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# MANAGING WILDERNESS RESOURCES: FOREST, SHRUBLAND, AND GRASSLAND.

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**List of tables**



## Glossary

Collective action: Activities that require the coordination of efforts by two or more actors.

Common Pool Resource: A good or resource which is subtractable and from which it is difficult or costly to exclude users from access and withdrawal.

Common Property: Strictly it means "Property held by two or more persons in common with each other", but in social science it is also used about property held jointly. The technical meaning of "ownership in common" is that upon the death of one owner his share of the property passes to his successors. "Joint ownership" means that the owner's share accrues to his co-owners.

Commoners: The group of people holding rights to some resources in common or jointly.

Commons: Historically, non-arable land held in fee simple by some landlord, in which commoners have rights to some resources in common with the landlord. Now the term is sometimes used to refer to any resource held in common or jointly.

Dominium plenum: A bundling of property rights so that the agent who holds rights to the ground also holds rights to all land-based resources on that ground.

Economies of scale: Exist when there is falling average unit cost from increasing volume of production.

Economies of scope: Exist when joint production of several goods costs less than production of the same goods by separate economic entities.

Enclosure: (sometimes called inclosure) Historically it meant an act of freeing land from rights of common, and generally all rights interfering with the landlord's cultivation and productive employment of labor on the soil.

Excludability: Describes the ease with which access to and withdrawal from a resource can be restricted.

Externality: A material consequence for stakeholders not taking part in the activities generating the consequence.

Institutions: Legitimate rules and their systems of monitoring.

Proprietor: An agent who has rights to access and extract a resource, make decisions about its management, and exclude others, but not the right of alienation.

Property: Commonly used to denote everything that is or may be subject to ownership including rights of use and enjoyment for lawful purposes.

Public good: A good or resource that is jointly consumed, or non-subtractable and non-excludable.

Rights appendant: Rights to a commonly held resource that cannot be separated from rights to arable lands.

Rights of common /profits-à-prendre: rights, shared by two or more stakeholders, to remove something material from the soil of another. Such rights are today usually discussed as a form of easement or servitude.

Settlor: The grantor or donor in a deed of settlement. Also one who creates a trust.

Social dilemmas: Situations where what seems to be the best course of action from one stakeholders point of view will, if pursued by all stakeholders, lead to results considered by all to be worse than feasible alternatives.

Social mapping of resource: The realized distribution of benefits from resource usage.

Stakeholder: A person or organization with a legitimate interest in the utility derived from some suitably delimited area.

Stinting: An arrangements to restrict extraction of a resource in an effort to ensure availability of it in the future.

Subtractability: Exists when use of a good or resource by one person reduces the quantity available for consumption by others.

Symbolic values: Values that can be enjoyed through knowledge of, or belief in some particular quality of an object as presented by a symbol.

Urban/ rural: Denote ways of life associated with a particular division of labor rather than settlement patterns.

Use values: Values that can be enjoyed either through extraction or direct interaction.

**Summary**

The quest to understand management of non-arable lands starts by understanding its base in ideas about these lands. Ideas about nature shape goals and influence decisions about the use of these lands. Management of resources implies conscious decisions about how to relate goals, technology and resources. Sustainable management of non-arable land must take interdependencies among products and resource systems into account. Property rights to resources affect attitudes about management and shape representation of interests in decisions. Social differentiation of resource use is reflected in the socioeconomic consequences of management decisions.

Reaching a sustainable use pattern is complicated by

- Problems of governing activities of people when these are interdependent,
- Problems of providing correct and trustworthy information on ecosystem dynamics in relevant decision arenas,
- Insufficient knowledge of the dynamics of ecosystems as affected by human usage and of how to design public policies to achieve specific objectives in resource management.

The management problem of the non-arable rural lands can be described as the problem of how people balance the dynamic system of market forces, local culture, and ecosystem responses to human usage to achieve stated policy goals without diminishing the values found in these lands, either through state legislation and regulation or local organization and self-regulation.

