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Developing an Analytical Framework for Multiple-Use Commons

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ABSTRACT:
Much of the work conducted on common property resources has tended to focus on relatively undeveloped commons, where the imperative is to establish coordinated action between a single type of user of the resource. There are some exceptions to this. For example, Gupta (1986) examined the stratified social structure in Rajasthan and explained how it affected commons in terms of the different expectations of the different classes of users and the different animals that they depastured. Nevertheless, whilst his work covered different classes of commoners with different animals, it focused on a single use: that of grazing. As traditional commons in developing countries evolve, research which explains the persistence of commons with multiple ownership, use and management structures will become increasingly relevant as a foundation for the theory of complex common property regimes.

This paper attempts to extend the simple analytical framework put forward by Oakerson (1986 & 1992) and developed by Blaikie & Brookfield (1987), Ostrom (1990a) and Tang (1992), for application in more complex multiple-use common property resource situations in developed countries. As such, the framework must be capable of facilitating analysis of resource systems which support multiple *types* of uses by *multiple types* of communities/groups. Initial research suggests that six essential components must be incorporated in the framework. First, the physical and technological characteristics of the resource must be analysed with respect to different uses. Second, the multiple-use framework must facilitate analysis of the different communities involved in the use and management of the common property resource. Third, the framework should focus the researcher on how different types of users respond to different institutional arrangements through analysis of 'context-bound' factors. Fourth, the framework must comprise a multiple-level analytical tool in order to further an understanding of institutional evolution and the progression of institutional reform through different levels of the institutional arrangements (Kiser & Ostrom, 1982). Fifth, the framework should incorporate different rule categories, in a generic fashion, at different levels of analysis. Finally, the framework must be capable of repetition through a succession of chosen time periods.

1. INTRODUCTION

In the increasingly popular debate over the sustainable use of natural resources, of particular interest to resource managers are the problems associated with resources which are used in common (Ciriacy-Wantrup & Bishop, 1975, McCay & Acheson, 1987; Berkes, 1989; Ostrom, 1990a; Bromley, 1992). It is often assumed that the extent of natural resources in relation to the demands of a relatively small population means that resources can be used without fear of depletion or degradation. However, small communities of resource users have found it necessary to limit and control use of resources for centuries, not because of encountering increasing population pressure but because of spatial and physical constraints of the resources. Shoard (1987:18) documents the co-operative land use institutions of Maori. Anderson (1991) explains how native Americans restricted hunting of buffalo, trapping of beaver and fishing of salmon in order to prevent depletion. The institutions devised by the resource users have helped to sustain the productive use of fragile natural environments for centuries. It is through a better understanding of those institutions and their effect in enhancing or detracting from effective management that we will be able to design and implement institutions for current and future resource management.

Although researchers have a tendency to refer to resources used in common variously as 'the commons', 'common-pool resources', and 'common-property resources', it is the institutions that turn a common-*pool* resource into a common-*property* resource. This is of particular importance, since when a number of competing users are present, it is the *institutions* which might prevent depletion or degradation of the resource system. Institutions are defined as:

> "sets of working rules that are used to determine who is eligible to make decisions in some arena, what actions are allowed or constrained, what aggregation rules will be used, what procedures must be followed, what information must or must not be provided, and what payoffs will be assigned to individuals dependent on their actions." (Ostrom, 1986:4).

In 1968, Garrett Hardin published the "Tragedy of the Commons", which has become a strong symbol of the problems of common-pool resources and the degradation which is assumed to follow from the common use of a scarce resource.[1] Implicit in Hardin's parable was an assumption that when a natural resource is physically and legally accessible to more than one resource user, the result will be a "free-for-all", with users competing with one another for a greater share of the resource to the eventual depletion in the quality and/or quantity available of the resource. Absent from Hardin's theory was the recognition that individuals can design and enforce rules which structure their individual and collective choices. Bromley (1986) refers to these sets of rules as "resource regimes", Oakerson (1986 & 1992) as "decision-making arrangements" and Kiser and Ostrom (1982) as "institutional arrangements."[2]

This paper considers a *common property regime* to be a set of institutional arrangements that define the conditions of access to, and control over, a range of benefits arising from a collectively-used resource system. Empirical research has shown that the institutional arrangements associated with common-property resources are as diverse as the social, cultural and ecological contexts in which they are practised. However, the management practices often share certain characteristics:

> "These practices emphasize respect, responsibility, and stewardship and are highly participatory." (Jacobs, 1989:vii).

It is important to distinguish the property rights to the resource from the governing institutional arrangements; property rights are constructed out of the institutional arrangements. 'Property' as a concept is a social instrument used to define a reservoir or flow of benefits. Property rights to land are social institutions which have evolved as a means of enforcing claims to that benefit stream:

> "a property right is a claim to a benefit stream that some higher body - usually the state - will agree to protect through the assignment of duty to others who may covet, or somehow interfere with, the benefit stream." (Bromley, 1992:4).

By attaching rights to property, we show the intention to enforce duties of a potential user to observe restricted (or prohibited) access to and use of the resource. In a common property resource situation, rights are assigned to a group of individuals, which exclude others from access to the resource. The group of individuals will normally be involved in the design, implementation and enforcement of rules to ensure the proper use of the resource. However, not all resources used in common will be managed as common property. There are three other basic classifications of property rights regimes for commons:

* Open access (i.e., no rights - a general 'free for all').
* Public property (i.e., access rights are held in trust by the Crown or state).
* Private property (i.e., individual, household or company ownership).

Feeny (1994) also points out that it is important to distinguish *de facto* from *de jure* property rights. For example, many resources may be classified as public property *de jure*, whilst access is often left unregulated in practice and the resource is held *de facto* as open access.

Whilst property rights classifications of commons can be helpful, they can also be misleading in that they suggest that each resource system will fall neatly into a single category. In reality, many resources can be classified under more than one property rights regime. For example, *de jure* rights pertaining to the New Forest commons in England include (i) Crown and (ii) private property ownership (both held as 'freehold' rights) and (iii) common property rights for grazing (*pasture*),

wood collection (*estovers*), turf cutting(*turbary*), clay cutting (*marl*), turning out pigs (*pannage*). In addition, *de facto* open access rights are assumed for recreational use of the Crown land (Edwards, 1996). Similarly, at North Heron Lake in Minnesota, private property rights to land adjacent to the lake were the basis of the establishment of common property rights over the lake itself (managed by a *Game Producers Association,* comprising the private property rights holders). Purchase by the state (in this case, the Minnesota Department of Natural Resources) of a piece of land abutting the lake raised fears that the lake would be turned from a common property resource into an open access resource, by the assumption of *de facto* rights by the public (Edwards, 1995).

1.1 Multiple Use Commons

Much of the work conducted on the analysis of common property regimes has focused on relatively undeveloped 'commons', where the imperative is to establish coordinated action between a single type of user of the resource. There are some exceptions to this. For example, Gupta (1986) examined the stratified social structure in Rajasthan and explained how it affected commons in terms of the different expectations of the different classes of users and the different animals that they depastured (sheep, goats, cattle, buffalo, camels and others). Nevertheless, whilst his work covered different classes of commoners with different animals, it focused on a single use; that of grazing.

As traditional commons in developing countries evolve, research that explains the persistence of commons with multiple ownership, use and management structures will become increasingly relevant as a foundation for the theory of complex common property regimes. An important first step is to distinguish the resources involved from the property rights regime (Feeny, 1994). Ostrom (1990a:30) distinguishes the "resource system" from the flow of "resource units" it provides. In doing so, she clarifies the difference between, for example, the common itself and the grass it produces. This also provides a useful distinction for multiple use commons, by helping us to distinguish between "extractive users", who appropriate resource units from the resource system, and "non-extractive users", who derive benefit from their use of the resource system itself. Such non-extractive users might be termed 'amenity users' and would include recreational users, nature conservationists, or any such other people who enjoy some benefit from the commons' existence.[3]

A single resource system may be capable of producing a wide variety of resource units. For example, an open woodland area can produce grass for grazing stock, wood for fuel and timber, nuts and berries for human or animal use (such as acorns and mast for pigs) and possibly even water for collection and distribution for future use. In addition, the woodland as a resource system may provide a useful non-extractive stream of benefits. A wide range of benefits can be attributed to an entire resource system: some of which demand use and others of which can be enjoyed without access to and use of the resource system. Thus, it is possible to divide further the non-extractive benefits associated with resource systems into 'direct' and 'indirect' benefits (Edwards, 1995). 'Direct benefits' refer to benefits derived from people having access to and directly *using* the site.[4]

They include:-

* recreational benefits: derived from the use of the natural area for recreational and amenity pursuits, such as hiking, wildlife viewing, photography, or merely resting.

* educational benefits, derived from the study of natural areas, providing information on, for example, evolutionary processes and the nature of ecosystems (see, for example, Allen, 1988).

* cultural benefits, derived from natural areas particularly when a culture has a strong tradition of associating natural resources with spiritual beliefs.

Most non-extractive uses demand the design and enforcement of appropriate property rights regimes in order to continue in a sustainable manner. For example, the woodland described above may be treated as a *de facto* open access resource by mountain bikers. The layering of this use on top of other, *de jure* uses may endanger the sustainable use of the woodland, by causing soil erosion and vegetation damage.

In addition, there are several different types of indirect benefits associated with natural areas. They are termed 'indirect' benefits because, by their very nature, they do not require the beneficiary to enter onto or use the natural area in any direct manner. As a consequence, indirect benefits are of less relevance to any discussion regarding common property resource regimes because they do not require issues of restriction to and management of the resource system to be addressed.[5]

Once the resource system and the different resource units have been identified, it is possible to examine the property rights regime to ascertain whether rights have been assigned for access to and extraction of particular resource *units* (for example, the right of *estovers* allows access to fallen timber in the New Forest scenario above), or whether the right applies to the entire resource *system*. For example, Crown and private 'freehold' ownership of the New Forest commons apply to specific geographical areas of the entire resource system. In addition, the *de facto* open access rights assumed by recreationalists relate to use of the resource system in a non-extractive manner, which are not resource *unit* specific (Edwards, 1996).

Clarification of the complex property rights regime existing in a multiple-use commons scenario is a necessary first step of analysis; but is not sufficient. Analysis of particular resource systems and regimes demands an interdisciplinary study, which combines an understanding of the resource, the resource users, institutional arrangements governing use, action strategies of individual users, patterns of interaction and outcomes of use. Imperative in such an interdisciplinary study is a means of organising information.

1.2 Analytical Frameworks

Examination of different commons provides information that reveals the potential and limitations for individuals to control and manage commons collectively. Comparative research, however, demands a consistent framework of analysis. Much work has been conducted on the development of appropriate analytical frameworks, most notably by Oakerson (1986 & 1992) and Ostrom (1990a). Such frameworks help to direct attention to the more important variables in a common property regime: those most likely to affect decisions about the institutions governing the resource and whether change is necessary or desirable. Natural resource management is truly interdisciplinary; bringing together, for example, the work of anthropologists, ecologists, economists, sociologists, political scientists, and biologists. There is a strong methodological argument, therefore, for a common framework of analysis to underlie case studies and so clarify thought and communication.

