emerging social experiments or in encouraging them to take place.

### II. The New Urgency of the Problem

In recent years, sustainable development policy has been elevated rapidly in importance by Defra and the governments of the UK and the EU due to the increasing pace of CO<sub>2</sub> build-up and resultant global warming. The growing urgency of the problem is reflected in a move by government away from the idea that we merely need to consume more efficiently—at less energy cost--towards the much more problematic notion that people must actually *reduce* their consumption of material goods and energy, and especially their emissions of CO<sub>2</sub> [consistency in format] in the many forms that these take.

Changing individual lifestyles across all strata of society and delivering “aggregate reductions in resource throughput” are now acknowledged to be essential to any real effort to slow down global warming. The government’s broad agenda for reducing the overall

---

<sup>1</sup> The ethnographic research has been carried out over a period of more than a decade in several peasants communities in the Peruvian Andes and, more recently, in several additional communities of much larger scale in Spain and in northern Chile. The latter research, particularly the work in Spain during 2—3-2004, was made possible by a generous Research and Writing grant by the John D. and Catherine T. MacArthur Foundation in the U.S., in their Program on Global Security and Sustainability. The author wishes to express his profound gratitude to the Foundation for their sponsorship, the benefits of which extended to and helped to inform the subsequent research in two peasant communities in northern Chile in 2005.

human "footprint" on the global ecosystem now includes preserving, restoring or enhancing local landscapes and the ecosystem services that these provide, and, particularly in the case of Defra, encouraging any and all efforts by people to combine their resources and cooperate in order to cut costs, for example by carpooling or jointly purchasing expensive energy-intensive equipment and tools. A great number of recent studies of global warming have shown that human beings must do all of this on the widest possible scale, and that we have very little time.

Stakeholder interactions and focus groups of the kind routinely carried out by Defra and other government agencies can and will be a primary forum for the effort. If properly framed in ways outlined in this report, these exercises in public engagement could promote a new "culture of cooperation and sustainability" that is already emerging widely in response to people's changing perceptions of global reality, both physical and social.

### III. Sustainable Consumption as a Problem of "Collective-Choice"

"Collective-choice" theory is a trans-disciplinary version of the "new institutional economics" which, like all such versions, is grounded in a rational choice paradigm. The theory is unique, however, in limiting itself to examining choices regarding the use of natural resources that people hold in common or somehow control as a group. It focuses particularly on resources that form a "common-pool" and are characterised by "subtractability," meaning that one person's harvesting or consumption inevitably reduces the availability of the resource for everyone else.

Collective-choice problems in real life pose a social and moral challenge to an identifiable group of resource-users. Expectations regarding other users' behaviour are central to individual motivation and choice in forming such groups, and in analysing such action the theory of collective choice makes these considerations a central part of the analysis. These social factors, although a source of some uncertainty, can either strengthen or weaken the incentives that individuals have to work out and abide by agreements to maintain a form of common property and to exercise mutual self-restraint in its use.

People in situations of collective choice show a primary concern with minimising a pervasive kind of risk: i.e., that some resource-users who fail to cooperate after a decision by the group to do so will receive the benefits nonetheless and thus be able to "free ride". The seminal work of Ostrom (1990, 1992, et. al.) shows that, in order to achieve sustainability and mutual restraint in resource use, local people must devise institutions—i.e. collectively-chosen rules and procedures—that somehow solve three basic problems which are nested hierarchically within each other, all of which themselves present dilemmas because their solution is fraught with its own "free-rider" problems:

- the problem of **supply**: i.e., of devising a workable set of rules, procedures and sanctions;
- the problem of **credible commitment**: i.e., of achieving and maintaining peoples' long-term commitment to those rules and to the goal of mutual self-restraint; and
- the problem of **mutual monitoring**—i.e., of effectively monitoring individual resource use as well as the activity of any designated officials whose duty it is to formally do such monitoring.

Both laboratory experiments and empirical studies have shown that the last of these "nested" problems is by far the most important, the one upon whose successful resolution the solving of the other two depends. Once mutual monitoring of individual behaviour is achieved, the other dilemmas tend to be resolved quickly and in effect to disappear. This produces a stable or equilibrium outcome that, in Game Theory simulations, is referred to as a "game 5 solution": a mutually-imposed, self-financed and binding contract to limit individual resource consumption, usually by employing an outside agent to monitor people's conformance to the

agreed-upon rules. Field research has confirmed that such sustainable outcomes are in fact very widespread throughout the world, especially in irrigation, but shown that local people have often worked out a way to monitor each other successfully without outside help, thus bearing the entire cost of such a solution themselves.

#### IV. Successful Principles Derived from Comparative Ethnographic Research on Irrigation

Comparative ethnographic research has revealed striking commonalities among the principles governing successful locally-managed irrigation systems in several parts of the world, cooperative agreements that in many cases have persisted without major modification for very long periods of time. All such communities appear to be examples of the aforementioned “game 5 solution” but, contrary to what collective-choice theory originally predicted, their success does not depend in any strong way on the size and scale of the irrigation system.

The key variable in this regard was formerly thought to be the relatively high visibility of individual behaviour in small and medium-sized communities, as compared to large ones where people’s activity is assumedly much more difficult to monitor. The ethnographic research shows that this is not the case, that mutual monitoring is actually fairly easily achieved, and indeed that it can be achieved in the same basic way in irrigation systems of small and large scale. The most important rules and principles that communities have in common, aside from the fact that water is scarce in each case, are listed below:

General Principles for Successfully Sharing Scarce Water
<b>Autonomy</b> – the local community or farmer organisation has and controls its own water flows.
<b>Contiguity</b> – fields receive water allotments in an order that is systematic and uninterrupted in terms of the movement of water utilisation through space.
<b>Uniformity</b> - everyone receives water from any major source with the same frequency, or has an equal chance of getting that opportunity within a specified period of time.
<b>Proportionality</b> - individual water <i>rights</i> are related proportionally to land ownership, as are accompanying <i>duties</i> to contribute to the operation and maintenance of the irrigation system.
<b>Transparency</b> – the rules for allocation and use of water are known to all users and compliance is capable of being monitored by all.
<b>Regularity</b> – the rules for allocation are always the same under scarcity, with no exceptions allowed and unauthorised expansion of the system prohibited.
<b>Graduated Sanctions</b> – penalties for rule violations are severe but vary according to the gravity of the offence.

These principles interact in a remarkable way to produce a mutually-beneficial and sustainable outcome for all water-users. Together they create:

- **a strong sense of “equity” or fairness** among water rights, and between rights and duties, through the act of sharing a water scarcity on a single schedule in allotments that are proportional to plot size;
- **a tangible notion of the common good**, one that people are very much concerned with maintaining because it is vital for their survival;
- **a strong sense of security regarding individual water rights**, simply because those rights are clearly defined and easily protected by the users themselves;
- **a clearly-perceived compatibility between individual self-interest and the common good**, mainly created by the fact that, by obeying the rules and limiting their consumption of scarce water, people are maximising the frequency and productivity of water use for themselves and everyone else in the long run.

## V. The Additional Explanatory Power of Other Theoretical Perspectives

**Bounded rationality:** Due to the complexity of most situations of choice in the real world, people make use of several means of “bounding” the reasoning process and simplifying their decision-making, which need to be integrated into the theory of collective action. For example, intuitive judgments, which are made automatically without deliberation, normally predominate in daily life. These “snap” judgments both set and reflect the preferences that determine most human choices, *unless* they are overridden by a conscious questioning and close examination of preferences that can somehow “kick in”, i.e. the mode of fully rational deliberation. Clearly both are involved in decisions about consuming vital resources that are held in common, especially irrigation water. The ethnographic research on the latter has revealed that the two modes appear to be activated periodically, but quite deliberately by the group, in such a way that they reinforce each other through increasing returns or “positive feedback. All of the information relevant to such choices is provided or “framed” in such a way that the wisdom or ‘utility’ of cooperating, its high probability as the preferred choice of other people and its high positive value relative to other possible choices for oneself, are demonstrated publicly from time to time. This “framing effect” activates the mode of rational deliberation and reinforces its basic logic, so that in effect it becomes “intuitive”, self-evident and automatic, leading most people to cooperate. An analysis of how these insights about the provision and framing of information can be used effectively by organisations like Defra in stakeholder engagement exercises is included in the report.

**Schemas or “cultural models”:** An alternative but complementary approach focuses on “cultural models”: shared interpretive frameworks analogous to cognitive “schemas” which are used to understand events and motivate choice, and which are internalised on the basis of learning and experience. Such models are shared and publicly instituted, passed down through the generations, and assumedly specific to a given society. They are mental constructs that, like the natural resources which they are often quite important in managing, people in a given irrigation community have in common.

In each of the successful irrigation systems studied, people clearly share a local “culture of irrigation” with several components: a mental model or map of the water distribution system, a listing of the rules for resource distribution and use, and a set of general principles that summarise in a moral sense how the system should work, for example through the central concept of equity or fairness. It now seems clear that the same general “schema” for irrigation is also found in a great number of local hydraulic societies throughout the world, so that the common elements of these cultural models can arguably be considered human ‘universals’: the ideas of reciprocity, of equity and fairness in sharing a scarcity, of the fundamental right of all community members to work, subsist and survive, even more concrete ideas like the principles of uniformity and proportionality.