Current best management practice seems to conform to the following principles:

- Co-management of state and appropriators with legal recognition of the interests of the local stakeholders, usually promulgated by some form of register of property rights and resources,
- Multi-purpose management recognizing the interdependencies and scale effects in the ecosystem as well as the diversity of stakeholders,
- Flexible management sensitive to locally diverse and changing conditions,
- Equity management with the goal of protecting the interests of the poorest stakeholders within the limits posed by rule-of-law and ecosystem.

## 1. Introduction

In people's imagination "Nature" is found outside the fence, in the non-arable rural land. Nature is seen as forests, grasslands and shrub lands teeming with wildlife. It may promise adventure and danger or quiet and pastoral recreation. To many, nature is also a storehouse of unused resources -- frequently considered free for the taking. Maybe the dream of the big catch is not so much fired by gold or timber as the possibilities for discovering a particularly useful gene or unknown medicine. Ideas about nature shape the treatment of non-arable lands in powerful ways. Understanding the management of land-based resources starts by understanding its base in ideas about these lands.

The diversity of goals and the diversity of resources in the non-arable lands lead to frequent conflicts with consequences for both ecosystems and distributional equity. Management of human activities in the non-arable lands seeks to limit and channel the conflicts and to control the impact of human activities on the ecosystem. The management problem can be described as the problem of how the government should design its legislation and regulations to balance the dynamic system of market forces, local culture, and ecosystem responses to human usage to achieve stated policy goals such as sustainable use of resources without diminishing the values found in these lands.

The main body of this text will on the one hand outline the links between human activities and ecosystem development, and on the other hand the links between management practice and human activities. The theoretical approaches are taken from the study of property rights systems and the theory of collective action embedded in a general theory of human culture and agency.

## 2. Ideas about "Nature"

Management always concerns the routinized goal-directed component in human actions. To understand goal-directed behavior in non-arable lands, the values that guide the choice of goals must be understood. The point of departure is the western development from pre-industrial to industrial and post-industrial culture. But cultural values have been conceptualized in a way that makes it possible to discuss non-western approaches as well.

### 2.1 Use values and symbolic values

One somewhat puzzling aspect of western culture's view of nature is the primacy given to the uninhabited and uncultivated lands. Nature is to be found in areas which are "unimproved" by human activities. In the management of the non-arable lands this is significant. The values associated with "nature" are more salient for these lands than for arable lands. Broadly two classes of values can be distinguished:

1) Use values: expressed by those who find in nature the values that they enjoy either through extraction or direct interaction, and

2) Symbolic values: expressed by those who find in nature the repository of - or symbols of - individual spiritual or communal cultural well-being.

These values will, however, appear somewhat different in different contexts. One particularly salient cleavage is caused by the organization and technology of industries. A convenient label for this divide is rural and urban. The labels "urban" and "rural" are used to denote ways of life associated with a particular division of labor rather than as descriptions of settlement patterns. In the western world as of today the cultural hegemony of rural society is held by the food producing community, in urban society by the academic and bureaucratic communities. The basic difference in perception of these groups is between the urban view of nature as a fragile system in need of

protection against human interventions, and the rural view of nature as basically a benign ally in the production of food.

**Table 1 A typology of values associated with nature**

| Segment of society | Ideas about nature | Use values | Symbolic values |
|---|---|---|---|
| Urban | Fragile production system for renewable resources and eco-system services | Needed for provision of ecosystem services, and as storehouse of biodiversity | The home of exotic and invigorating experiences, and a peaceful refuge from modern stresses |
| Rural | Benign production system for biological resources | Production of timber, pasture, and other marketable products. | The home of a rural way of life and of the ancestors |

**2.2 Changes in use values and symbolic values**

But neither views of nature, nor their association with particular social segments are static. During the transition from pre-industrial to post-industrial society both urban and rural ideas about nature changed, but the change of the urban segment was the most important. The shift in the urban segment of society was basically from nature seen as a capricious force that humans need to be protected from, to nature seen as a fragile system full of romantic qualities in need of protection from human predation. In the rural segment of society the shift was more from seeing nature as a dangerous adversary in the fight for survival to a benign ally with amenities and resources that should not go to waste. In between, during the early modern industrialization period, a dominant view of both segments was of nature as an inexhaustible reservoir of resources just waiting to be put in mankind's service, but with the urban segment taking a somewhat more romantic view of the qualities of the wilderness.