This paper attempts to evaluate and extend the simple analytical framework developed by Oakerson (1986 & 1992) for application in more complex multiple-use common property resource situations. As such, the framework must be capable of facilitating analysis of resource systems which support multiple *types* of uses by multiple *types* of communities/groups. In addition, to be applicable worldwide, the framework must recognise the importance of different socio-political structures that determine the context for institutional development, individual behaviour and collective action.

The multiple-use framework presented in this paper was developed initially to assist research into the control and management of common land in England, which needed to take account of traditional use of the common by graziers and foresters ('extractive users') and contemporary use by amenity and recreational users ('non-extractive users') (Edwards, 1996). It was recognised that institutions devised to assist in the control and management of common grazing would not necessarily be successful in achieving sustainable use of the common for a wider variety of purposes and that the complex nature of the emerging use patterns of common land in England may demand more appropriate institutional arrangements. We are currently using the multiple-use framework and further adapting it for the analysis of a various resource management regimes in different countries.[6]

Like Oakerson's simple framework, the adapted framework does not attempt to be a fully-specified model, but merely a conceptual tool for organising and analysing information about different commons supporting multiple-uses and types of users. It does not set out to provide answers, rather to prompt a series of questions that distinguish different characteristics of the commons and the relationships between the different characteristics. The relationships between the situational characteristics identified can then be specified in ways which will allow diagnosis and understanding of problems of a particular multiple-use common property regime.

In this paper, the analytical framework for multi-use commons is constructed incrementally. Section Two explains Oakerson's framework, its component parts and their interaction. Section Three develops Oakerson's framework for multiple-use commons. Section Four provides some conclusions for the future development and testing of the framework.

2. OAKERSON'S FRAMEWORK

Oakerson's framework (Figure 1) was adopted by the Panel on Common Property Resource Management at the US National Research Council.[7] The framework was used to organise the analysis and presentation of case studies at the First International Conference of Common Property Resource Research, in Annapolis 1985 (National Research Council, 1986). The framework comprises four elements. First, it distinguishes two categories of characteristics used to analyse common property situations:-

(i) physical characteristics of the resource and technological solutions to resource constraints; and

(ii) decision-making arrangements governing use of the resource.

Both sets of variables combine to result in:-

(iii) patterns of interaction; and

(iv) outcomes.

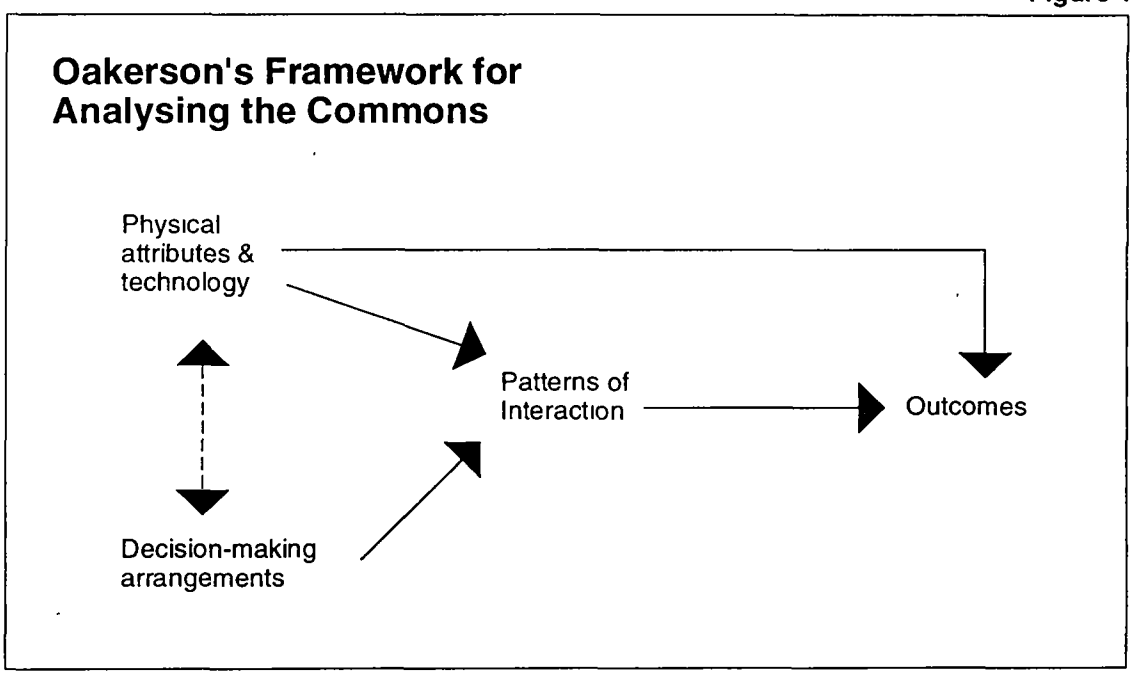
Each component part is explained before explanations of the relationships between the variables are provided.

Physical and Technological Characteristics of the Resource

Problems concerning commons of all types are firmly rooted in the natural, physical constraints placed as a result of the physical characteristics of the resource. The amount of grass available for grazing stock is determined, for example, by the size of the common, the availability of water and shelter, and the rate of growth of the grass (affected by such variables as the type of grass mixture, climate and degree of shading). Inclusion of technology with the physical characteristics of the common acknowledges an ability to control, to some extent, the natural limitations set by the resource by employing technology. For example, recovery of grassland might be facilitated, if other favourable conditions are present, by the application of fertilisers. Technology will also help in the transfer of water from an area of the common where it is naturally occurring, to another where water is scarce.

Much of the work conducted on commons has questioned how the physical properties of the resource system have limited its ability to support extraction of resource units. Kiser and Ostrom (1982) refer to the concepts affecting the resource governance: (i) the 'subtractability' (or 'jointness of consumption') of a resource system[8]; and (ii) the 'excludability' (or the 'extent to which exclusion is possible')[9]. In subsequent work, Oakerson (1992:43-5) identifies a third factor, (iii) the 'divisibility' of the resource, which is also acknowledged by Tang (1992:20)[10].

Figure 1



Source: Oakerson, R. (1992). Analysing the Commons. In Making the Commons Work: Theory, Practice and Policy, Ed. Daniel W. Bromley,San Francisco, ICS Press, 41-59

Decision-Making Arrangements

Oakerson's framework includes decision-making arrangements or 'institutional arrangements' as a component of analysis of common property regimes. Kiser and Ostrom (1982:179) define institutional arrangements as:

> "the rules used by individuals in determining who and what are included in decision situations, what actions can be taken, and in what sequence, and how individual actions will be aggregated into collective decisions."

The rules may be formal, written down and detailed, or informal. The term is used to convey a broad set of arrangements for governance, not a single organisation or institution: organisations are formed as composites of participants following the rules. Schlager & Ostrom (1992:250) also distinguish 'rules' from 'rights':

> " 'rights' are the products of 'rules' and thus not equivalent to rules. 'Rights' refer to particular actions that are authorised (V. Ostrom, 1976). 'Rules' refer to prescriptions that create authorizations. Thus, when we examine property rights, we are examining an authority to undertake particular actions related to a specific domain (Commons, 1961)."

Patterns of Interaction

Once the information on the situational variables (physical and technological characteristics of the resource and decision-making arrangements) has been collected for a particular resource, the relationships between the variables should become the focus of the study. One must examine the strategies that individuals adopt and question the extent to which they cooperate to manage the resource collectively; *patterns of interaction.* It should be noted that the physical and technological characteristics of the resource can *indirectly* affect outcomes through *patterns of interactions*, but can also *directly* affect the outcomes, independent of human interaction. This is represented in the framework (Figure 1), where a black line shows a direct link between the physical nature of the common and the technology available and outcomes of use.[11]

Outcomes

Several criteria can be employed to evaluate the outcomes of collective behaviour. Oakerson (1992) suggests the adoption of 'efficiency' and 'equity' as appropriate. Efficiency is concerned with the overall rate of use. He suggests that the physical and technological characteristics of the common will indicate the optimal rate of use, this being one which will allow a maximum amount of extraction from the common without reducing the common's capacity to produce similar yields in successive years.[12] Oakerson (1992:52) argues that the presence of inequities might be revealed as a breakdown in collective action and subsequent inefficiency of use results from users failing to receive a "reasonable and fair return on their contribution".[13]

Using the Oakerson Framework in Practice

The Oakerson framework helps researchers to gain insight into the interaction processes between people and a resource that lead to an outcome: the state of the resource in terms of ecological, economic and social sustainability (Steins & Edwards, 1996). The framework reaches its full potential as a diagnostic tool if researchers work backwards through the relationships. The first question is: what is the outcome of resource management? The next question is: why is it happening? A first-order answer to this question can be obtained by studying interaction patterns among resource users; second-order answers depend on how physical and technological properties of the resource, together with institutional arrangements, affect interaction patterns (Oakerson, 1992). In addition, factors from outside the actual management system can have an enormous impact on the outcomes of a resource management system (see section 3.3)

2.1 Initial Adaptation of the Framework

Since its inception, the framework has been adopted and praised by other scholars:

> "we found the Oakerson model to be the most appropriate for use in analysing CPR problems. .... I therefore commend it for widespread use by CPR analysts and managers." (Singh, 1994:47).

In addition, several scholars, including Blaikie & Brookfield (1987), Tang (1992) and Singh (1994), have chosen to further develop the framework for their specific applications. In particular, the framework has been extended to include a third 'first-order' attribute:-

* social characteristics of the community.

Social Characteristics of the Community

In more simple frameworks of common property regimes, the objective of analysing the social characteristics of the users is to ascertain whether they are capable of organising themselves into successful collective action. Kiser and Ostrōm (1982:201) identify three characteristics of the community which are relevant to institutional analysis:

(i) the level of common understanding;

(ii) the similarity in individual's preferences; and

(iii) the distribution of resources among those affected by a decision situation.

Sugden (1984) argues that the more heterogeneous a community, the more difficult coordination becomes. Ostrom (1990a:36) explains that the type and extent of shared norms amongst the user group will have an important impact on the degree of opportunistic behaviour employed by individuals. Shared norms may prevent the need for elaborate monitoring and enforcement mechanisms, although Steins (1995) shows that in the case of an Irish oyster fishery, shared value sets amongst users resulted in a breakdown of informal monitoring and enforcement mechanisms because individuals were reluctant to expose violations by other users or impose agreed sanctions.

Norms of behaviour, which affect the way that alternative strategies are perceived will also affect the way in which strategies are evaluated with respect to time. Individuals attribute less value to benefits which they expect to receive in the distant future than to benefits to be received in the immediate future (Ostrom, 1990a & Galjart, 1992). The extent to which individuals might discount future benefits depends upon social norms of the user group and physical and economic security of the individuals. For example, resource users with descendants who expect to rely on the resource for their future livelihood are likely to place a greater value on future benefits than those whose children may already have left the area and/or are not dependent upon the resource for economic security.

2.2 Using the Adapted Framework

Rather than prescribe answers, Oakerson's adapted framework should be used to raise questions which will aid in the diagnosis and analysis of problems and subsequently help in the design of policy prescriptions. Information concerning outcomes can be used in two ways. In order to *diagnose* problems, the analyst must examine first the *patterns of interactions* between the users of the common and second, the *physical and technological characteristics* of the common, the *social characteristics of the community* and the *decision-making arrangements* governing use and management of the common.