These elements, it is argued, are shared in some way by all peoples as *potentials or latent values* that are activated in situations where individuals face a potentially life-threatening scarcity or an impending subsistence crisis. They come readily to mind whenever people are forced to make the best of a bad situation in using a resource that is vital and that they hold in common, making them of great potential importance in meeting the challenge of sustainable consumption.

## VI. “Collective-choice” Theory Applied to Emerging Sustainable Communities in the UK

**Pont Bren:** An informal cooperative of small farmers in Wales, this group consists of ten households that began to organise gradually in 2000 for the purpose of pooling their limited resources in order to provide mutual support for a way of life that, according to the members,

had become unsustainable and unbearable in terms of the work load it required. The cooperative began as mutual-aid among three sheep farmers in a forestation effort--planting trees--which, once the "side benefits" of the activity became evident, soon spread to include other neighbours, leading to a limited expansion of both the group and its activities.

Pooling resources initially in order to buy tree seedlings, combined with mutual-aid in the actual planting, led to the establishment of a small nursery to cut costs. Reciprocity was also practiced in planting hedgerows and buying and installing fences which, along with the trees, provided shelterbelts that made it possible for the farmers to keep their sheep and lambs outside all year round, again significantly reducing production costs. The tree nursery now produces some seedlings for sale to neighbouring farmers; and money has been pooled to buy traditional breeds of sheep for producing meat products that are now sold in a cooperative farm shop, whose profits are evenly divided up but often reinvested together. A wood chipper has recently been purchased by the group to produce bedding for the animals as well as profits from commercial sales that, like all of the benefits (and costs) of group affiliation, are shared uniformly among the members.

**East Suffolk Water Abstraction Group:** Today having roughly 100 members, this group of commercial arable farmers was formed in 1997 in response to an effort by the regulatory Environment Agency to decrease groundwater withdrawals for irrigation in response to the 1989-92 drought and, somewhat later, to impose bans on water abstraction during the 1996-1997 irrigation season. The major impulse for the group's formation came from five major commercial irrigators, who saw the impending risk as well as the potential benefits, and who were locally seen as influential farm business leaders. The group had no formal constitution until 2002, when it successfully applied for a grant from Defra and the England Rural Development Programme, acquiring £70,000 delivered over four years to appoint a Company Secretary and help to establish a Company Limited by Guarantee, based on the holding by each member of a £1 share. The opportunity for such funding and, importantly, the need to obtain indemnity insurance, spurred this collective decision by the members.

The Company is now owned by the members, whose rights and benefits are uniform even though the underlying abstraction licenses are not. The latter are based on a mixture of older permanent licenses (pre-1963) and more recent temporary or time-bound licenses, awarded by the Environment Agency (EA) on the basis of 'reasonable need' for crop production. Thus licenses are loosely tied to areas of irrigated land, but not necessarily proportional to the amount of land held by any one farmer. Otherwise the rights of members are uniform: membership provides equal entitlement to representation, and to the benefits of other group activities such as legal advice, extension or education. Monitoring of individual conformance to the conditions of abstraction licenses is not directly carried out by the members or their leaders but is monitored directly by the EA itself.

## **VII. Recommendations and Conclusions**

It seems clear that Defra and other agencies involved with the environment could, at very little expense, play a pivotal role in encouraging the emergence of sustainable community experiments like the examples discussed above, which are already forming locally throughout much of the world of their own accord. Some of the ways in which government could do this, widely and systematically through participatory planning and a kind of "mutual aid", are revealed in the body of the report and in the accompanying Practical Guide. Such a programme could be initiated from the ground up, by trying to 'replicate' successful groups while expanding their range of conservation activities, or by expanding the communities themselves and, in either case, building upon existing capacities and strengths. Or, alternatively, the effort could begin much higher up, in an explicit attempt to disarm the "culture of consumption" and replace it with something else, an alternative "culture of sustainability" that, again, is already emerging widely throughout the world and may well have existed right alongside us for a very long time. A combined approach involving both

kinds of effort, one designed to meet somehow “in the middle”, is suggested intuitively to be the best choice of all.

## I. Introduction

The objective of this research is to explore the potential of a highly promising and unique body of work, known as “collective-choice theory” (Ostrom 1990, 1992, 1998, Dietz, Ostrom and Stern 2003.), for achieving Defra’s goal of finding new ways of motivating people to produce and consume in a sustainable manner. Although this work makes important use of formal analytical models—such as “rational choice” theory, game theory (especially variations of the well-known Prisoners’ Dilemma), and the theory of communicative action—it is largely inductive in nature and based on the comparative analysis of empirical cases where local people have achieved sustainable collective action, with regard to a particular resource that they hold in common, on their own. That is, the theory emerged from the study of a large number of situations throughout the world where local people have been able to come to an enforceable and sustainable agreement to restrain their individual consumption of a resource that is shared within a group and is vital to the life and livelihood of each individual member. Explaining how this kind of cooperative action happens, specifying the conditions under which it is likely to take place, and identifying the general features that the resulting local “institutions” for achieving mutual self-restraint seem to share—i.e., the rules and principles governing individual resource use—are the major tasks previously undertaken by the theory’s proponents. “Collective-action theory”, as it is also known, being relatively new and evidence-based, is highly relevant to the challenge that Defra and other agencies in the UK and the EU are now trying, with a renewed sense of urgency, to address in novel ways in their programmes on motivating sustainable consumption.

From its inception as a well-defined and coherent program of social science research—centered mainly in the United States--the theory was intended to produce a set of rules and principles, hopefully even a replicable model, *of* successful collective action and *for* such action as well. This is to say that the research goal was to identify institutions that would *describe and explain* successful cases of group choice in situations where such action had already taken place and proven to be sustainable and to *facilitate* such action in situations where conditions favourable to its emergence seem to exist. Especially promising in this regard, however, are results that have recently emerged in studies where the theory was applied to sustainable farmer-managed irrigations systems in various parts of the world, which will be brought into this discussion and made a central focus in order to help to improve collective-choice theory itself. Comparative ethnographic fieldwork conducted by the author in numerous locales in several countries has revealed the existence of set of basic commonalities that appear to be shared by all such examples of local success, in hydraulic communities ranging from very small to quite large in scale, some of which have been overlooked in previous comparative analyses.

Perhaps the most interesting characteristic that all of the irrigation systems have in common, at least for the purposes of the sustainable development programmes of Defra, is the fact that water is scarce in each case, i.e., far from adequate to fully meet the needs of all local water users. Such scarcity of a vital resource, and the unavoidable necessity that the scarcity be shared, are arguably the most important factors that have led to successful long-term cooperation in each case. This initial insight, together with the theoretical advantages offered by collective-choice theory itself (particularly when it is improved upon, as we will see below), make sustainable hydraulic communities especially promising examples for study. There is an obvious possibility that the rules and principles upon which they are based might be “scaled-up” and applied to other sustainability problems at higher levels and scales of

social organisation, which is one way of summarising the general challenge that Defra now faces.

The general model that those principles comprise, which can be accurately characterised as a kind of “moral economy”, will be shown to be quite useful in analysing two examples of similar collective action toward sustainability that have been taken recently by local people in the UK. The discussion will conclude with a brief overview of these cases which highlights both their similarities and their differences and shows that there is much fertile ground in the country upon which Defra can readily build, social capital that is emerging of its own accord in response both to changing needs and circumstances and to people’s changing perceptions of material and social reality. It will be argued that a “cultural shift” is taking place, a fundamental change in people’s understanding of how the world works and of their own place in it, a movement that makes Defra’s formidable task somewhat easier than it would otherwise be and that can, and should be, directly encouraged in various ways.

## **II. The New Urgency of the Problem**

Since the Rio Earth Summit in 1992, sustainable development policy has been elevated rapidly in importance by Defra and the governments of the UK and the EU due to the increasing pace of CO<sub>2</sub> build-up and the resultant global warming. Each new study released today seems to show that these processes have advanced much farther and faster than we think, and that it may already be too late to achieve emissions-reduction targets that were seen as possible only a short time ago.

The growing urgency of the problem is directly reflected in a move by Defra and other agencies away from the appealing idea that we merely need to consume more “efficiently”—i.e., at less energy cost—and towards a full embrace of the realisation that people must radically change their lifestyles so as to also reduce their consumption of material goods and energy, and especially their CO<sub>2</sub> emissions in the many forms that these take. The difficulty here, especially for politicians, has always been the obvious threat that reduced consumption appears to present, whether rightly or wrongly, to continued economic “growth” as we define it. An understandable early reluctance to face the heart of the problem was not itself sustainable, however, and soon gave way to the findings of a wealth of studies in the earth sciences which have shown conclusively that we have run out of time for avoidance and wishful thinking (e.g., Amman and Wahl 2005; Hansen, et. al. 2005; Barnett et. al. 2005).

The agenda laid out by Defra in its 2005 Sustainable Development Strategy attempts to meet head-on the critical problem of reducing consumption in general. Changing individual lifestyles across all strata of society and delivering “aggregate reductions in resource throughput” are now acknowledged to be essential to any real effort to slow down global warming. A new realisation seems to have emerged that people, acting both as individuals and as groups, must somehow do more by consuming less, a change in focus that is summed up in the goal of “sustainable lifestyles”. This new emphasis does focus on the crux of the problem, the steadily increasing consumption of ‘goods’ of all kinds. This is “economic growth” itself as we have chosen historically to define and measure it, the standard indicator for which is the GDP, a statistic that is now widely recognised to be poorly suited to that purpose.