**Table 2 Changing views of nature**

| | Pre-industrial | Industrial | Post-industrial |
|---|---|---|---|
| Urban | Nature is a capricious force against which man needs protection | Nature is full of adventure and inexhaustible resources | Nature is a fragile system in need of protection from man's predations. |
| Rural | Nature is a dangerous adversary to be tamed | Nature is a dangerous ally to be tamed | Nature is a benign system to be used |

The distinction between an urban and a rural segment is a simplification, but it illustrates two of the more important views of nature in the current political debate. The reasons for the shifts in perception in the two segments are found in changing organization of political power, evolution of technological capabilities and differences in industrial organization rather than in a separate self-contained development. Thus the urban views do not replace rural views (or vice versa), but live on side by side, tied to their segment of society.

**2.3 Resources for economic growth**

In conjunction with the technological developments of the industrial revolution the view of nature as an unused resource came to have an enormous impact on ecosystems around the world. Throughout this process of change, the hegemonic view of the more powerful western states have frequently been imposed on the rest of the world irrespective of local conditions. A "high-modernist" perspective guided government development strategies in the non-arable lands in many countries. Modernizing, industrializing, and colonial regimes of the past as well as expansionist

governments today have required settlers to develop their non-arable land to gain legal recognition of their claims. International development agencies have also promoted policies that attempt to generate wealth through the conversion of non-arable rural land to other uses.

The broad characterizations of how nature is perceived need to be qualified in several directions. The various cultures around the world see different values in the landscapes surrounding them. This contributes to the variety of management practices seen. Both pre-industrial and industrial values and views of nature live on in sections and segments of the population, not least in established customs and regulations. They are no longer hegemonic in the management discourses of western societies. But their somewhat invisible existence in old established institutions such as statutory property rights should not make us forget that these values still affect management decisions and activities in profound ways. Sometimes they clash with current ideas in unexpected ways and often with unwanted consequences.

### 2.4 Ideas and Actions

Imagined notions of nature influence decisions about the use of non-arable land and land-based resources. Views of nature as under-utilized resources encourage the transformation of non-arable rural land to other uses. Concern about the fragility of nature motivates the conservation of non-arable rural land. Management strategies involving large-scale extraction and transformation displace small-scale or informal uses of land-based resources, denying their economic value and sometimes even their existence. Large-scale institutions for governance confront difficulties in recognizing small-scale or informal uses of land-based resources. Regardless of scale, governing bodies do not always recognize positive externalities associated with non-arable land. Conservationist policies focus on symbolic values and externalities. They often recognize utilization of land-based resources and their role for people's livelihood. Usually they see these activities, however, as potentially harmful and unsustainable. For conservationists, the value of nature in its pristine form outweighs the benefits associated with extractive activities.

Both transformation and conservation of non-arable land restrict the allowable uses of land-based resources. Restrictions on the utilization of land-based resources alter the nature and distribution of human benefits from these systems. Both intensification of land-use and the curtailment of extractive land-uses affect the operation of ecological systems.

## 3. Why Do People Have to Manage Non-Arable Lands?

Managing non-arable lands means developing systems of norms and rules to guide human activities in ways believed to enhance the ability to achieve goals in cost effective ways. These norms and rules will at one level tell people what to do with a resource. A more difficult part of the management problem comes with the realization that there are competing activities and incompatible goals. The present section introduces these two issues by considering first the diversity of activities going on in one particular forest in Nepal, and second, the divergent outcomes of the conflict between grazing and regeneration of trees in different management environments in Denmark and England.