Diagnosis of current problems will provide a clearer understanding of the relationships between the characteristics of the common and its community, the decision-making arrangement, the patterns of interaction and the observed outcomes. This understanding might then be used to examine outcomes in comparable settings, or to study outcomes when any of the variables identified change or are changed. Working *forwards* through the framework should then help to understand how altering the institutional arrangement of the commons might affect the patterns of interactions between users and the resultant outcomes. Of particular interest is the way in which the framework might be used to assist in the design and establishment of new institutions for management of common property resources.

3. ADAPTING THE FRAMEWORK FOR MULTIPLE-USE COMMONS

Several changes must be made to the simple Oakerson framework before it becomes readily usable in a multiple-use common property situation. First, the physical and technological characteristics of the resource must be analysed with respect to different uses. Second, it is vital that the additional first order attribute, *the social characteristics of the user community*, is included as part of the framework so that it facilitates analysis of the different communities involved in the use and management of the common property resource. Third, the framework should incorporate two new components, *action strategies of individuals* and *context-bound factors*. Context-bound factors affect the patterns of interaction of the resource users and so, in turn, the action strategies of individuals. This encourages the researcher to focus on how different types of users respond to different institutional arrangements. Fourth, the framework must comprise a multiple-level analytical tool in order to further an understanding of institutional evolution and the progression of institutional reform through different levels of the institutional arrangements (Kiser & Ostrom, 1982). Fifth, the framework should incorporate different rule categories, in a generic fashion, at different levels of analysis (Ostrom, 1986). Finally, the framework must be capable of repetition through a succession of chosen time periods.

3.1 Multiple Uses

In a multiple-use common property resource situation, the resource system will need to be evaluated with respect to:-

(i) each separate extractive and non-extractive use;

(ii) the resource system's ability to support combined uses.

The capacity of the resource system to support different uses will depend upon its general physical condition, the impact of each type of use and of different combinations and permutations of multiple-use. Different uses may be incompatible, with a particular use driving out other uses. For example, use of a moorland area for grouse shooting may, for safety reasons, prevent the areas being used for grazing or recreational use. Clearly, the imposition of a shooting season, can confine incompatibility in such cases to a specific time period.

Three particular physical and technological attributes are important in determining the degree of subtractablity of combined uses:-

(i) the density of the different uses (in time and space);

(ii) the changing physical conditions of the resource system (most particularly, weather influences); and

(iii) technological innovations that can reduce the impact of resource use (such as habitat restoration techniques).

The complexity of multiple-use demands an effective information base from which to design use rules. In multiple-use situations, the type of monitoring of the resource system required to help design and implement appropriate institutions may be more sophisticated than in single use situations.[14]

3.2 Multiple Users

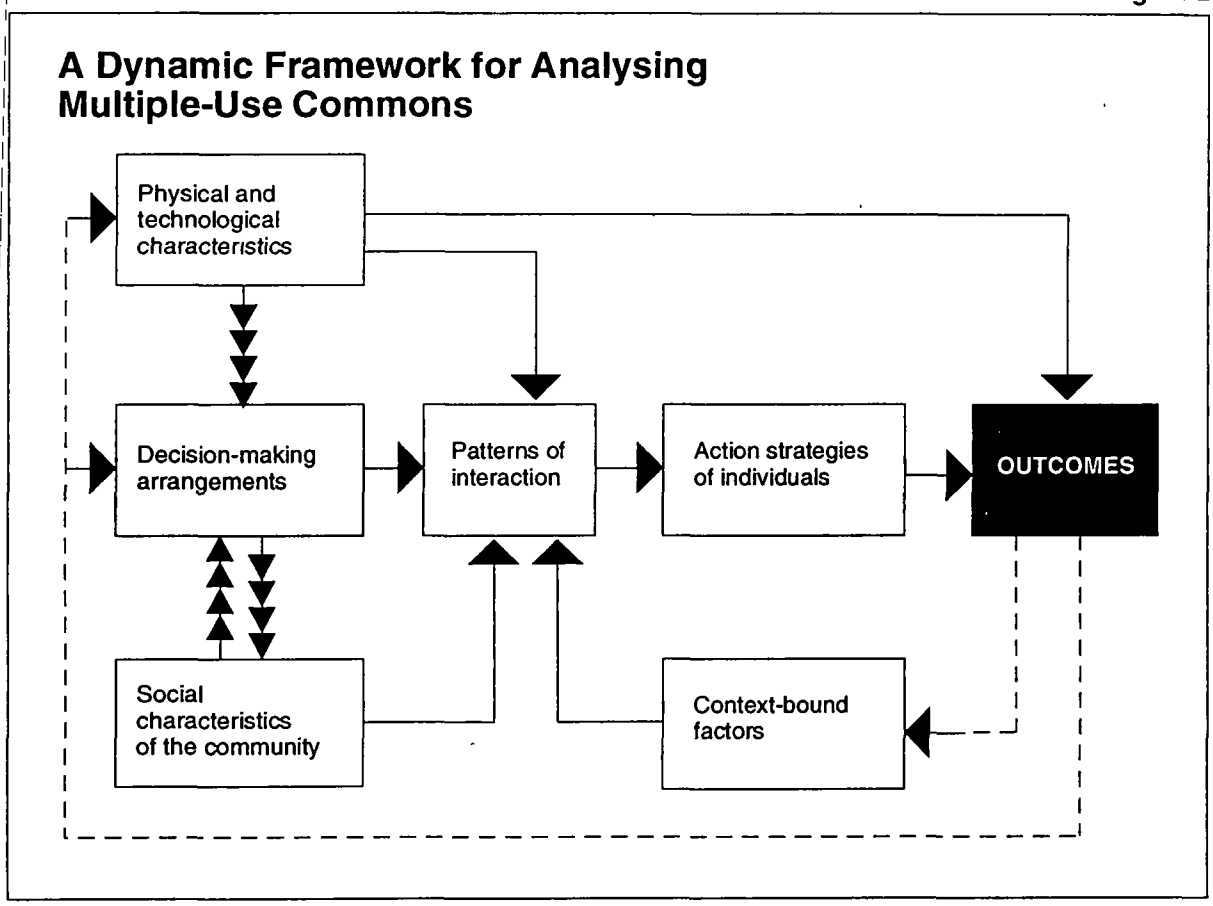
In most studies of common property resources the community is narrowly defined as the appropriators of the resource units; little attention is paid to other individuals situated around the resource system who may affect or be affected by its use and management. The reason for this is probably two-fold. First, most case studies have looked at relatively undeveloped areas of common property resources, where the majority, if not all, of the local community are actively involved in use of the resource; indeed, they may depend upon such use for their livelihoods. Second, existing case studies have tended to look at single, extractive uses of resources systems. In such cases, it is assumed that any persons resident in the local community but not actively involved in extractive use may remain relatively unaffected by their lack of involvement. By introducing the concept of other users and people who have a vested interest in how the resource system is managed, we must extend the definition of 'community'. The proposed definition of 'community' in a multiple-use situation is:-

* all individuals who have an influence over or are influenced by the institutional arrangements of the common property resource, either directly or indirectly.

This extends the 'user community' greatly and may include, for example, occasional users of a common property resource, such as annual visitors or tourists. Clearly, with such a broad definition of 'user', it is desirable to construct categories of user groups, so that some patterns of use, norms, and discount rates, etc., can be established. These in turn will help to establish separate incentive structures for different *types* of user, by identified group. Such distinctions are important since they help to explain the types of physical pressures on the resource system and the vested interests of the different groups in the evolution of institutions governing the resource. It is only through the distinction of varied incentive structures that we will be able to understand the relative stakes of each user group. Such observations will help to predict the type and extent of demands that specific user groups might have on the resource system and the likelihood that they will be able to:-

(i) act in cooperation with other users from their particular group to restrict use of the resource; and

Figure 2



Source: Adapted from Oakerson, R. (1992). Analysing the Commons.In Making the Commons Work: Theory, Practice and Policy, Ed. Daniel W. Bromley, San Francisco: ICS Press 41-59

(ii) act in cooperation with other types of resource users, in the overall management of the resource.

In many common property resource situations, the continued use of the resource system is dependent upon the continuation of combined uses (see, for example, Edwards, 1996). Limitation of the resource system to a single use is not an option and institutions must be based, therefore, on this multiple-use cooperation imperative. The identification of social subgroups; by use, socio-economic circumstance and location might further analysis of the evolution of institutional arrangements for managing the commons. In particular, it is apparent that groups participate in discussion and decision-making at different institutional levels (see below). These sub-groups may be made up of people from a similar social background and/or people united by their common *type* of use of the resource system. Having categorised different user groups, the framework can help the analyst identify how the members that comprise a group:-

(i) perceive the physical nature and value of the common property resource system;

(ii) gain access to the different levels of decision-making with respect to allocation and management of the resource;

(iii) interact within their own user group and *amongst* other user groups;

(iv) respond to influences outside the common property resource management regime;

(v) adopt individual strategies on the common;

(vi) respond to particular outcomes on the commons.

3.3 Action Strategies of Individuals and Context-Bound factors

In Figure 2, Oakerson's simple framework has been further developed to include two new categories, '*action strategies of individuals*' and '*context-bound factors*'. The presence of a well established set of rules does not necessarily guarantee successful collective action (see, for example, Steins, 1995; Eyborson, 1995; & Barrett, 1991).

North (1990b:422) comments that institutional analysis is:

> "the study not simply of the rules of the game but of the individual responses to such rules."

Resource users find themselves in complex an uncertain situations. Based on their social experience, they have to choose between different courses of action and believe that they can judge the appropriateness of these (Long, 1989). The action strategies that individuals adopt are the result of

weighing the costs and benefits of contributing to common property resource management against those resulting from alternative strategies. The way in which an individual perceives the benefits and costs of different strategies will be affected by both the situational variables of the specific common property resource and the 'external world'; the wider socioeconomic environment in which the common property resource is embedded. Situational variables include:-

(i) physical characteristics of the resource system (for example,the overall size of the resource and its productive capacity);

(ii) technology available to assist use (for example, pasture improvement techniques);

(iii) institutional arrangements for management (for example, the effectiveness of the rules of grazing the common).

Hitherto, the influence from factors outside the management of the common property resource have more or less been regarded as a 'black box' (Steins, in prep.). Only recently, the *social characteristics of the user community* have been included in Oakerson's framework (Tang, 1992; Edwards, 1996). 'Context-bound'[15] factors that influence individuals' action strategies include, *inter alia*:-

(i) opportunity costs (for example, the presence of 'better-value' economic alternatives);

(ii) past experiences (for example, successful collective action in the past will have a positive influence on decision-making);

(iii) the presence and agenda of external agents (for example, users' perception of intervention strategies from development projects);

(iv) social characteristics of the user community (for example, a community characterised by multi-stranded relationships may perceive difficulties in acting collectively).

It is important to realise that actions at the collective management level and the users' everyday environment are interdependent. In addition, the behaviour of individuals using the common is interdependent: that is, observations and expectations of how *others* behave will affect the strategies of

individuals (Runge, 1981).[16] In the evaluation of others' behaviour, users will use social experience gained from their involvement in the common, as well as experience from everyday life.

Thus, information collected on context-bound factors and different situations can be used to understand individual behaviour. Clearly, this is of particular relevance in multiple-use common property situations, where there is more than one *type* of user. Analysis of multiple-use commons must address expected differentials in the adoption of individual strategies according to use of the common. Such differentials can be observed through the analysis of the different external worlds of different types of users and how such external influences will affect the incentive structure for each individual.