The fact that continual growth in the capitalist economy, and particularly the pursuit of continual growth in the GDP, would inevitably lead to a crisis of global scale, one that would be both economic and environmental, was foreseen many years ago by a prominent economic historian, in an argument now widely referred to as “the Polanyi problem” (Polanyi



1944). The important question, of course, is what can be done about it, and achieving sustainability in both production and consumption across all levels of society is the answer, one that encompasses both increasing energetic efficiency and decreasing resource throughput. Efforts are also underway to develop a more suitable general measure of economic well-being than the GDP, a project that will potentially be of great benefit but that will not directly enter into this discussion.

Having recognised the full nature and extent of the problem, Defra is faced with the challenge of promoting an enormous range of inter-related efforts by consumer groups of widely varying scales, all equally necessary to the goal of sustainable 'development', including both production and consumption. The goal is not just to reduce the overall human "footprint" on the global ecosystem, but to preserve, restore or even enhance local landscapes of various scales and ensure the continuity of the ecosystem services that these provide. The government's programme also requires it to encourage any and all efforts by people to combine their resources and cooperate, for example by carpooling or jointly purchasing expensive energy-intensive equipment, or jointly using almost any kind of good or service, a remit that is broad indeed and challenging to say the least. The perhaps obvious suggestion of this report is that the best level at which to begin the effort, for the purposes of analysis and planning, is the local, where such efforts are already emerging widely of their own accord.

Any effort by government to "address the culture of consumption" (Jackson 2005b:42) and actually shift people's routine behaviour toward consuming less, achieving greater energy efficiency, and pursuing ecological sustainability will have to begin, not just at the 'individual' or household level, but with existing communities and identifiable social groups. Indeed, a major insight of this report is that, particularly for the purpose of reducing consumption, the former—the 'individual'—can only be appealed to and reached effectively through the latter—through groups. In both a theoretical and a practical sense, there is arguably no such thing as "the individual", a realisation that has emerged gradually in the social sciences over the last three decades and is now widely shared, even by many economists (e.g., "new institutionalists" such as North [1986, 1990]).

Stakeholder interactions and focus groups of the kind that are routinely carried out by Defra and other government agencies could be a major forum for engaging with groups of producers and consumers, beginning at the local level and then moving up in size and scale from there. If properly framed, these exercises could promote a new "culture of cooperation and sustainability" that is already emerging among the public in response to people's changing perceptions of a global physical and social reality. Such a shift in policy will require a new design for public interactions and a concise plan for implementing them in stakeholder meetings of various sizes and scales, which is one of the main goals of this analysis and report. The emerging body of work known as "collective-choice" theory—also referred to as "collaborative environmental management" (Marshall 2005)—provides an evidence-based foundation upon which such a change in policy and a plan for action can readily be built, especially as it has been applied to the theory and practice of sustainable locally-run irrigation.

### **III. Sustainable Consumption as a Problem of "Collective-Choice"**

"Collective-choice" theory is a trans-disciplinary version of the "new institutional economics" (N.R.C. 1986; Bromley 1986; McCay and Acheson 1987; Ostrom 1987,1990, 1992, 1998; North 1987, 1990, 2005; Ostrom, Gardner and Walker 1994; Burger, Ostrom, et. al. 2001; Ostrom et. al. 2002; Dolsak and Ostrom 2003), which, like all such versions, is ultimately grounded in a "rational choice" paradigm. It assumes that individuals make choices based

on the expected costs and benefits of their options, that an option will only be chosen if the benefits exceed the perceived costs and that, all other things being equal, the more that anticipated benefits exceed those costs the more likely it is that a given choice will be made. However, the theory is unique in limiting itself to examining and accounting for choices regarding the use of natural resources and other 'public goods' that people hold in common, or somehow control as a group. It focuses particularly on resources that form a "common-pool" and are characterised by a feature called "subtractability," meaning that one person's harvesting or consumption inevitably reduces the availability of the resource for everyone else. Two key points here for Defra are that in today's energy-intensive and globalised economy this concept applies to fossil fuels as well as to most other kinds of 'public goods', and that "subtractability", perhaps not surprisingly, seems to be entering rapidly into public discourse and public consciousness.

Consumption choices about such 'goods' are by definition social in nature and linked to each other, rather than made in isolation, since their outcomes (both predicted and actual) interact, either at a given moment of choice or extending forward through time from one decision situation to another. This fact fundamentally alters the logic and the possible outcomes of such decisions, making them inherently "collective". The theory, being concerned with both modeling and explaining these kinds of interactive decisions, is an explicit attempt to move away from approaches based on false assumptions about a supposedly isolated and 'sovereign' consumer, upon which conventional microeconomic theory and the vast majority of studies of consumer behaviour are based.

Collective-choice problems in real life pose a social and moral challenge to a group or community of resource-users, whose choices and their mutual well-being are intertwined in that their individual acts of consumption will inevitably interact to determine the availability of the resource for everyone in the long run. Expectations regarding other users' behaviours are thus central to individual motivation and choice, and in analysing such group action the theory takes these expectations into account, making their consideration a central part of the analysis of decision-making. Such situations are social, reflexive, and predictive exercises wherein the anticipated behaviour of other people, as well as their past behaviour, plays a crucial role in shaping an individual's expectations, preferences, strategies and choices. These social factors, although a source of some uncertainty, can either strengthen or weaken the incentives that individuals have to work out and abide by agreements to maintain a form of common property and to exercise mutual self-restraint in its use.

The great strength of the theory is its very broad potential for application. As we will see below, the vast majority of supposedly 'individual' decisions about sustainable consumption and production, and nearly all decisions about cooperation, can be set up or "framed" for consideration as group choices regarding resources or other public goods that form a "common pool" and are in a sense collectively provided and collectively owned. This act of framing problems in an appropriate way has great potential for encouraging cooperative and sustainable outcomes, and it is something that organisations like Defra can, through appropriately designed stakeholder interactions, not just promote but actually oversee and do widely throughout rural society.

People in situations of collective choice show a primary concern with minimising a pervasive kind of risk: i.e., that some resource users who fail to cooperate and restrain their consumption after a decision by the group to do so will receive the benefits regardless and thus be able to "free ride". They therefore try to develop institutions—rules, principles and procedures—that shape and reinforce people's incentives, both positive and negative, to exercise mutual self-restraint and use the resource in a sustainable way, for example by providing for monitoring of people's behaviour and the reliable issuing of any necessary sanctions. The formation of those institutions, and the task of providing assurances that they will work, are themselves major costs that are explicitly included in models of collective

action, and such “transaction costs” are carefully weighed in the effort to trace out the logic of choice by the individuals involved.

Collective-choice theory, also known as “collective-action theory”, began as an effort to refute the doomsday scenario presented years ago by Hardin (1968) regarding the inevitability of the well-known “tragedy of the commons”. Hardin’s argument was a highly abstract application of conventional microeconomics that employed a famous scenario from what would later be known as game theory, in which the users of a “commons” were depicted as involved in a non-cooperative game (analogous to the now famous “prisoners’ dilemma”) in which there was no communication between them, no community to which they all belonged, and where access to the resource in question--a hypothetical pastureland--was unrestricted and open to anyone. In such a situation, Hardin argued, the inherent selfishness of human beings will ensure that ‘rational’ self-interest always prevails over any concern for the common good--as expressed, for example, in an effort to restrain grazing according to the limited carrying capacity of the land.

Thus ‘rational’ individual behaviour leads, in the aggregate and the long run, to an outcome that is sub-optimal and detrimental to everyone, and therefore both irrational and tragic. Hardin predicted that people in such situations will continue to add another animal to their personal herd until the pastureland is overexploited and exhausted, an outcome that he thought was predictable for all “commons” and indeed all public goods. Even though fossil fuels are not, strictly speaking, a communal resource, an unrestrained consumption today, the resulting build-up of CO<sub>2</sub>, and rapid global warming are perhaps the most obvious and threatening examples of this kind of social phenomenon. Such tragic outcomes were, according to Hardin, avoidable only through the intervention of a strong State that would coerce people into acting in their own long-term best interest, or, alternatively, through privatising the resource in question and dividing it up so that the costs of overuse, and not just the benefits, were internalised by all of the individuals involved.

Critics of the theory, although numerous, were slow to point out its many flaws because that task, unlike the formulation of the original argument, required a great deal of empirical research on real cases of communal resource use. First of all, an “open access” resource is not a typical commons, which nearly always belongs to a community of people who restrict access to, in this case, the hypothetical pastureland (McCay and Acheson 1987). Second, if the exploitation of communal resources like irrigation water is to be simulated realistically using game theory and metaphorical models such as the “prisoners’ dilemma”, the game must by definition always be cooperative, allowing and relying upon communication between resource-users, who invariably take action both to restrict access and to set up rules and sanctions that govern resource use. Finally, in real life such decisions are not one-off events like the prisoners’ dilemma, but rather choices that are repeated indefinitely (Axelrod 1984) so that the outcomes of individuals’ decisions are linked to each other both in the short-term, in a given situation of choice, and in the long run over time. Such decision situations are inherently social ones that have a long history, involve existing webs of relationships, and are seen and evaluated through the lens of “culture”.