3.4 Multiple Level Analysis

Although Oakerson's framework does not specify different levels of analysis, it is important to recognise that 'rules' can occur at different levels of decision-making. The multiple-use framework must be converted into a multiple-*level* analytical tool in order to facilitate an understanding of institutional evolution and the progression of institutional reform through different levels of the institutional arrangements. Kiser and Ostrom (1982) distinguish *three* levels of analysis:-

(i) The operational level of analysis considers interactions between resource users. The rules which affect behaviour at this level are derived from the collective choice level.

(ii) The collective-choice level of analysis considers interactions between the collective decision-makers. The rules which affect behaviour and decisions taken at this level are derived from the constitutional level.

(iii) The constitutional level of analysis considers decision-making arrangements external to the local community.

Thus, the rules affecting operational choice are made within a set of collective-choice rules which are themselves made within a set of constitutional-choice rules (Figure 3).

Operational Level

Operational rules directly affect the day to day decisions made by individuals. Their purpose is to regulate behaviour in the interest of maintaining the resource system and, in particular, its ability to continue to produce an acceptable flow of resource units over time. Indeed, the success of operational rules might be measured by their ability to ensure that the products of the resource are sustainable at a particular level over time. In the case of the multiple-use commons, this should include not only the common's ability to produce a flow of extractive resource units (such as grazing units), but also the common's ability to sustain a certain amount of resource-system users over time.

The degree to which use of the resource subtracts from the resource itself will determine the type of operational rules which must be devised. Some single uses of the common, if practised to a large enough degree, can deplete or degrade the common over time. Different uses may be mutually incompatible, with a particular use driving other uses out. Rules which are devised to limit use of the common to a sustainable level will reflect the subtractability of different uses. For example, on common land, highly subtractive uses, such as peat cutting, may be limited in area or prohibited altogether. Less subtractive uses, such as grazing, which can damage the common through cumulative use, might be limited in duration. Where more than one use is made of the common, then operational rules must take into account the relationships *between* the uses. Where uses are mutually incompatible, segregation of use over time or area might be necessary. Thus, operational rules governing multiple -use of common land might comprise:

(i) Definition of users - such as a register of people entitled to access to the common and clarification of the details of different rights.

(ii) Specification of what each of the categories of users can do - rules concerning the manner in which the common may be used.

(iii) Details of how the different rules will be enforced - who will adjudicate disputes and what recourse they will have in attempting to remedy issues.

Clearly, coordination of the use and management of the common is facilitated if all users and other interested parties share knowledge of the operational rules.

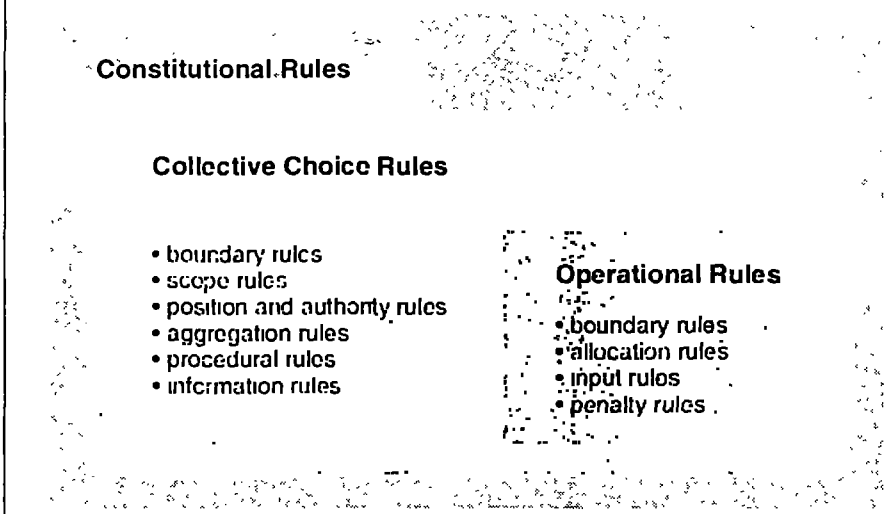
Collective Choice Level

Collective-choice rules indirectly affect operational choices. Whilst operational rules control use of the resource system by establishing constraints, they are not self-generating nor can they be enforced without the presence of some collective body. Collective choice rules are used by the resource users, their officials, or external authorities in making policies (the operational rules) about how the common property should be managed. They establish institutional arrangements to enforce the operational rules, resolve any conflicts, enforce decisions, and subsequently monitor, and modify the existing set of operational rules.[17]

The holders of rights at the operational level will not necessarily have the right to participate in collective-choice actions (Schlager & Ostrom, 1992:251). This holds important implications for the future use of multiple-use commons with competing uses; it is this right to devise future operational-level rights that makes collective-choice rights so powerful. Any analysis of a multiple-use common property regime must identify those members of the community who are involved in collective-choice decision-making in order to reveal the relative power of different user groups. For example, analysis of the multiple-use commons of the New Forest reveals the predominance of certain groups throughout history (Edwards, 1996).

Figure 3

Decision-Making Arrangements: The Nesting of Decision-Making Rules.



Source: Adapted from Ostrom, (1986) An Agenda for the study of Institutions. Public Choice 48: 3-25

Constitutional Level

Constitutional level rules govern future collective decisions with respect to the common property resource. Constitutional-choice rules determine (i) who is eligible to participate in the system and (ii) what specific rules will be used to form the set of collective-choice rules, which in turn affect the operational rules (V. Ostrom, 1982). Thus, it is at the constitutional level that we must analyse the processes used to create, enforce and modify collective-choice or 'organisational' rules.[18]

Decision-making rules which are *external* to the immediate user community of the common property resource affect the operation of the resource both indirectly and directly. First, they may affect the management of the resource by determining the specific rules to be used when establishing the set of collective-choice rules present and so influencing the way in which the community engages in collective-choice decision-making. For example, constitutional level rules might specify the terms of reference of the organising body or bodies responsible for controlling use of the common property resource. Second, the community may be directly dependent upon external decision-makers for legislation and enforcement of operational rules.

In addition to the constitutional level rules which *directly* affect the resource and its governance, constitutional arrangements external to the resource may be relevant *indirectly* in establishing economic, social and legal parameters within which management of the resource system can be undertaken.

3.5 Generic Rule Configuration

Different authors have identified different categories of rules (Kiser and Ostrom, 1982; Ostrom, 1990a; Tang, 1992). The multiple-use framework presented here adopts categories of rules advocated by Ostrom (1986) in a generic fashion at both the operational and collective-choice levels. This is particularly useful in enabling the researcher to evaluate (i) the treatment of different groups of users of the common at the operational level and the relative equity of the regulation of extractive and non-extractive uses; and (ii) the relative authority and responsibility of the different organisations involved in the management of the commons at the collective-choice level.

For the purposes of multiple-use commons, four categories are identified in the conceptual framework at the operational level (Figure 3):-

Boundary rules

Boundary rules limit the number of individuals entitled to resource units from the common.[19] The existence of boundary rules prevents a sharp increase in the number of users of a common, making the common a 'common-pool' resource as opposed to one with open access to all.[20] In a multiple-use situation, it is important to identify any lack of congruence between the boundary rules applied to different users. For example, for a fishery, a register of commercial fishers may be kept to identify all those with access rights to the fishing grounds. If no similar boundary rule exists for recreational

fishers, one might expect a breakdown in the common property regime, as commercial fishers recognise that their common property resource is in fact open to all. In a less extreme case, whilst recreational fishers may be subject to boundary rules, power boat operators may not. In such a scenario, the power boat operators could sufficiently disturb both the commercial and recreational fishers to upset the stability of the common property regime.

Allocation rules

Allocation rules prescribe the procedure for limiting the amount of use units individuals can withdraw from the common. Allocation rules might restrict, for example the type and number of animals which may graze common land or the type of nets which might be used in a common fishery. Again, in a multiple-use situation there should be parity between the allocation rules for different users. This is difficult when one set of allocation rules might govern extractive uses and another govern non-extractive uses. For example, simple allocation rules for pasture include rules of 'stinting', 'levancy and couchancy' or 'home-feed', all of which restrict the amount of grazing animals that can be depastured.[21] Devising and enforcing allocation rules for horse-riders, who use the entire resource system, may be more problematic. If such rules are to be devised with some specified outcome in mind (for example, no long term damage to vegetation), they are likely to include restrictions on where, when and for how long riders may have access to the resource system.

Input rules

Input rules specify the amount of labour and other resources which each user must contribute to the management of the resource system. For example, on smaller grazing commons, graziers might cooperate to provide operational management, such as renewing fencing and water troughs. For a collectively owned irrigation system, contributions may take the form of monetary payment to some organisation which manages the irrigation system on behalf of the farmers. When the type of task necessitates the presence of large numbers of people (such as the rounding up of animals) then all users will be expected to participate. The extent to which participation at such events is a written requirement of each user or merely relies on peer pressure may be a good indication of the cohesiveness of the user community.

In a multiple-use situation, the complexity of organising contributions from a large number and wide variety of users may result in the need to install management teams and demand monetary payment from users in order to support such teams. Whilst this might be the most efficient means of organising management in the short term, it may gradually erode the sense of commitment of individual users to their community group. Collective action which directly relates to the ongoing management of the common property resource can form an important social function and provide regular opportunity for individuals to meet and renew shared norms and interests. If a particular group depends upon operational level interaction to maintain its cohesion (for example, if it is less active as a group at the collective-choice level), removal of any collective labour input can be particularly harmful.

Penalty rules

Penalty rules specify the penalties for breach of operational rules. The most effective design of penalty rules depends upon the characteristics of the users' community. A homogeneous community may be able to rely on peer pressure for effective enforcement of rules. It is generally accepted that severe penalty rules need to be enforced by some external authority with legal power for coercion. Penalty rules may take the form of fines to be imposed, sanctions or total exclusion from the resource.

In a multiple-use situation, penalty rules based on peer pressure may be less effective in the long term. Where multiple uses and, more particularly, multiple types of users are present, a 'them and us' scenario can arise, whereby users from one category fail to enforce their own operational rules effectively. This can happen for several reasons. For example, resentment of the presence of other users (particularly 'newcomers') may be enough for one user group to increase its exploitation of the resource system in group self-interest. Alternatively, users may fail to identify and impose sanctions on violators because they do not wish to attract the poor public image associated with violation by members of their particular user group. Equally, peer pressure may break down simply because one particular user group is too busy focusing its attention on potential violation of operational rules from another user group, and so ignoring day to day management of its own use.

At the collective-choice level, six different categories are adopted for investigation (Kiser & Ostrom, 1982:93):-

Boundary rules

At the collective-choice level boundary rules set the entry and exit conditions for participating in any collective-choice decision-making arenas. They should specify, for example, who may be a member of any collective-choice decision-making organisation; whether membership is compulsory for users of the resource; and whether rights of collective-choice decision making can be taken away from members. The boundary rules determine, to a large extent, the legal domain of the collective decision making body. Highly specified boundary rules may have the effect of restricting participation in the collective-choice level of decision-making to a well-defined subset of resource users. This, in turn, might be expected to change the nature of the operational rights defined over time for use of the common property resource. In a multiple-use situation, it is important to check that:-

(i) collective choice arenas exist for all types of uses;

(ii) all users have access to the collective choice arenas; and

(iii) all users are encouraged to become involved in institutional reform.

Scope rules

Scope rules specify allowable action and allowable outcomes from interaction within organisations. Such action might include the ability of the organisation to sanction certain uses of the resource system or to allow for the transfer of rights within and outside the existing group. For example, users may be able to sell or licence their rights to other users or to individuals with no rights. The ability of a group to exercise such arrangements will depend upon the relationship it has with the wider legal environment. It may be that while certain groups have rights to use the resource system, they have no power as a group to regulate overall use of the resource system. The ability of users to influence other uses of the common property resource is of particular interest in the multiple-use context.

In most multiple-use scenarios, several collective decision-making arenas may be in place at any one time. Different uses of the resource system may be governed by different organisations, although these may have overlapping responsibilities. It is vital, therefore, that the analyst understands the dynamic relationship between such organisations; particularly in terms of which has the ultimate authority over users and so controls overall use of the resource system. For example, in 1992 English Nature launched the "Campaign for the Living Coasts". This campaign includes the "Estuaries Initiative", which aims at promoting cooperation between central and local government, public bodies, maritime users and the voluntary sector, to develop strategies for estuary management. In the Medina Estuary (Isle of Wight), local Harbour Authorities initiated the development of an *Estuary Management Plan*, in conjunction with the County Council, English Nature, National Rivers Authority and Southern Water (CCZM, 1996). All these, who are part of a steering committee, have certain powers to control use of the Estuary. For example, English Nature have the power to notify specific areas as a nature reserve and impose related restrictions on use. However, ultimately, use is most controlled by the local Harbour Authorities and the local interest groups (who are not members of the actual steering committee; for example, the Federation for Sea Anglers and the Royal Yacht Club), since both are able to most effectively monitor use at the operational level.

Position and Authority rules

Position and authority rules distribute authority among the positions within organisations and thus allow individuals within those positions to take particular actions. In a multiple-use situation, the analyst should check whether similar authority rests with similar positions in different governing organisations. For example, in the case of the New Forest commons, 'Agisters' have the authority to order graziers to take specific stock off the common, at their discretion, when they suspect that either the common is overgrazed and/or that the animals are in poor health. Forest 'Keepers', who are responsible for the enforcement of recreational rules, have no such flexible authority to request, for example, mountain bikers to refrain from using a specific area of the common when they perceive that it is becoming eroded (Edwards, 1996).

Aggregation rules

Aggregation rules specify how joint decisions within the organisation may be aggregated. This may include, for example, the rules related to referenda and what constitutes a 'win' in terms of a proposed motion. Of particular interest in a multiple-use situation is the way in which decisions from different collective-choice arenas are aggregated. For example, partnerships between the European Union (EU), a country's governance and local organisations have gained increased popularity in the past decade. Their aim is often to support socio-economic development in deprived areas. In many cases, the result of this 'partnership' has been that the EU, as most powerful agent, has set the development agenda.

Procedural rules

Procedural rules link decisions together in complex situations. They specify the various paths which changes in policy must take before rules are changed. Again, in a multiple-use situation, it is imperative that different user rules are treated in a uniform fashion. If multiple-use has evolved over time, which is the most likely scenario, then it is unlikely that there will be parity between different types of procedural rules. For example, in the New Forest example above, the Keepers could only obtain the authority to act with discretion over recreational users through lengthy appeal to a higher authority and a change in legislation. Until uniformity is achieved in terms of how rules can be changed, inefficient institutional arrangements are likely to persist.

Information rules

Information rules specify information constraints in the organisation and how information about use and management of the resource system and any institutional changes will be conveyed to those involved. It may include, for example, rules concerning the notification of seasons in a particular year, election of officials, revised payments and fines. Communication *inter* and *intra* different groups must be taken into account when such information rules are devised. Poor communication links can be improved through the operation of specific rules. This can be important when voluntary compliance with operational rules is relied upon. For example, wide dissemination about a particular group's willingness and ability to restrict its own use for the long terms benefit of the resource system can prove a motivating factor in persuading other users to comply with similar restrictions.

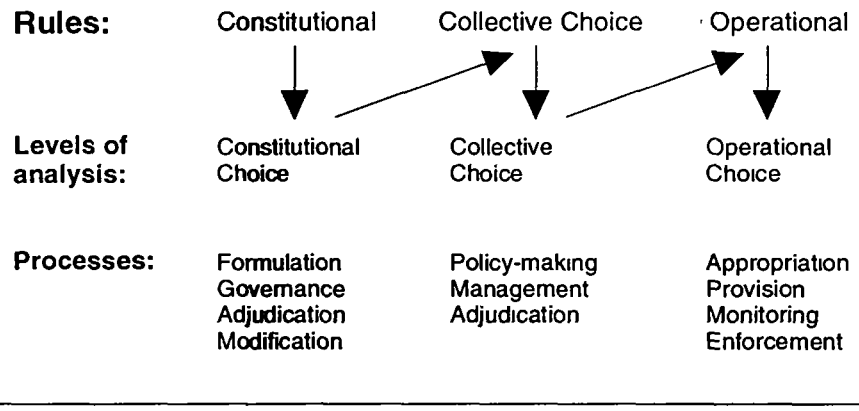
3.6 Multiple-Use Framework - Relationships Between the Variables

Figure 2 presents the completed multiple-use framework. Lines between the variables indicate the dynamic nature of the different component parts.

The fact that physical and technological characteristics can have a *direct* effect on outcomes is indicated by a strong black line. In addition, physical and technological characteristics can have an *indirect* effect on outcomes by (a) influencing the type of the decision-making rules which are adopted and (b) affecting the action strategies of individuals. The social attributes of the user's community have no *direct* effect on outcomes, but can only affect outcomes through (a) their

Figure 4

Links Between Different Levels of Decision Making



Source: Ostrom, E. (1990). Governing the Commons, New York: Cambridge University Press

influence on the decision-making rules (institutional arrangements) and (b) the effect that they have on patterns of interaction and selection of individual strategies. In both cases the lines are shown with a series of arrows to illustrate the dynamic nature of the relationship: as the physical and technological and social characteristics change, so the effect that they have on the decision-making rules and individual strategies continue to change. The separated box, *context-bound factors* influences action strategies.

The framework further develops Kiser and Ostrom's general institutional framework (1982), Oakerson's common property resource framework (1986 & 1992) and Tang's adaptation of it (1992), by showing that the relationship between the social characteristics of the community and the decision-making arrangements are reciprocal in nature. That is, that the social characteristics of the community affect and are affected by the decision-making arrangements for the commons. This is represented by a series of arrows, leading from the decision-making arrangements back to the social characteristics of the user community. The reciprocal nature of this relationship is particularly important in a common property regime with a long history of use. The decision-making arrangements governing use of the resource will establish the choice sets available to the community of potential users. In this respect, the decision-making arrangements are bound to influence the development of social characteristics in the community. For example, in the case of the New Forest commons, it has been recognised that a subsector of the total user community, the traditional graziers ('commoners') of the area have encountered over 900 years of governance whereby individuals outside their own immediate community (from a 'higher' socio-economic standing) have controlled the collective-choice decision-making arenas on their behalf. As a result, the commoners have failed to develop the necessary skills to participate effectively in contemporary collective-choice decision-making arenas, nor does their culture present them with the will to do so. As a result, evolution of operational rules has been very much influenced by new types of users (such as recreational users), who have greater access to the collective choice decision-making arenas (Edwards, 1996).[22]

3.5 Making the Framework Dynamic - Links Between the Different Levels

Ostrom (1990a:52) illustrates the linkages among rules and the related level of analysis at which individuals make choices and take actions (see Figure 4):

> "The processes of appropriation, provision, monitoring, and enforcement occur at the operational level. The processes of policy-making, management, and adjudication of policy decisions occur at the collective-choice level. Formulation, governance, adjudication, and modification of constitutional decisions occur at the constitutional level."[23]

The "nesting" of rules within rules demands dynamic, multi-level analysis of common property resource problems. Decision-makers at the operational level are not helplessly constrained by the institutional rules which govern them, but are able to change them. Indeed, institutional change at one

level is the *outcome* of *patterns of interaction* at another level. According to Ostrom (1990a:50),

> "Individuals who have self-organising capabilities move back and forth between operational-, collective-, and constitutional-choice arenas, just as managers of production firms switch back and forth between producing products within a set technology, introducing a new technology, and investing resources in technology development."

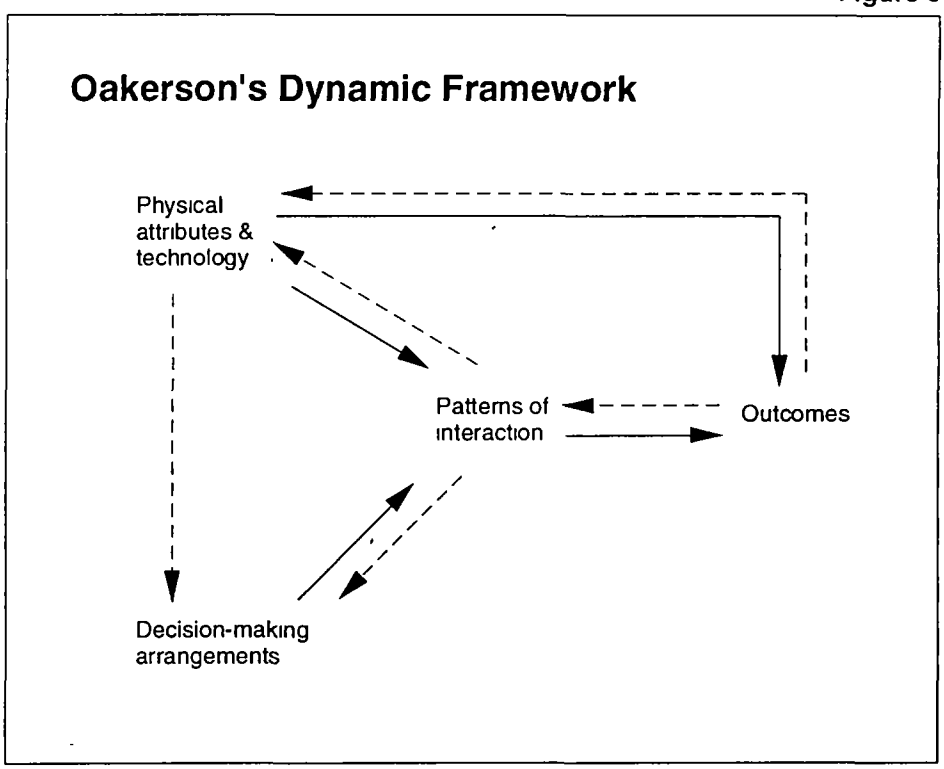
In this respect, it is also essential that the framework is dynamic, with inquiry moving back and forward between levels of analysis. Oakerson's simple framework is essentially static, providing the analyst with a 'snapshot' of a specific common property regime at a particular time. This assumes that the physical and technological characteristics of the resource system, the social characteristics of the user community and the decision-making arrangements are unchanging in the short term. In the long term, analysis must allow for change in one or all of these first order characteristics. If the framework is simply repeated over time it will help merely to identify changes at successive points; taking a series of 'snapshots' and failing to analyse the *continuously* changing exploitation of the commons and the institutions governing them does not help to explain how and why institutional change was brought about.