A large number of ethnographic or empirical studies involving various kinds of “commons” have confirmed that a positive result involving cooperation and mutual self-restraint in resource consumption is by no means rare, an outcome that has come to be known in game theory and in “prisoners’ dilemma” simulations as the “Game 5 Solution”. This refers to the formulation by a group of common-pool resource-users of a mutually-imposed, self-financed and binding contract that limits individual consumption according to an agreed-upon set of rules (Ostrom 1987, 1990, 1992; Ostrom, Gardner and Walker 1994; Ostrom et. al. 2001; Dolšák and Ostrom 2002; Dietz, Ostrom and Stern 2003). In the case-study literature, such successful outcomes have been shown to be both sustainable and very widespread, especially in irrigation. Indeed, they are common enough that a new term is now widely

used in the literature to distinguish them from the more familiar tragedy: “‘comedy’, the drama of humans as social rather than private beings, a drama of social actions having a frankly corrective [and mutually-beneficial] purpose” (M.E. Smith 1984).

In farmer-operated irrigation systems such as the ones to be analysed here--but also in the use of other communal resources such as fisheries, forests, etc.--local people have repeatedly shown themselves to be capable of setting up effective rules to govern resource allocation and use, of establishing sanctions to penalise infractions, and of hiring and paying an outside agent to monitor individual behaviour and collect any necessary fines. More importantly, it is quite clear, particularly in the case of irrigation water, that farmers themselves have often come up with the rules to limit consumption and also set up a system for mutually monitoring each others' behaviour and imposing sanctions, all self-financed and done without outside support. Evidently, this “game 5 solution” successfully resolves the famous “commons dilemma”--the supposedly inevitable conflict between ‘rational’ self-interest and the common good—something that Hardin and other subscribers to conventional choice theory thought to be impossible.

Ethnographic studies have shown that such “happy” outcomes exist in great numbers throughout the world, especially in irrigation, and game theory simulations and laboratory experiments have confirmed that such collective actions can form sustainable “equilibrium” solutions to this fundamental problem (Axelrod 1984; Ostrom 1990; Ostrom, Gardner and Walker 1994). However, both kinds of analyses have also usually indicated that the size and scale of the user community are important limiting factors on the chances for success—an insight originally provided by Olsen (1965) in his theory of communicative action. This limitation, although it can be attenuated or minimised (see below), is due to the relatively high degree of visibility of the act of resource use in small and medium-sized communities, as compared to larger groups where individual behaviour is more obscure, private or anonymous.

The reasons for the critical importance of size and scale were revealed by Ostrom (1987, 1990, 1992) in her early work, which involved a synthesis of previous theories (including game theory) and a systematic comparison of the results of ethnographic research on successful systems of common-property management, especially of sustainable hydraulic communities in various parts of the world. Ostrom (1990:73-74) observed that community members in successful management systems have somehow been able to resolve three major problems or dilemmas that are “nested” inside each other hierarchically, and interdependent in a fundamental way.

The first is the “problem of supply”, meaning the problem of devising the initial rules for allocation and restrained use of a scarce resource which the members can agree upon as equitable or fair. Doing this is problematic because it can be difficult conceptually, it requires time and effort and, since such rules are themselves a kind of ‘public good’, their creation is subject to the perennial temptation of some people to “free ride” and benefit from them while contributing nothing. Preventing this “free riding”, or at least minimising the probability that members will shirk their responsibility and get away with it, is always a major concern.

The “problem of credible commitment” is a second-order version of the same quandary. People's commitment to a set of fair and effective rules, once those rules are in place, may initially be very strong. However, as time passes, by virtue of their very effectiveness, such commitments can tend to weaken among some community members as the rules begin to be taken for granted. People may start to think that breaking them now and again under urgent circumstances will not do any noticeable harm, particularly if a person can get away with it. Such a weakened commitment, which always threatens to break down the cooperative agreement, can also manifest itself in the form of less active vigilance by people to ensure that the rules are being obeyed, with obvious consequences.

These points reveal the third major problem, upon which the successful resolution of the other two always depends: mutual monitoring. Although collective-choice theory recognises that people have solved this problem in countless cases and somehow worked out ways to monitor each others' compliance with agreed-upon rules, the theory itself does not show exactly how this monitoring can be done. It simply points out that the three principal problems are a set of nested dilemmas-within-dilemmas, and notes that in a great many cases--especially in irrigation communities--they have successfully been resolved in a way that somehow enables the resources-users themselves to monitor each other. It also indicates that this success is significantly dependent on the size or scale of the community, an issue to which we shall return. Unless people are able to come up with a convincing plan for effective mutual monitoring of rule compliance, they will have no good reason to make a strong effort to attempt to solve the other two problems and, even if they do come up with a workable solution for them, without such monitoring the whole system will tend eventually to come unravelled.

Although it has many advantages, collective-choice theory also has some limitations which suggest that it is in need of improvement or revision. Even in the case of irrigation communities, the theory provides no real insight into how resource appropriators can effectively monitor each other, an effect that has clearly been achieved in the many successful irrigation systems that are known to exist. One might assume, based on this fact, that the methods worked out for doing this locally are simply very diverse and have little in common. But that would be, and indeed has been, a mistake.

#### **IV. Successful Principles Derived from Comparative Ethnographic Research on Irrigation**

A major limitation of Ostrom's comparative analyses of successful farmer-operated irrigation systems, like those of Tang (1992), Sengupta (1991) and Lam (1998), is that they are not ethnographic studies and are based on the comparison of data gathered by other people. These comparative analyses thus reflect the limitations of the original field studies (Agrawal 2002), which in the case of irrigation routinely failed to address the most important issue of all: how individual water rights are defined, in terms of the frequency, amount and duration of water flow, as this is understood by local farmers themselves.

Ethnographic and comparative research into how locally-managed irrigation systems actually work from the water-users' point-of-view, and why they are thought to succeed and be sustainable by farmers themselves, has produced enlightening results that depart significantly from—and yet are complementary with--previous efforts to examine them using a collective-choice framework (Trawick 2001a,b; 2002a,b; 2003; 2004; 2005a,b; in press). Self-sustaining systems are now known to exist at all scales, from very small single-community systems to large systems covering thousands of hectares and incorporating dozens of separate user groups. Thus successful mutual monitoring and the resolution of the three “nested dilemmas” do *not* appear to depend in any truly deterministic way on the size or scale of the group, a fact that has important implications for sustainable development policy. The systems are also known in many cases to have persisted without any basic modification in their operating principles for very long periods of time, even several centuries (Glick 1970; Maass and Anderson 1978; Trawick 2001b, 2005b). Most important of all, striking commonalities among the principles governing successful systems of all sizes and scales have finally become evident.

A single set of basic principles, listed below, has been shown to underlie effective and sustainable organisations of both the single-community and multi-community types in many different parts of the world—including both communal and ‘market’ systems--principles that

are more concrete or tangible than those generally recognised in previous research. These “design” principles have been verified empirically in nine farmer-operated systems of very different scales in three countries on two continents; at the most basic level they manifest *equity* or “fairness” among water rights, and fairness in accompanying maintenance duties, as well as *transparency* in water use. In each case the principles are recognised, affirmed and known to exist by local farmers themselves, so that in irrigation we can now speak of something that is unprecedented, at least in the history of anthropology: a case of the parallel and independent emergence, in many different parts of the world, of the same “culture” or “cultural model” of irrigation, a clear example of convergent cultural evolution.

General Principles for Successfully Sharing Scarce Water
<b>Autonomy</b> – the local community or farmer organisation has and controls its own water flows, which are not adequate to fully meet everyone’s needs. Institutions of governance above this level either encourage this autonomy (perhaps by providing the assured water flows) or are simply unable to interfere with it.
<b>Contiguity</b> – the cultivated area served is firmly bounded and the order in which fields are entitled to receive water is systematic and uninterrupted in terms of the movement of water utilisation through space.
<b>Uniformity</b> (one defining component of “ <i>equity</i> ” or fairness] - everyone receives water from any major source with the same frequency or, if higher frequencies are periodically enjoyed by some irrigators, everyone has an equal chance of getting that opportunity within a specified period of time.
<b>Proportionality</b> (the other component of <i>equity</i> ] - individual water <i>rights</i> are related proportionally to land ownership, as are accompanying <i>duties</i> to contribute to the costs of operation, maintenance, etc, of the canal system, so that rights and duties are proportional to each other.
<b>Transparency</b> – the rules for allocation and use of water are known to all users and compliance is capable of being monitored by all.
<b>Regularity</b> – the rules for allocation are always the same under scarcity, with no exceptions in case of extreme drought and no unauthorised expansion of the system allowed.
<b>Graduated Sanctions</b> – penalties for rule violations are severe but vary according to the gravity of the offence.

The remarkable way that the principles interact to produce a non-tragic outcome can only briefly be explained here. First, a strong sense of “*equity*” or *fairness* among water rights is created in these systems through the act of sharing a water scarcity on a single uniform schedule. This, together with the following practices, produces among community members *a tangible notion of the common good*, one that they are very much concerned with maintaining because it is vital for their survival:

- a basic proportionality among rights
- a similar proportionality between rights and duties
- related equalities in other domains of social life (in voting, participation in decision- making, in the obligation to serve the community).

Second, *a strong sense of security regarding individual water rights* is created, simply because those rights are clearly defined and easily protected by the users themselves. This security is largely due to the fixed nature of the rules and to transparency, a feature that is itself produced by the contiguous order of water distribution and utilisation. Contiguous distribution can be achieved and followed pervasively throughout irrigation systems of any scale; it has the effect of concentrating irrigation on a given day during the watering cycle within a circumscribed and previously-defined space or spaces (a linear sequence of fields along one or more widely-separated canals) that are known in advance by everyone. This has the effect of making irrigation a public activity, typically carried out by neighbours in view of each other.

Such visibility, in turn, means that the monitoring of individual water use, the most crucial of the three “nested” problems identified by Ostrom, is pervasive and spread out among all the water-users, rather than being a responsibility concentrated solely in the hands of the appointed Water Distributor (see Ostrom 1990:73-74). The irrigators are able to watch each other and also monitor the distributor himself in doing his duties, creating a transparency that pervades the entire canal system, and this can clearly be done in systems of any scale, even the very largest (see Trawick 2005a, n.d.a.; Mulhotra 1988). Any “free riding” is very difficult to conceal under these circumstances, and its negative effects for everyone are obvious, a fact that creates strong social pressures against such behaviour.

Finally, under the above conditions there is a direct and obvious link between the efficiency and orderliness of individual water use (as manifested in conformance to the rules) and the duration of the irrigation cycle. From the point of view of the individual farmer, the functional logic of the system is that, by obeying the rules and limiting their own consumption of scarce water, people are keeping the distribution cycle as short as possible and *maximising the frequency or intensity of water use for themselves and everyone else in the long run*. The interaction or mutually-reinforcing effect of a simple set of principles in these cases, involving both positive and negative incentives or “feedback”, thus creates a *clearly-perceived compatibility between individual self-interest and the common good*; one whose recognition by the farmers themselves has been strongly confirmed in each of the ethnographic studies carried out to date<sup>2</sup>.

In these locally-operated canal systems, the only rational and sustainable way to behave in the long run is, from the water-users’ own point-of-view, to cooperate. This rational combination of choice outcomes produces a final mutually-beneficial effect that has repeatedly been confirmed in the empirical studies and shown to be sustainable over long periods of time: social conflict among community members (as manifested for example in the form of water theft) is minimised. Violations of the rules, the primary cause of such conflict, occur very rarely mainly because there is little or no payoff in a situation where they are so reliably detected. It is important to note, however, that people also seem to share a strong perception or feeling that such behaviour is both irrational and morally wrong. Again, this appears to reflect a widely shared model or “schema” of, and for, equitable irrigation, a “culture of sustainability” which evidently exists in all of the systems studied to date.

---

<sup>2</sup> Note the specific way that the concepts of positive and negative feedback are used here, which points to a basic conceptual difference or contradiction that has become problematic in the literature. In complex systems theory, the term “positive feedback” is used to counter-intuitively to refer to any effect that is “deviation-amplifying”, or anything that moves critical system variables away from their equilibrium range or range of sustainability, so that it is positive only in a mechanical sense and, from the point of view of sustainability, is generally a bad rather than a good thing. “Negative feedback”, on the other hand, is deviation-reducing and acts to return variables to a stable range and restore equilibrium, and is therefore a good thing. According to this usage, “positive feedback” is dominant in systems that are running out of control and are unsustainable, whereas negative feedback would characterize self-restraint and be the essence of sustainability. In the economic and institutional literature, “positive feedback” is used in reference to all situations of “increasing returns” or mutually-reinforcing results of a given choice or action, which can often be a good thing, as when they strengthen a positive trait such as self-restraint in consumption. “Negative feedback”, on the other hand, refers to situations of diminishing returns, which are assumed to be self-dampening or weakening, an effect that can also be either good or bad from the point of view of the sustainability of the system. Systems theory thus uses the terms in a way that expresses values, the value of stability or equilibrium in the system, whereas economics uses them in a more ambiguous manner that does not. The two usages should not, however, be confused, as they often are today. Their contemporary “folk” usage, of course, generally assumes that “positive” feedback is truly “positive” or helpful, and thus shows both elements of this confusion.

## **V. The Additional Explanatory Power of Other Theoretical Perspectives**

The basic construct that has emerged through the work on collective-choice theory to date, research that is now underway in a wide array of social science disciplines, is that of a “complex adaptive system” (Marshall 2005) or a complex “social-ecological system” (Anderlies, Janssen and Ostrom 2004), an analytical social unit of variable scale that has important and basic continuities yet is dynamic and continually evolving. The concept closely approximates a real community of the sort long studied by anthropologists, a group of people who have a great deal in common, including a certain amount of mutual accountability and trust, a history of practicing reciprocity, especially in the use of shared natural resources, and a shared future--all of which is a far cry from the randomly assembled group of ‘sovereign’ consumers of microeconomic theory.

### **Bounded Rationality**

The theory has been further advanced by recent work, primarily in cognitive and social psychology, which has undertaken a thorough reconsideration of the nature and limitations of human reason itself. Based on the findings of studies stretching back over several decades, researchers today share the recognition that human reason is “bounded” or limited in its capacity to handle all of the information that could potentially influence a given choice. This has provided a ringing indictment of the absurd assumption of neoclassical economic theory that consumers have, and make “perfect” use of, “perfect information”. It is actually beyond people’s capacity (not to mention their patience) to fully examine all the costs and benefits involved in many complex decisions and to arrive at a truly optimal “maximising” choice, even when they have all the necessary information, which is rarely the case. Although perhaps not that surprising upon reflection, this discovery has further undermined the reputation that conventional choice theory in economics once enjoyed, since it makes even clearer the fact that microeconomic theory is less able to explain the emergence of cooperative institutions of any kind, including those that underlie the modern nation-state (Allingham 2000). From a strictly logical point of view, the preferences of “autonomous” individuals or consumers cannot produce a cooperative outcome in a non-iterative or “one-off” scenario--a limitation that expresses Arrow’s famous “impossibility theorem”--and truly isolated individuals (i.e., “prisoners”) in a non-communicative game are, not surprisingly, incapable of consistently choosing trust and cooperation even if the game is repeated (Axelrod 1984).

All of this means, among other things, that including and considering all the “transaction costs” in a decision is often not feasible and that people have a strong incentive to minimise those costs whenever they can. The creation of institutions such as markets and well-defined property rights is one of the main ways that people, acting as members of groups, attempt to do this, but they also have recourse to other more individual and idiosyncratic means as well as cultural ones. A great deal of experimental research (Simon 1957, 1987; Kahneman 2002) has shown that people normally resort to a kind of “bounded” thinking that has the effect of drawing a perimeter around a group of seemingly reasonable and desirable choices. They then rationally select from among that subset of all possibilities rather than deal cognitively with all of them. People also often adopt, quite rationally, a “satisficing” strategy that seeks to arrive at a solution that is “good enough”, and not necessarily the best one of all. The pursuit of true optimality or maximisation, the goal of all human decisions according to neoclassical economics, will only be pursued in situations where a thorough assessment of all the costs and benefits is itself not too costly in terms of time and energy.



Current research on this topic is informed by the recognition (following Herbert Simon [e.g., 1957, 1987]) that, even though it is mathematically impossible to maximise two variables at the same time--unless they are strongly correlated with each other--people try to do this all the time in making choices in the real world. People wisely acknowledge tradeoffs between variables as pervasive and inevitable in life, and they routinely try to come up with a compromise solution that achieves “the best of both worlds”, the real and the imaginary (Smith 2000). This will often be true even where variables or preferences contradict each other or largely cancel each other out, as Hardin and others claim is inevitably the case with ‘rational’ self-interest and the common good. Instead of truly maximising their own “utility” in a given choice, people often just “muddle through” in the face of multiple and competing values and do the best they can from a strictly rational point of view.

Given the exceeding complexity of most choices and the resulting need to “bound” the reasoning process, people make use of a number of specific means of simplifying their decision-making. Experimental research has identified two modes of thinking and making decisions that are distinct, or activated in different contexts, and yet interdependent, in that they can mutually shape each other: intuitive judgments and fully deliberative or ‘rationalised’ thinking (Kahneman 2002). Intuitive judgments normally predominate in daily life; they are made quickly and automatically, without any deliberation. They may be based on any one of a number of simplifying “heuristics” that have the effect of transforming and simplifying the variables under consideration (sometimes through mere substitution), and they often involve the use of previously-formulated schemas or models, ones that may reflect dominant cultural values concerning what is appropriate or right versus wrong.

These “snap” judgments both set and reflect the preferences that determine most human choices, *unless* they are overridden by a conscious questioning and close examination of preferences that can somehow “kick in”--i.e., the mode of rational deliberation. Clearly both reasoning processes are involved in producing sustainable collective-choice outcomes about consuming vital resources that are held in common, especially irrigation water. The ethnographic research on the latter has revealed, perhaps not surprisingly, that the two modes appear to be activated periodically in different situations through institutions that cause them to reinforce each other through increasing returns or “positive feedback”. In an institutional regime of mutually-restrained consumption such as a farmer-operated irrigation system, the intuitive or “snap” judgment of the majority of people most of the time is clearly to cooperative and conform, and not to cheat or “free-ride”. But how is this effect accomplished, cognitively speaking, reliably over a long period of time?

Part of the answer is that the wisdom or ‘utility’ of cooperating, its high probability as the preferred choice of other people and its high positive value relative to other possible choices for oneself, are demonstrated, periodically and publicly, in such a way that the mode of rational deliberation is activated and its basic logic is strongly reinforced, so that in effect it becomes “intuitive”, self-evident and automatic. The reliable detection and public punishment of occasional infractions seems to serve the function of shaping or permanently framing the “snap judgment” mode of thinking, and making the two modes mutually reinforcing and compatible. Deliberative reasoning obviously prevails in the initial collective decision to set up the institutional framework for cooperation, but it is important to note that, even in sustainable systems of long standing, it is periodically reactivated in dealing formally with occasional “free-riding” and violations of the rules<sup>3</sup>. This occasional activation is both unavoidable--since no set of collective-choice institutions is ever truly perfect, and some amount of free-riding will occur in any system no matter what the rules--and desirable, so

---

<sup>3</sup> This happens with some regularity in informal tribunals and even in weekly or bi-monthly public courts, such as the famous water courts of the *tanda* irrigation systems of Valencia, Murcia and Alicante in Spain (Glick 1970; Maass and Anderson 1978; Ostrom 1990, 1992; Trawick 2002, 2005a,b, in press).

that it should arguably be made into a kind of formal group exercise that is provided for regularly in the institutional design.