Oakerson (1992:56) suggests that in order to aid analysis of institutional change, the framework can be modified by adding a set of long-term relationships, shown by the broken lines in Figure 5.[24] In the more dynamic model, outcomes can affect patterns of interaction through a process of learning, by which individuals modify their strategies and modify institutional arrangements in order to produce preferred outcomes. Equally, individuals may invest in technological innovations that will change the physical characteristics of the commons. For example, investment in irrigation systems might allow better growth of grass in summer months. Unfortunately, the physical characteristics of the resource may also change over time as a result of the strategies pursued in securing certain outcomes. For example, strategies of increasing the number of stock turned out on the common might result in degradation of the resource system and its ability to renew forage.

Whilst Oakerson's adaptation of his framework is useful in explaining the dynamic relationships between its different components, it does not help to explain how institutions evolve. For example, how does the observation of a particular outcome at the operational level (such as a lack of grazing) result in a new policy and set of operational rules? The answer appears to lie in the multiple-level analysis, which helps to explain how an observation at the operational level gets translated into major legislative change.

In a multiple-use situation, a framework that facilitates multiple level analysis is important because lack of congruence between the first order variables (physical and technological attributes of the resource; social characteristics of the user community; and decision making arrangements) may occur at the operational, collective *or* constitutional level. Thus, the multi-level framework should be

Figure 5



Source: Oakerson, R. (1992). Analysing the Commons. In Making the Commons Work: Theory, Practice and Policy, Ed. Daniel W. Bromley,San Francisco, ICS Press, 41-59

repeated through a succession of chosen time periods. Once adapted in this way, the framework can be particularly useful in explaining the nature of institutional evolution and how the outcome of institutional reform in one period can form the basis for the decision-making rules in next. It enables the researcher to draw conclusions regarding the institutional evolution of the commons by freezing analysis within a given time period at successive intervals.

Enabling the analyst to investigate multiple levels at successive points in time reveals the effect of the underlying institutional arrangements which might influence access to different decision-making arenas at different times. For example, in a study of the New Forest commons, the multi-level framework helped to explain the dynamic relationships at work for over nine hundred years of institutional evolution and to identify more specific points at which institutional change was slow or non-existent and why users of the resource had difficulty in realising such change (Edwards, 1996).

Figure 6 illustrates the evolution of institutional change in a hypothetical example, by showing how lack of grazing on a common gets translated into a new piece of legislation through a rather complicated procedure, which involves:-

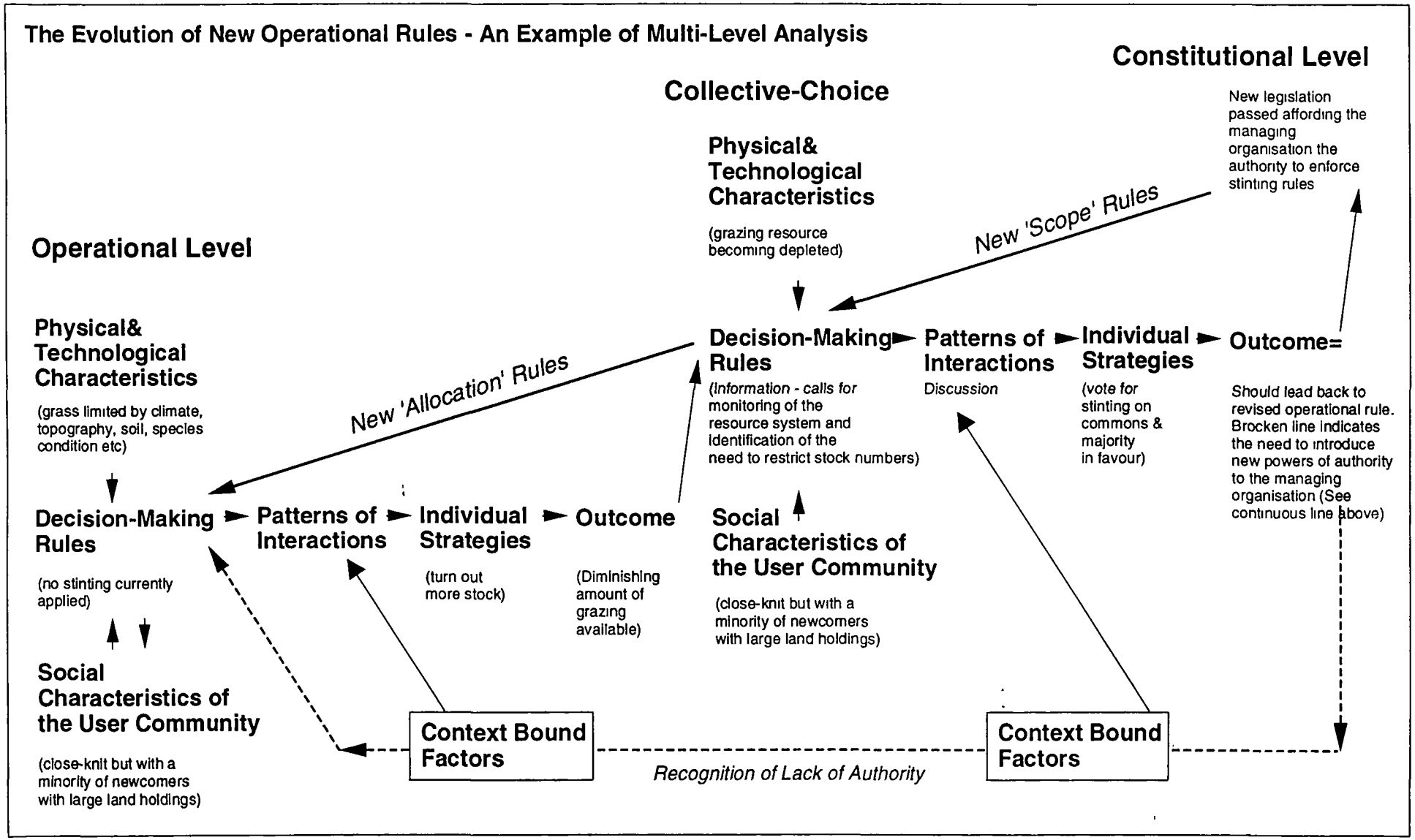
1. monitoring of the resource system;
2. acknowledgement that there are too many cattle grazing the common in relation to the resource system's ability to produce forage;
3. recognition of the need to reduce the number of cattle on the common;
4. discussion, followed by a majority vote that some form of restriction of cattle numbers should be imposed;
5. realisation that the managing organisation has no authority to introduce or enforce rules that limit the number of cattle depastured;
6. application to a higher authority for additional powers for the organisation;
7. drafting and passing of a piece of legislation awarding such powers.

In addition, the cycle could be followed further to include:-

8. introduction from the collective-choice level of a rule of stinting that is related to the size of each commoner's holding;
9. widespread violation of the rules of stinting and problems with effective enforcement;
10. continued degradation of the grazing;
11. identification that the rules introduced do not suit the user community;
12. design of new stinting rules by the managing organisation.

In the follow-up to the example (see Figure 6), widespread violation of the new stinting rules takes place because of a context-bound change. The user community in this scenario comprises the owners of a few large landholdings, who are relatively new to the community, and the owners of numerous

Figure 6


The Evolution of New Operational Rules - An Example of Multi-Level Analysis
Constitutional Level
Collective-Choice
Physical& Technological Characteristics
(grazing resource becoming depleted)
New legislation passed affording the managing organisation the authority to enforce stinting rules
New 'Scope' Rules
Operational Level
Physical& Technological Characteristics
(grass limited by climate, topography, soil, species condition etc)
New 'Allocation' Rules
Decision-Making Rules
(Information - calls for monitoring of the resource system and identification of the need to restrict stock numbers)
Patterns of Interactions
Discussion
Individual Strategies
(vote for stinting on commons & majority in favour)
Outcome=
Should lead back to revised operational rule. Brocken line indicates the need to introduce new powers of authority to the managing organisation (See continuous line above)
Decision-Making Rules
(no stinting currently applied)
Patterns of Interactions
Individual Strategies
(turn out more stock)
Outcome
(Diminishing amount of grazing available)
Social Characteristics of the User Community
(close-knit but with a minority of newcomers with large land holdings)
Social Characteristics of the User Community
(close-knit but with a minority of newcomers with large land holdings)
Context Bound Factors
Recognition of Lack of Authority
Context Bound Factors

well-established small landholdings, who depend on the resource for their livelihood. As a result, the new stinting rule, which specifies that the amount of cattle to be kept on the common is proportional to the size of each grazier's holding, is not widely accepted by the traditional commoning community.

The multi-level framework can be important also in the analysis of different user groups, by identifying which user groups in the overall community are involved with institutional reform, and in revealing the disparity of involvement of different groups at different levels. Our current work on the Medina Estuary, Isle of Wight, reveals that one local user group (recreational fishers) have greater involvement at the operational level, but that an external user group (recreational sailors from all over the UK) enjoy greater access to the collective-choice decision making arenas. In such a case, one would expect the design and enforcement of new operational rules to favour use of the resource system by recreational sailors because of their greater influence at the collective-choice level, where operational rules are devised.

4. CONCLUSION

4.1 The Need for a Multiple-Use Framework

Oakerson (1992:42) likens commons to a factory, but states that they differ in that commons produce "not a series of differentiated products, but a stream or pool of undifferentiated 'product' from which individuals take a portion for their use." His analogy, which emphasises the production of a single product from commons, is misleading in its implication that only a single stream of benefits might be derived from a single resource system. Many commons around the world produce a stream of differentiated benefits or 'products'. To this end, conceptual frameworks must be developed which can be properly applied to such *multiple-use* commons. In particular, they need to be adapted to take account of *all* resource users.

The Oakerson framework is useful in the analysis of relatively simple and small-scale common property resource situations, where:-

(i) the resource system is owned in common by the users;

(ii) the resource system is exploited for a single (or very few) extractive purposes, such as grazing, forestry, fishing;

(iii) the users can be identified as a single community.

The simple framework is particularly useful in analysing common property resources in rural communities that still derive their primary existence from the resource system. However, as the community becomes more diverse, as other uses of the commons emerge (especially 'new', non-

extractive uses, such as amenity uses), and where resource management is increasingly affected by external policies, then the basic framework may be too simple to take account of the new pressures. If the framework continues to focus on the extractive use of the commons, other uses will be ignored in analysis. In such cases, the framework will fail to identify those new community groups and the incentives which they face when making decisions about their use of the commons. A multiple-use framework must be adopted, therefore, which incorporates:-

(i) physical characteristics of the resource system, in terms of different uses;

(ii) the social characteristics of the wider user community;

(iii) individual action strategies, influenced by context bound factors;

(iv) multiple-level analysis, at the operational, collective-choice and constitutional levels;

(v) rule categories in the analysis of the decision-making arrangements.

In addition, for the purpose of time series analysis,

(vi) the framework should be capable of being repeated and used to create distinct periods, characterised by institutional change.

4.2 Multiple-Use Frameworks and Change

Institutional analysis emphasises the need for institutional change as economic and social circumstances change: emerging problems require flexibility and innovation. Bromley (1985:784) refers to the need for dynamism in institutions as the "order-change antithesis", and recognises that:

> "order creates expectations about secure futures, but there must also be mechanisms for mid-course correction. .... Too much 'order' and not enough 'change' insures revolution, too much 'change' and not enough 'order' insures the absence of expectations, and hence stagnation."

It is vital that any institutional arrangement for the management of a common property resource is flexible enough to accommodate change. Change is demanded when there is a discrepancy between achievable and desired social goals and actual outcomes that arise from present institutional arrangements. In particular, institutional arrangements that have supported the use of a resource with a single, traditional use must develop in order to accommodate any additional, contemporary uses. Livingston (1987:287) confirms this requirement:

> "resource use for recreation, aesthetic and intrinsic purposes places increased demands and pressures on the environment. According to institutional theory, arrangements governing resources and their use must adjust to accommodate a new mix of social goals."

Most common property resources that begin with a single use evolve into multiple-use scenarios. Often the institutions devised to govern single use of the common property cannot cope with the demands of the new, competing uses. If revised institutional arrangements are not forthcoming, drastic institutional reform might be imposed on the particular regime; such as privatisation or nationalisation of the common property resource. Failure to understand the reason why a particular regime is not adequately taking account of new uses will impede the design of successful revised institutional arrangements for both the resource in question and other common property resources around the world. Analysis must further our understanding of the limits to which collective management of resources can be achieved.

The institutions governing the use and management of multiple-use commons have often evolved over hundreds of years. In such cases of long term institutional development, changes in the institutional arrangements occur within and are linked to ongoing evolution in the system of resource exploitation. The multiple-use framework presented recognises that the evolution of a particular rule may involve all three institutional levels. However, the institutional development does not occur exogenous to the characteristics of the common property regime, as defined by the framework. Thus, the physical and technological characteristics of the resource, social characteristics of the user community, the individuals strategies, the influence of context-bound factors, patterns of interaction and outcomes, all occur at each level of analysis and each stage moves the common property regime on in time.

4.3 Criticism of the Framework

In developing the multiple-use framework, we have been able to identify several criticisms of this particular framework and frameworks in general.

Evaluating Multiple-Use Outcomes

A particular problem is the need to be able to identify preferred outcomes for the use of common property resources. In measuring the performance of a common used only by only one type of user, Oakerson's use of efficiency as a criterion is useful. However, it becomes problematic when we introduce other users to the scenario; particularly non-extractive users. Performance means different things to different users. Efficiency measures need to be qualified by the perceptions, values and attitudes of different users. It may be necessary in a multiple-use scenario to introduce new criteria for performance of the common and to change the basis of performance measurement in order to recognise competing demands. Second, overall measurement becomes even more complex when each individual is asked to judge the optimal rate of the other's use of the common. Previous research on common property resources has also highlighted the problem of specifying an effective measurement

of performance for the outcome (Peters, 1986:618):

> "the questions to be asked, then, are whose equity and whose efficiency, or whose success and whose failure are we measuring in assessing performance?"

The problem stems clearly from the manner in which operational objectives are defined by separate groups. As soon as more than one type of user is introduced to the common, then multiple *types* of objectives might apply. The inherent problem is that user groups will focus on their objectives for commons as *use* goals, such as:-

* 'to extract x units of grazing per annum';
* 'to graze 'y' number of ponies per annum';
* 'to ride on the commons for z hours per day.

Decision-making forums which are established as bargaining arenas for different user groups to further their own cause will encourage conflict, although might help to establish platforms that can be used for resource use negotiation (for example, Roling, 1993). The collective-choice institutional arrangements should facilitate, through such platforms, the formation of resource-based objectives, which seek conformity by setting ideological objectives for the resource and the institution, such as:-

* 'to conserve the resource over time';
* 'to improve the resource system's ability to restore itself'.

If user groups are genuinely prepared to start debating the premise that they wish to conserve the resource system over time, then the design, implementation and, in particular, enforcement of operational rules should be achievable as user groups decide collectively upon limits to their use. Nevertheless, the effectiveness of such institutions would rely heavily on mutual confidence in compliance from other users. The complexity of the uses made of the commons and the sheer extent of the commons suggest that a third party authority will always be needed to facilitate, monitor and enforce operational rules and to provide a context for conflict resolution.

Oakerson's second criteria, that of equity, is equally problematic. Again, the use of equity as a performance criterion for management of commons must be adapted in the case of multiple-use commons to include equity amongst different *types* of users, not merely *amongst* users from a single group. Ostrom (1992:309) suggests interesting measures of efficiency and equity which may be particularly relevant in the multiple-use setting. She raises the issue of the difference between the benefits arising from the operation of an organisation formed by the commons' users and the decision-making and potential deprivation costs of the organisation:

"A minimal efficiency criterion is that this difference is positive."

Thus, measurement might be adapted to the multiple-use setting by measuring the amount of benefits each different user group receives from the commons relative to the amount of costs they incur in contributing to the overall management of the common and the operations it supports. Wherever net benefit is revealed, then at least minimal efficiency might have been achieved for that particular user group. She then suggests that two questions are involved in using the criterion of equity (Ostrom, 1990a:309):

(i) Is the distribution of the costs roughly similar to the distribution of benefits?

(ii) Are there patterns of redistribution that appropriators wish to achieve at this level of organisation?"

Inappropriate Use of the Framework

Collective action research tends to examine resource management in isolation from wider socio-economic environments. In doing so, context-bound factors can be overlooked. Such factors are important because of the interdependent nature between the common property resource management system and the users' everyday life. The Oakerson framework, even when used in a single-use setting with a single user group, fails to examine the wider environment. In this respect, it cannot explain the fact that outcomes are successful, since it only examines the resource management system in isolation from its wider environment. Influences from outside the management system, however, might be critical factors in the success or failure of collective resource management. The setting within which the management system is located influences the actors' priorities and, as a consequence, the extent to which they are prepared to fulfil the demands made by the collective management system. These priorities do not only vary between geographical settings, but also between users who are engaged in the same management system. Moreover, individual action strategies will be reshaped through interactions between shareholders, other individuals and non-human entities (such as the resource, the state of the economy, etc.) (Steins, in prep.).

A second danger of using the framework and frameworks in general, lies in the temptation to employ it as a blueprint rather than a heuristic tool. Frameworks should be used to order information and to facilitate understanding of resource management problems. Common property resource management is a social process; the outcome of the intermingling of the collective management system and context-bound factors. As such, isolated examination of the interactions between the component parts will not provide a blueprint for design of resource management systems.

4.4 Future Developments

Many resource management situations reflect the 'commons dilemma', in which two underlying dynamics occur.. First, there is a conflict between short-term self-interest and the long-term interest of the community. Second, there is the perception that resource use by one person has little effect on overall consumption and that constrained action by one individual will have only a minimal impact on the resource (Shelling, 1971). For example, large areas of land in public ownership, including national parks in many countries, exhibit classic examples of the commons dilemma; whereby exclusion is difficult, because of natural physical features or political pressure and where the presence of one visitor subtracts from another. To view the situation as a commons dilemma rather than a need for public control prevents the range of possible solutions from being narrowed down too early on in the policy process. Effective management of such areas may involve public/private group partnerships, known as 'co-management arrangements', whereby state governments define group rights and govern inter-group interactions, and local organisations govern interactions among members within a particular group (Swallow & Bromley, 1994).

Involvement of local communities in the management of public lands can help to ensure that access to and management of public lands is not determined on the basis of maximising the net economic benefits of any one particular activity - be it logging, grazing, or tourism - but that decisions are considered in a broader context of providing a suitable system in which competing uses might co-exist. Analysing wildlife as a common property resource has led some African nations, most recently Kenya, to re-arrange the institutions governing wildlife management in favour of co-management arrangements (Gibson & Marks, 1995). In such cases, the nation states have acknowledged the importance of the allocation of rights to the common property resource and associated distribution of benefits in the design of effective management institutions.

Of particular interest to this paper is the extension of the commons dilemma as a concept in the analysis of multiple-use management, where 'use' involves both extraction of use-units and non-extractive use of the entire resource system. In essence, any resource management situation where: (i) there are a number of competing uses, (ii) exclusion is problematic and (iii) a degree of subtractability exists, may be analysed as a common dilemma. In Britain, the coastline provides a good example, where several conflicting uses (recreation, fishing, waste disposal, conservation, military defence) meet in a dynamic and fragile environment. The problems of exclusion suggest that institutional arrangements based on cooperation may be more effective than a regulatory approach. Co-management arrangements, whereby local or central government defines group rights and governs inter-group interactions and local organisations govern interactions among members *within* a particular group may be the most effective means of combating the enforcement problems associated with multiple-use control in such areas.[25]

Land management problems often display many of the classic problems inherent to those found in the sharing and managing of resources, such as overuse, congestion and free-riding and where, over time,

the resource base itself may be depleted. In such cases, it is vital to recognise the place that institutions may play in preventing the tragedy of the commons occurring. A framework which makes institutions the focus of the analysis may be particularly appropriate. Whilst analysts from different disciplinary backgrounds continue to analyse institutional arrangements according to their particular perspective, the multiple-use framework holds great scope to the land manager who may wish to combine different approaches in the analysis of a single problem. Land management as a discipline offers no single analytical perspective, framework or model. It lies, essentially, as a collection of disparate subjects which are brought together in case study work. As such, it has no theoretical base of its own, but borrows from the theories of different disciplines when confronted with a problem solving exercise. It has, therefore, often been considered an art rather than a science. In this respect the institutional approach has much to offer land management. It provides a theoretical structure for enquiry which is broad in its scope and yet capable of bringing together and ordering data from multiple sources. In doing so, it enables the analyst to research problems in the holistic fashion which is expected of land managers.

Further research will examine and test the worth of adopting this multiple-use in the analysis of land management problems and in designing analytical frameworks which characterise the institutional approach.

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[1] Hardin uses the example of an area of grazing land to express the depletion of resources used in common. Use of the common is analysed assuming that each grazier acts as a rational individual. Each grazier, because he receives direct benefits from his own animals and bears only a delayed share of the costs resulting from overgrazing, is motivated to add more and more animals to the common. The tragedy is that the common becomes overgrazed as "each man is locked into a system that compels him to increase his herd without limit." (Hardin, 1968:1244). A succession of authors have subsequently criticised Hardin for his exposition. Dasgupta (1982:13) comments that: "it would be difficult to locate another passage of comparable length and fame containing as many errors."

[2] Authors from other disciplines, working in similar areas, have identified the importance of institutional arrangements, albeit using different terms. Curtis (1991:12), a social anthropologist, refers to "organisations" and "structures" but captures the essence of institutional arrangements when referring to problems of the provision of collective goods: "solutions to these problems are found in sharing formulae - social constructs which legitimate and sanction particular patterns of relationship and allow co-operation to take place."

[3] Arguably, the term 'amenity user' includes those people who derive some benefit from the common without tangible use. Such benefits are collectively referred to as 'non-use benefits', 'intangible benefits' or 'indirect benefits' by economists and include existence benefits; option benefits; quasi-option benefits; and bequest benefits (see endnote 5).

[4] Some authors (for example, Wilkes, 1977 & Weeden, 1976) reject the term 'non-extractive' or 'non-consumptive' use with respect to recreational use, arguing that although the recreational pursuit may not involve the direct extraction of resource units (in the way that, for example, hunting or fishing might - be it commercial or recreational), the damage caused to the habitat through recreational use suggests that it is indeed *extractive* in some fashion.