This practical suggestion for designing sustainable institutions follows from a principle known as “reference-dependence”, which comes from a theory of risky choice known as Prospect Theory, proposed by Kahneman and Tversky (1979) in their work on bounded rationality. It is also a prediction about sustainable irrigation systems that has thus far been confirmed strongly in the comparative ethnographic research. Experimental studies on cognition have shown that the “carriers of utility”, or the relevant measures of value that determine the preferences of individuals in situations of choice under risk, are not final states or “asset conditions”—i.e., *not the actual assets or material benefits that a person will possibly end up with*, as rational choice theory assumes, such as a certain amount of irrigation water that a person might like to steal or take out-of-turn. Instead, they are *the potential changes in a person’s assets relative to what he or she has when the choice is made*.

Experimental research on this subject (Kahneman 2002:460-465) has revealed that preferences and attitudes in such situations are heavily influenced by a *reference point*, that of the individual’s existing assets or “wealth”, and that it matters a great deal to the outcome whether or not those assets are explicitly mentioned when a given choice is laid out. In other words, in framing a choice and considering the possible options in situations involving risk, gains and losses—i.e. changes in holdings of assets—are always potentially much more important than states of wealth themselves (either initial or final). Where an assessment of existing assets is included when the choice is framed—along with the options, the risks and the possible outcomes—this reliably leads to risk avoidance and cooperation, apparently because the possible changes in assets, i.e., the gains and losses, are activated consciously or “brought to mind”. The opposite tends strongly to occur when the reference point is left out. In the “snap” judgments of everyday bounded rationality, the necessary reference point *will not automatically come to mind and be considered by most people*, as conventional choice theory assumes. But it will reliably change people’s preferences and choices if this is done for them, swaying them away from risk-taking in what is referred to as a “framing effect.”

The comparative ethnographic research on successful farmer-managed irrigation systems suggests that the necessary “reference point” of existing assets is constantly activated and “brought to mind”, even in the intuitive judgments that farmers routinely make about their water use in each irrigation round. This vital piece of information about the current irrigation frequency or length of the watering round—a variable that is common to all users at a given point in time—is routinely given by water distributors when they inform people that the water will soon reach their area and their turn will soon come. A statement is normally also included about the flow each person is entitled to and the length of time it can be used, even though each individual already has that information and knows it perfectly well. The current watering frequency is invariably common knowledge in these systems, but this appears to be the main reason why: for the water distributors, regularly informing farmers about these “current assets” is one of their most basic and essential duties.

As emphasised above, the farmers are also well aware that the watering frequency, or the interval between individual “turns” to irrigate, depends not just on the amount of water available in the system but also on their own behaviour in conforming to the rules, since cooperation has the effect of maximising that frequency and minimising the waiting time. The ethnographic research to date (e.g., Trawick 2001a, 2005b, in press) has shown that farmers know from experience how quickly non-cooperation and free-riding will lead to a significant decline in the watering frequency and to the adding of an additional day or more to the communal cycle. Under conditions of prevailing scarcity, farmers tend to perceive irrigation as a constant mutual effort to avoid such delay, and they show a conscious concern with making adjustments to ensure that the round is kept as short as possible.

Although additional research is needed to confirm this hypothesis more strongly, it appears that the aforementioned combination of routine practices may demonstrate a “framing effect” in which farmers routinely receive all the information necessary to bound the reasoning process in a way that, according to the work of Kahneman and Tversky (1979), leads them to strongly prefer and choose the non-risky option of obeying the rules and limiting their own water consumption, even in the non-reflective mode of rapid intuitive choice. People are routinely made aware of their existing assets—the “reference point” of how much water they reliably get and how often—of how much water they stand to gain or lose by cooperating or not cooperating, and also of the high probability of detection of the risky choice if it is in fact made, as well as the costs or sanctions that would result (usually a monetary fine, but some loss of water rights in the case of repeated violations).

This may be a real-life example of the “perfect information” that neo-classical economists have traditionally simply assumed to exist, but it is in fact provided by the institutional framework within which everyday choices are made in sustainable locally-run irrigation systems, a framework that itself was created *and is continually maintained* through collective choice and action. Some of the implications for policies that encourage sustainable consumption are obvious, as are the most important suggestions that can be deduced or inferred for carrying out stakeholder engagement exercises. Success at any scale or level of organisation will, at the very least, be contingent on the explicit creation of this kind of framing effect, for any and all kinds of “assets’ or resources.

### **Schemas and “cultural models”**

Although largely embraced by theorists in all the fields of research being discussed here, the work on bounded rationality has been criticised for focusing exclusively on individual choice and, most of all, for having identified strategies for simplifying decisions that are situational and highly reliant on personal experience. “Framing effects” of the sort examined in the experiments referred to above, for example, have little to do with what people as members of groups learn through the process of socialisation, and what they assumedly share to some extent simply because they are members of the same society and culture. In cognitive science, mental models or “schemas” are employed as constructs that help to explain reasoning and choice, but those models are highly idiosyncratic and more often personal than cultural.

An alternative but complementary approach coming out of social anthropology focuses on the importance of “cultural models”: shared interpretive frameworks analogous to schemas which are used to understand events and motivate choice and action, and which are internalised on the basis of learning and experience (the schema of and for “going to a restaurant” is one famous example). Such cultural models are also shared and publicly instituted, passed down through the generations, and assumedly specific to a given society (D’Andrade 1987, 1995; D’Andrade and Strauss 1992; Guillet 2000). They are mental constructs that, like the natural resources which they are often quite important in managing, people in a given irrigation community have in common. They readily lend themselves to symbolic formulation and are used to model aspects of the real world that have to do with choice and decision-making, especially regarding complex social phenomena like systems of resource use and property rights.

What schemas and mental models, then, do farmers have of, and for, the successful locally-operated irrigation systems in which they participate, and how much alike are these representations? If successful and sustainable systems turn out to be so similar, even basically the same as the ethnographic research indicates, then one would expect the mental models to be highly similar as well, and indeed they are. That fact has already been confirmed in discussing how individual water rights are defined concretely in each of the

cases studied, and how those rights are perceived to relate to each other by the farmers themselves. But what is the reason for, or origin of, that similarity; does it lie more in culture and local tradition or in personal experience and in reflective thought? If the models of local people are highly culture-specific, and if their availability is a critical factor in motivating people to accept the risks involved in setting the systems up initially and then behaving in a consistent and reliable way, then what are the implications for the current efforts by government to motivate sustainable consumption?

In each of the successful irrigation systems studied, all of which have a very long history, people clearly share a local “culture of irrigation” that has several components: a mental model or map of the water distribution system, a “list” of the rules for resource distribution and use, and a general construct summarising how the system should work and actually does work, as expressed for example in the concept of equity or fairness. Its less abstract principles or working rules, which arise readily in conversation when the ideas of a cultural model and a shared ethos are raised, have already been defined, and there is no need to consider them again here: *autonomy, contiguity, uniformity, proportionality, regularity, transparency* and *graduated sanctions*. Other commonalities are evident in these local “cultures of sustainability” at a deeper level, however, which are less obvious, not explicit, but definitely real and significant. These consist of principles that are secondary or derivative: moral precepts that follow logically from the almost sacred, central value of fairness in sharing a resource that is scarce, vital to people’s livelihoods, and “subtractable”, or subject to positive and negative feedback effects.

Among other things, the ‘doctrine’ of equity or fairness implies that--and in practice ensures that--no one individual’s share of the resource can ever grow so large as to jeopardise the rights and the livelihood of everyone else. This maxim implicitly recognises the inherent worth or value of every member of the community by affirming their inalienable right to work, to subsist, and to live. It therefore limits appropriately the right of all community members, even the wealthiest, to use and consume the resource upon which everyone’s lives and livelihoods depend. Moreover, the duties of individuals to the community, their obligations to give back, are proportional to the benefits that people derive from living there and using its resources.

Such models are definitely cultural rather than personal or idiosyncratic, since they seem to be shared by most of the people involved; but note that the same general “culture of sustainability” is found in each of the communities studied: again, a total of nine communities from very small to rather large in scale in three countries on two continents. How can this parallel or convergent evolution be explained?<sup>4</sup> Since it now seems clear that the same culture or schema for irrigation is also found in hundreds of local hydraulic societies throughout the world (Trawick 2002, 2004, 2005a, in press, also Trawick n.d.a., n.d.b.), I would argue that the basic elements of these models--the ideas of reciprocity, of equity and fairness in sharing a scarcity, of the fundamental right of all community members to work, subsist and survive, even the more concrete elements like the principles of uniformity and proportionality--are human ‘universals’. They are shared in some way by all peoples as *potentials or latent values* that are activated in situations where people face a potentially life-threatening scarcity and an impending subsistence or resource crisis. They come readily to mind when people are forced to make the best of a bad situation in using a resource that is vital and that they hold in common. Where the threat and the collective challenge are the same, it is not surprising that the solutions, the basic values and the cultural model that readily come to mind, turn out to be the same.