[5] Indirect benefits include:-

* natural functional benefits: derived from the role that resource systems play in assisting in the effective functioning of the ecosystem, such as watershed protection, photosynthesis, regulation of climate and soil production; storage and cycling of essential nutrients; absorption and breakdown of pollutants; and environmental monitoring (see, for example, Newman & Schereiber, 1984 and Myers, 1988).

* aesthetic benefits are derived from the sense of well-being that people experience from being able to view the resource system. Such benefits can be enjoyed from an adjacent area of land and do not necessitate access to the site itself.

* existence benefits: derived from the knowledge that a resource system exists, regardless of whether the beneficiary is able to see it. McNeely (1988:24) comments that existence benefits reflect "the sympathy, responsibility, and concern that some people may feel toward species and ecosystems".

* option benefits: derived from being able to use the resource system at some time in the future. For example, an individual may not wish or be able to visit a site at the present time, but would like the forest to be conserved so that he or she may have the option to use it in the future. Interestingly, it has been noted that the benefits derived from the option to visit sites in the future may encompass hope, opportunity, dreams and fellowship that are independent of the values of *actually* visiting the place (Cicchetti & Freeman, 1971). Alternatively, the resource system may contain resources which we have no use for at the present, but which we may wish to harvest in the future. In this respect, option benefits acknowledge the need for an 'ark' of diversity which may be needed in the event of future biological, socio-economic or political events.

* quasi-option benefits: derived from the uncertainty regarding future availability of information associated with resources which might otherwise face irreversible damage. Conrad (1980) summarises quasi-option value as "the expected value of information gained from delaying an irreversible decision". The use of plant material for the manufacture of drugs illustrates the importance of recognising quasi-option benefits. Pearce and Turner (1990) point out that "the issue at stake is what value has yet to accrue from plant which *are* endangered but which have yet to be 'screened' for medicinal properties. Brief appraisals exist for only one plant in ten. Detailed assessments exist for only one in a hundred."

* bequest benefits: derived from the knowledge that a particular resource system will be conserved for enjoyment by future generations. The value placed on the future use of the system links bequest benefits very closely to existence, option and quasi-option benefits. The presence of bequest benefits are often used to economically justify conservation of natural areas (see, for example, Krutilla & Fisher, 1975).

[6] For further information, please contact the authors at the Land Management Research Unit, University of Portsmouth.

[7] The Panel was organised by the Board of Science and Technology for International Development (BOSTID) at the National Research Council.

[8] The *subtractability* of a resource is the extent to which one user's enjoyment subtracts from the enjoyment of another user. The concept is important since it distinguishes resources used in common from public goods. A public good may be consumed by all persons *simultaneously* and consumption by one person does not subtract from the consumption opportunities of others. However, when a resource is used in common, consumption by one person *does* subtract from the consumption opportunities of others. In this respect, the distinction between the resource system and the resource units which are extracted from that system is helpful. Subtractability might affect enjoyment of a common property resource in two ways. First, whatever is extracted by one user cannot be extracted by another. Thus, one fisher's use of the fishery leaves less resource units in the form of fish for a second fisher. Second, cumulative use of the common might eventually subtract from its total yield over time. This is clear in the case of grazing, where extraction of grazing units from the common must not occur at a rate higher that the rate of recovery in order for production yields to be sustained. Thus, Oakerson (1992) and Ostrom (1990a) recognise that the subtractability of a resource can relate not only to its ability to withstand simultaneous use, but also serial use and that over-grazing can produce not only short-term over-crowding effects, but also can destroy the ability of the resource system to produce resource units in the long-term.

Just as *over*-use of the common affects the flow of benefits subsequently available to appropriators, so might *under*-use. For example, under-grazing can lead to the dominance of non-grass species on the common. In the New Forest, England, such species would include bracken and gorse and an eventual depletion in the amount of grass available (Penford & Francis, 1990). Most commons exhibit partial subtractability: the threshold at which use of the commons becomes subtractive varies with each common and, indeed, varies over time. An understanding of the physical limits of the common which impose subtractability, enables users to devise and impose rules for reducing its subtractability. Rules which can be devised in this way are largely affected by the degree to which exclusion can be achieved on the common.

[9] The exclusion concept is used to differentiate public from private goods. A pure private good is one which can be consumed by a one person, to the exclusion of others. No one can be excluded from enjoying a pure public good (the most frequently cited example is air), the flow of benefits derived from it are available to all. Commons usually fall somewhere between these two definitions. The physical nature of the common and the availability of technology will affect the degree to which exclusion can be achieved (for example, the size and shape of the boundary of the common and the cost and ability to fence).

[10] Divisibility refers to the extent to which the resource is capable of being divided amongst the users into smaller parcels for management or ownership. It is important to recognise that the degree of divisibility of a common does not necessarily imply its suitability for division into private property (Oakerson, 1991:45). Indeed, division of large commons for management purposes can facilitate collective control of the common.

[11] Hardin's theory (1968) acknowledges the importance of this link, and predicts that the common will become depleted by the free-riding pattern of interaction between the graziers. This conclusion is based not only upon his pessimistic assumption of lack of coordination between the graziers, but also upon recognition that the common has physical limitations which will prevent sufficient recovery of the grass to sustain the level of grazing imposed.

[12] A recent model of land use developed by Savory (1988) emphasises the complexity of different physical and technological variables in contributing to the ability of grasslands to sustain production in this way.

[13] He also warns that measuring equity is more difficult, in that we may be compelled to rely on "rough-and-ready indicators, such as whether most members of the commoners community seem to be relatively satisfied with existing arrangements." In the evaluation of the outcomes of resource management, we must be aware that the researcher's and users' concepts of efficiency and equity are social constructs. For example, researchers are often inclined to view efficiency in terms of ecological sustainability, but local users may have a different point of view: farmers in the Hills of Nepal could not make the concept of sustainable agriculture explicit. Their idea of sustainability can be described as social sustainability, namely "enough yield to feed their family, enough labour to work the fields and non-decreasing soil fertility." In the evaluation of outcomes, we must make explicit which meaning we ascribe to efficiency and equity (Steins, 1995).

[14] For example, for grazing use of common land, the commonable stock provide an informal monitoring procedure, producing observable physical change when the level of use units produced by the resource system decreases. No such monitoring system is readily available for recreational use of the commons, where resource degradation may not be so readily apparent to the recreational users pursuing their activities.

[15] 'Context-bound' factors are influences from outside the actual resource management regime: they are constituted ion the user group's social, cultural, economic, political, historical and institutional environment (Steins, in prep.)

[16] Kiser & Ostrom (1982:188) refer to such strategies as "contingent strategies". The interdependence of individual strategies means that the type of norms and the discount rate selected by an individual are influenced by variables outside the individual's own 'internal' world: the shared norms held by the relevant user group and the opportunities available outside a particular situation. For example, in deciding whether to renege on limited grazing rules of a common, a grazier may refrain from doing so not only because *he/she* has a strong belief in rule complicity, but also (a) there is a strongly shared ethic amongst the graziers that each will observe the agreed rules and (b) the grazier in question knows that he/she has to rely on the future productivity of the common for her livelihood. The presence of these variables results in her perceiving (a) a high present cost (in terms of community disapproval/penalty) against overgrazing and (b) placing a low discount rate on expected future benefits of grazing, and thus opting not to renege on the limited grazing agreement.

[17] Tang (1992:31) argues that collective choice rules are particularly important because of individuals' bounded rationality and opportunism: whilst individuals' bounded rationality makes it impossible to devise operational rules that anticipate all kinds of contingencies, opportunism makes individuals inclined to take advantage of their fellow commoners. As a consequence, collective-choice arrangements are a necessary ingredient in order to sanction against opportunistic behaviour and to facilitate modification of the operational rules as circumstances and information changes. Thus, we might assume that the performance of collective-choice institutions might be measured according to their ability to (a) successfully enforce operational rules and to resolve any operational disputes; and (b) to maintain the dynamic nature of operational rules, ensuring that they are adapted and modified to suit changing conditions.

[18] Bromley (1982) and Ciriacy-Wantrup & Bishop (1975) refer to the constitutional choice level as the "policy level".

[19] Boundary rules may or may not be congruent with the physical nature of the resource. For example, individuals with rights to graze the common may not necessarily reside adjacent to the common. In addition, certain rules may allow casual use of a common by graziers without rights to that common. For example, when two commons adjoin each other in England, animals may stray from one common to the other. This is recognised as a legal right, known as 'the right of common by reason of vicinage'. It is not a separate right, but arises only from the right to graze one common, and can be terminated by the owner of the adjoining common by the erection of a barrier.

[20] For this reason, the existence of boundary rules is often seen as a necessary condition in the control and management of a common property resource. However, it is not a sufficient condition, since more detailed rules governing individual use are required.

[21] 'Stinting' refers to limiting the number of cattle that can be depastured, simply by allocating a number for each grazier. The rule of 'levancy and couchancy', used on English commons, stated that the number of beasts which a commoner could pasture was limited to the number which could be kept over the winter on the commoner's holding, using only the produce of that holding. The rules of levancy and couchancy are defined by Lush J in *Lascelles v Lord Onslow (1877) 2 QBD 433* (at p.449) as follows: " The right to turn out is measured by the capacity of the commonable tenement to maintain; it is to turn out as many commonable animals as the winter eatage of the tenement together with the hay and other produce obtained from it during the summer is capable of maintaining. Similar rules of proportional-allocation are used in commons throughout the world. Ostrom (1990a:64) states that the 'home-feed' base rule was common throughout most of feudal Europe. Indeed, the Forest Service and Bureau of Land Management in the United States presently allocate grazing permits based on the home-feed base of the applicant and the carrying capacity of the grazing area (Ciriacy-Wantrup and Bishop, 1975).

[22] In such circumstances, there is an element of 'chicken and egg'; whereby it is difficult to ascertain whether the community of graziers were constrained in their social development by the rigid institutional arrangements governing the commons, or that their lack of involvement in the collective-choice decision-making arenas can be directly attributed to existing social characteristics. It is likely, in effect, that the two conspired to prevent change (Edwards, 1996).

[23] It is important to recognise, however, that rules are in fact changed less frequently than are the strategies that individuals adopt within the rules. Changing rules at any level of analysis will increase the uncertainty that individuals will face. Rules provide a stable environment of expectations and efforts to change rules can rapidly reduce that stability. It is also important to recognise that it is easier to change operational rules than collective-choice rules, and easier to change collective-choice rules than constitutional rules.

[24] Oakerson acknowledges, in a footnote to (1992:56) that, since the design of the framework, he has concluded that a multiple-level framework is needed, incorporating constitutional, collective-choice and operational levels of analysis.

[25] In addition to natural resource management problems, many environmental problems fit the model of a commons dilemma, in which short-term self-interest may lead individuals to act in an unconstrained manner which is not in the long term interest of the group/society. Thompson and Stoutemyer (1991) examined water use as a commons dilemma and the effects of education of individual action. Similar applications may include recycling of waste, where individuals may perceive that their own action will have little effect on the overall reduction in waste disposal, although long term benefits depend upon collective action. The concept of common property resources has also been applied to several examples not pertaining to natural resources, (such as the 'Internet' , by Hess, 1995).