---

<sup>4</sup> The historical evidence shows that it is definitely not the result of any diffusion of the ideas through direct or indirect contact between people, or any other historical relationship between the communities studied.

## VI. “Collective-choice” Theory Applied to Emerging Sustainable Communities in the UK

An argument about a ‘universal’ culture of irrigation might seem to have little relevance to the practical challenges faced by Defra and other government organisations in their attempt to promote sustainable development, but that is not the case. There are many examples of efforts by local people in rural areas throughout the UK to achieve sustainable forms of cooperation and cut down on their expenditures and their energy consumption (Jackson 2005b), social experiments that have emerged spontaneously, particularly among the country’s farmers, and that appear to have much in common. A brief examination of two such examples reveals institutions that are strikingly similar to those that underlie sustainable irrigation, whose logic and whose history provide important insights about how government can encourage such experiments to take place and help to ensure their success.

### Pont Bren

An informal cooperative of small farmers in Wales, Pont Bren consists of ten households that began to organise gradually in 2000 for the purpose of pooling their limited resources in order to provide mutual support for a way of life that, according to the members, had become unsustainable and unbearable in terms of the work load it required. Government subsidies encouraging a general intensification of agriculture across the board in the 1990s had led to a rapid expansion of upland sheep grazing, their primary cash-earning activity, with accompanying problems of rising overall costs and local environmental degradation. The cooperative began as mutual-aid among three of the original members in a forestation effort--planting trees--which, once the “side benefits” of the activity became evident (e.g., hydrological improvements in the groundwater regime), immediately spread to include other neighbours and led to an expansion of both the group and its activities.

The mutual-aid organisation was so successful that the members ultimately decided to close membership for the group, limiting it to ten farms, because they perceived that further growth would require formally codifying their collectively-chosen institutions, an act that might compromise some of the group’s strengths and perhaps jeopardise some of the benefits produced. This, of course, immediately raises the question of scale, as in the previous irrigation examples, and suggests that Defra, if it is to make efforts to encourage similar actions among small farmers in other upland regions, should probably concentrate on replicating such groups by providing financial support in meeting their start-up costs, rather than on expanding existing groups.

*“Before Pont Bren was formed, we were coming to the stage where the main part of our income was coming in the form of what we call the ‘brown envelope’. To me it didn’t seem a sustainable way of going on. So we at that stage had about a 1000 mules, the big sort of heavy mule ewes here. And we were up to about 75 cows...right at our peak...I thought, well there’s something wrong here. So what I decided to do was change my breed of sheep, go back to a hardier breed...cut the cattle numbers down. And I wanted to lamb outside, because when we had our big heavy sheep they had to be indoors...In doing the nights one spent a lot of labour, a lot of feed, very intensive...so I wanted to go more extensive. But to help this process I needed shelter because there was very little shelter on the farm. So by planting trees and regenerating hedgerows I could achieve this. This is where we are now.”*  
(Roger Jukes, informal leader and instigator of the group)

The positive experience of farmers in the group is described, in their own words, as one of clearly increasing returns of various kinds, some quite tangible and others less so, which are reflected in the widening scope of their activities. Pooling resources initially in order to buy tree seedlings, combined with mutual-aid in the actually planting, led eventually to the establishment of a small nursery to cut costs. Reciprocity was also practiced in planting hedgerows and buying and installing fences which, along with the trees, provided shelterbelts that made it possible for the farmers to keep their sheep and lambs outside all year round, again significantly reducing production costs (i.e. labour and feed requirements).

At first the main benefit was only indirectly economic; it reduced the farmers' workload dramatically, thus allowing each household to spend time diversifying and doing other productive things. However, the experience of pooling resources soon gave way to other activities intended to provide more cash income, which was again pooled and invested as the members saw fit. The tree nursery now produces some seedlings for sale to neighbouring farmers; money has been pooled to buy traditional breeds of sheep for producing meat products that are now sold in a cooperative farm shop, whose profits are evenly divided up but often reinvested together. This income helped to finance the recent purchase of a wood chipper that now provides bedding for the farmers' own animals as well as wood shavings for sale to other farmers and the general public.

The rights and duties of the group members are entirely uniform (and thus also proportional to each other) and, since the group has remained small and based simply on reciprocity and mutual trust, there has been no need to formalise those institutions legally or even to elect any officers. Monitoring of individual contributions and benefits is easily done and not considered to be a problem, again because the group is small and the members are neighbours who have known each other all their lives. Among the most interesting results from the interviews was the clear recognition by the farmers that the benefits of such cooperation and the effort to operate farms in a new way have not been merely economic.

The group recognises that a sustainable environment is an important precondition for a sustainable farm, and they have invested their resources accordingly: in woodland preservation and the protection of watercourses as well as shelter for the animals, all through tree planting, fencing and hedgerow management. But in interviews the farmers all made some kind of reference to the importance of a "feel-good factor", basically saying that they now take real pride in their managed woodlands and hedgerows and enjoy the wildlife attracted by the trees and the ponds. They clearly consider themselves to be stewards of the land in a way they did not before, when the constant chase for subsidy payments governed virtually their entire lives. Ironically enough, by working their land cooperatively and wisely, the members have become more 'independent' farmers who form a close-knit community that provides important benefits for themselves, the general public, the nation, and the planet.

Regarding the practical policy implications for Defra, a final point is worthy of note. In a real sense Pont Bren was formed in response to changing agricultural policies that were mainly intended to benefit large farms. The new agri-environmental schemes of the government were not appropriate for these small operations; the members found them too rigid and restrictive and the formal agreements too long-term, so they were forced to get funds for their own environmental schemes, mainly by pooling and sharing their capital and labour. There would seem to be good reason, therefore, for Defra to carry out stakeholder engagement exercises to encourage this kind of collective action by farmers who could potentially benefit from it--a procedure for which will be outlined in the forthcoming Practical Guide. But in its desire to encourage economic and environmental sustainability, Defra might also consider developing policies specifically designed to support small family farms in

the uplands, drawing on the mechanisms of the new Environmental Stewardship and the Single Payments schemes.

There are many obvious parallels between this organisation and the irrigation systems previously described. The resources pooled by the farmers are both scarce and vital to their livelihoods, and they are pooled and used in rotation in one case—the labour, with the total “pot” being used consecutively on each farm to plant trees and build fences—while the other resource, the capital, has been pooled periodically and used as a group fund to make large multi-farm purchases that reduce the price of trees, fencing materials and animals, and therefore cut costs. Despite the “pooling”, however, these are *not* resources characterised by ‘subtractability’, and the farmers have deliberately designed their institutions for using them so as to preclude or eliminate this effect. The total stock of each one is assembled and then used, either all at once or in rotation, in such a way that all the farmers derive equal benefit on the same schedule. Although the overall effort could be said to involve mutual self-restraint, this form of cooperation does not require them to actually cut back on their consumption and use of the resources that they have or hold in common. They simply use them more wisely and efficiently, without necessarily using them any less. This means, of course, that such self-organised efforts, so rich in “social capital”, would be fertile ground upon which to build a comprehensive sustainability programme that also embraces the broader aims of Defra.

### **East Suffolk Water Abstraction Group**

A final example fits the “collective-choice” model more closely because it is an organisation of irrigators who, despite the generally humid nature of the English climate, face similar challenges to those confronted by their counterparts in most other parts of the world. Today having roughly 120 members, the East Suffolk Water Abstraction Group was formed in 1997 in response to an effort by the Environment Agency (under the 1991 Water Act) to decrease groundwater withdrawals for irrigation in response to the 1989-92 drought and, somewhat later on, to impose bans on abstraction during the 1996-7 irrigation season. The major impulse for the group’s formation came from five major commercial irrigators, who saw potential benefits and were locally seen as influential farm-business leaders.

The group had no formal constitution until 2002, when it successfully applied for a grant from Defra and the England Rural Development Programme, acquiring £70,000 delivered over four years to appoint a Company Secretary and help to establish a Company Limited by Guarantee. The opportunity for such funding and, importantly, the need to obtain indemnity insurance, spurred this collective decision by the members. The Company is now owned by them, each of whom now holds a £1 share. Membership fees are charged annually at £1000 per cubic metre of licensed water abstraction, and range from £25 to over £1000 per year per member. The committee comprises elected members plus a number of co-opted members with specialist skills, e.g., an irrigation consultant. The group is, however, independent of any specific commercial interest.

The group’s main purpose today is to secure access to water for irrigation in the medium to long term, given growing pressure on water supplies due to increasing demands from other users and, as will be the case again this year, specifically in the short term during drought. The group provides mutual benefit for all its members: a significant degree of security over individual abstraction licenses and a kind of countervailing power to balance that of the Regulator and other dominant local interests. Farmers feel unable individually to promote their interests against, for example, the more powerful and better organised water companies and, increasingly, against environmental organisations and ‘development’ groups. Thus they act together in order to face strong competitors who, during drought conditions, become a clearly-perceived common threat. Their effectiveness in such collective endeavours was well demonstrated recently in their dealings with the Regulator, when they struck an agreement to make a 50% reduction in groundwater abstraction during

drought periods, on the understanding that the complete bans on abstraction imposed in 1996-7 would not in fact be enforced.

In pursuing its general ends the group's elected leaders fulfill the following specific functions: liaise with the EA concerning proposals to change abstraction licenses; provide a forum for expressing and communicating members' interests; respond to EA consultation documents on behalf of members; act as a conduit for EA information and guidance to the irrigators; and undertake selected research and education activities in support of the farmer's needs. According to the members interviewed, the group was formed because local farmers saw a clear advantage in acting collectively in order to represent their mutual interests to the EA, rather than relying on the separate responses of individuals. That view has since been strongly vindicated, as the level of representation has increased in response to recognition by the Regulator. The EA now directly approaches the Group on salient issues; it is a first port-of-call. Group activities also include participation in some research—for example, in a formal review of the importance of irrigation on the rural economy—in extension, and in training for members.

Given the many direct parallels with the cases previously discussed, the question of how the members' rights and duties are defined and related to each other is of special interest, as is the question of monitoring, not only of the exercising of rights but also the performance of duties. The founding members of the group sent letters initially to all agricultural and related abstraction license holders (approximately 200) within the prescribed catchment, inviting them to join. Membership is voluntary and open, largely catering to farmer interests rather than other minority interests in the catchment, such as those of people irrigating for sports and recreation purposes. The rights to abstract groundwater and surface water are based on a mixture of 'grandfathered' permanent licenses (pre-1963) and more recent temporary or time-bound licenses, which have been awarded by the Regulator on the basis of 'reasonable need' for crop production. Thus licenses are loosely tied to areas of irrigated land, but not necessarily proportional to the amount of land held by any one farmer. Otherwise the rights of members are uniform: membership provides equal entitlement to representation, unrelated to, for example, the size of the abstraction license. This rule has not changed since the inception of the group. Monitoring of individual behaviour and conformance to the conditions of abstraction licenses is not directly carried out by the members or their leaders, however; that is monitored directly by the regulating agency itself.

Thus the set of operating principles or institutions forming this group conforms quite closely to Ostrom's "Game 5 Solution", and is otherwise similar to the locally-run hydraulic systems previously described. However, in this case the initial constitution of the group was stimulated by local leaders in response to actual or likely constraints imposed by the regulating agency. Although the individual farmers already had their licenses, in conditions of drought and increasing competition over a dwindling resource they were no doubt ripe for organisation as an interest group. Membership has remained fairly constant ever since, covering an estimated 90% of all agricultural and horticultural abstractors--and of total irrigated area--in the watershed. Given its longevity and successful functioning, the East Suffolk Group demonstrates the important role that Defra could potentially play in both the replication of new groups patterned on older cooperatives like Pont Bren, and in the formation of new sustainable-livelihood groups, especially those involved in agricultural production based on the use of resources that ultimately belong to the people or the state.

A potentially contentious issue has recently arisen which reveals the existence of a basic kind of differentiation among the members that has remained relatively insignificant until now. A reform of the licensing system has been proposed by the EA regulator, one that, as previously mentioned, would convert permanent abstraction licenses to time-bound and temporary licenses. Views on this proposal naturally vary, depending on whether members are permanent or temporary license-holders. The group has decided to handle this



problematic issue by forming sub-groups of permanent (about 2/3<sup>rd</sup> of group) and temporary license holders (about 1/3<sup>rd</sup> of group), and seeking to meet their needs separately.

The group explicitly promotes good irrigation practices in pursuit of the sustainable use of water. The members are quite aware that any kind of increased efficiency of water use results in greater energy efficiency and monetary savings through reduced pumping. In this respect the benefits of cooperation, which is defined in a more open-ended way here than in the cases previously described (systems that are based mainly on the use of surface water stored in reservoirs), are relatively uniform, although the rights to water themselves are not. Membership provides equal entitlement to representation, unrelated to the size of the abstraction license, but “duties” or membership fees are charged proportionally or “pro rata”, to reflect the size of abstraction licenses and the potential share of benefit derived from them. Again, this rule has not been changed since group’s inception. The “unit of service or benefit” is thus provided to the group as a whole, on the one hand, in the form of formal representation, and to individual members, on the other, in the form of support or guidance on particular issues and problems, e.g., in applying for winter abstraction licenses, or interpreting a particular regulation on water use.

Due to the necessity of pumping--a cost that is borne separately by each individual--the rewards for increased efficiency are more direct and immediate than in gravity-based irrigation systems tapping surface water, which in those cases are always potentially shared with, and diluted by, other farmers who use the same water source. Because water deficits are common in the summer, no new licenses for summer abstraction are likely to be granted in the catchment. The group is now promoting the idea of building reservoirs to abstract winter water and store it for use during the dry months. Although such investments are expensive, adding roughly 40% to the cost per m<sup>3</sup> of water, there is scope for such groups to collectively finance such reservoirs, perhaps with Defra’s help, to provide additional water as well as potential benefits for natural habitats.

In terms of the possible involvement of government, and the potential influence of Defra’s sustainability initiatives, this may mean that abstraction groups have a greater potential for expanding their membership than other kinds of cooperatives and, due to the energy-intensive nature of water pumping, they might also be more receptive to initiatives focusing specifically on reducing energy consumption and use. The range of their cooperative activities could thus probably be expanded relatively easily as well. While there is no formal monitoring of abstraction by the group, there is an understanding that the membership will abide by the aforementioned negotiated settlement with the EA; otherwise the process and the benefits will be put at risk. There will, however, ultimately be upper limits on the possibilities for both kinds of expansion, whether of the group’s size or of its range of activities, as any cooperating group can grow too large in either respect.

It is important to note, by way of conclusion, that the group is extremely concerned about the potentially critical impact of global warming on the supply of and demand for water. And, in a situation of already intense competition between different kinds of users, they are quite mindful of the likely impact that this will have on the rights of irrigating farmers. The group has participated in consultation processes with the EA and other relevant organisations, promoting the importance of irrigation as a valid use of water while at the same time expounding on the benefits of more ‘efficient’ water management amongst its members. Thus they already show a strong preoccupation with all of the objectives subsumed under Defra’s concept of “sustainable development”, including both increasing efficiency and reducing overall consumption or “throughput” of resources in both production and consumption. As in the case of the local irrigation communities previously discussed, many such abstraction groups already exist; thus the “social capital” upon which Defra could potentially build, whether through replication or expansion—the capacity for collective-action--is already there.

## VII. Recommendations and Conclusions: Motivating Sustainable Production and Consumption

The need for an established organisational framework within which stakeholder groups can operate is obvious, a forum where such groups can fulfill their legitimate functions and also appeal for, and perhaps even get, the outside advocacy and support that they need for new kinds of activities, as the East Suffolk Group did with Defra's help. Also clear is the fact that Defra and other agencies involved with the environment could, at very little expense, play a pivotal role in encouraging the emergence of sustainable community experiments like Pont Bren, which are already forming throughout much of the world of their own accord. Some of the ways in which government could do this, widely and systematically through participatory planning and a kind of "mutual aid", have been suggested or revealed in this report. Such a programme could be initiated from the ground up, by trying to 'replicate' successful groups while expanding their range of conservation activities, or by expanding the communities themselves and, in either case, building upon existing capacities and strengths.

Additionally, the effort could also begin much higher up, in an explicit attempt to disarm the "culture of consumption" and replace it with something else, an alternative "culture of sustainability" that, again, is already emerging widely throughout the world and may well have existed right alongside us for a very long time. A combined approach involving both kinds of effort, one designed to meet or integrate somehow "in the middle", would seem intuitively to be the best choice of all.

The cross-cultural analysis presented here has tried, hopefully with some success, to demonstrate that all the necessary components and ingredients for achieving sustainable development and truly changing people's lifestyles are available and ready to be activated or, in a great many cases, already in place. The components for sustainable development that already exist and can be built upon and integrated into decision-making include:

- a widespread questioning of the values that support the dominant culture of over-consumption;
- rules and principles for successfully exercising mutual self-restraint in the consumption of vital and scarce resources instead, ones that are well understood theoretically and have been repeatedly demonstrated to be both effective and sustainable in practice;
- well-documented examples where those rules and principles have been discovered independently, implemented as collective-choice institutions, and maintained successfully by groups of local people over long periods of time, even in modern capitalist settings;
- cultural ideas and values that underpin these institutions and are responsible for their power and success, ones which appear to be 'universals' that are readily activated in situations where people are forced to share scarce and essential resources in order to survive;
- a demonstrated need for, and a strong interest in gaining, the direct support of Defra by similar collective-action groups existing in the UK, in their ongoing efforts to expand the range of their sustainability-oriented activities;
- new understandings, both theoretical and practical, about how such people actually make collective choices and decisions, both within "the market" and outside it, all of which reveal the pivotal importance of the precise manner in which the information needed to make a given 'rational' choice is framed.
-

The existence of all of these necessary components will come for many people as a welcome surprise. Given such news, it is not hard to envisage how the components of a new “culture of sustainability” might be activated, and their power potentially combined and channelled, especially in stakeholder interactions, the standard forum that Defra and other government organisations use to engage with the public and enlist their participation in policy-driven programmes. The means for doing this in a truly new way, based on the revised version of collective-action theory presented in this report, will be outlined in detail in an accompanying practical guide. But it is not hard to see, at this point, that the potential for doing something genuinely new in that social and cultural domain may be great. A novel approach would work from the level of culture downward and, simultaneously, begin from the ground and water and move upward, framing the choices that local people make about their consumption and their lifestyles in terms of specific resources that are held in common by a definable group, thus revealing their collective nature and emphasizing the very long tradition of successful human cooperation of which they are a part.