In a situation with abundant resources and in the absence of markets there are no reasons to believe that people will make any particular effort to manage their non-arable lands. Only with experience of problems like scarcity of a particular resource, or conflict over its distribution will management become an issue. The diversity of activities and multiplicity of stakeholders in the non-arable lands in conjunction with the complicated dynamic interactions of social system,

climate and ecosystem imply that conflicts and scarcities abound. But experiencing a problem does not ensure that it will be solved.

One recurring conflict is between grazing and regeneration of trees. The conflict may lead to destruction of the forests or a management system may develop to accommodate both processes. Looking back in history it is seen that in Denmark the forests disappeared. In England the management system in several instances was able to accommodate both processes for several hundred years. An in depth discussion of why the outcomes were different will have to be framed in terms of differences in the basic governing institutions such as the legal system and the distribution of power.

### 3.1. A diversity of silvicultural activities in Nepal

Below the diversity of activities is illustrated by listing the silvicultural activities in one community forest in the middle hills of Nepal. In addition to timber and pasture there are non-timber forest products such as medicinal and aromatic plants. Note how the evaluation of species as inferior or desirable informs several of the activities. Also note how rotation of grazing or outright prohibition is an ordinary management option. The point of the list is to illustrate the great variety of activities one has to consider in the management of non-arable lands and how the values of the actors affect decisions. The list is valid for one particular local community. In other communities the list will be different.

**Table 3 Silvicultural activities in one community in Nepal**

| Activity | Summary description |
|---|---|
| Selective felling | Occasional cutting of trees for local use or sale |
| Thinning | Cutting of poles in dense stands to meet the needs for small poles; (local intensity of cut is always below the forester's prescription for perceived future security of poles requirement); removal of inferior species |
| Pruning | Cutting of branches of poles and trees roughly up to two thirds of the tree height to obtain firewood |
| Cleaning and weed control | Ferns and other less useful shrubs are cut from plantation areas and other parts of the forests. Succulent weeds are left to decompose while other inferior woody plants are accumulated and burnt. In higher elevations thorny and hardy species are retained to shelter tree seedlings against frost. |
| Leaf litter collection | Generally collected twice a year for making compost as the leaf litter collection time coincides with lowland and upland farming cycle. |
| Grass collection | Grass areas are divided into a number of plots and each plot is linked to a "tole" (hamlet of community households) and further divided to each household; the system is considered to distribute equal amount of grasses to every household. |
| Grazing | Rotational systems or complete ban on open grazing throughout the forest the year round |
| Nursery management | Mostly constructed with buyback agreement with district forest office (DFO) or projects, with the purpose of availing seedlings for private and community planting. |
| Cultivation of cash crops | Planting and management of a number of commercially traded crops such as cardamom, broom grass, argeli, and others; sometimes given to poorest members on lease |
| Dry twig collection | The people of neighboring villages are sometimes allowed to collect dry twigs free of charge after a forestry operation is completed. |

| | |
|---|---|
| Multiple shoot cutting and singling | Multiple coppices, mostly in Schima-castanopsis forest, are done in 2-5 years rotation system to obtain fodder, syaula (animal bedding material), and fuel wood. |
| Establishment and monitoring of trial Plots | Sometimes with outside technical support and sometimes on their own, forest user groups establish experimental/ demonstration plots mostly to observe the effect of thinning intensity on growth and yield of the forest crops. |
| Water sources protection | Areas where forest users obtain water are specially protected, but occasionally ferns and other less useful herbs and shrubs are removed as they are considered to dry the spring out. |
| Wildlife habitat improvement | Part of the forest is kept intact without any cutting as a habitat for common wild animals such as deer and wild birds. |
| Bamboo propagation | Rhizomes are separated from clumps of bamboo 2-3 months before monsoon begins and planted out in gullies of the forest. |
| Regeneration management | Grazing and fire are considered threats to regeneration establishment and treated accordingly. Over matured and inferior trees are removed from the forest to allow penetration of light to the forest floor, which encourages seedling growth. |
| Planting seedlings | Users plant seedlings under cover of other vegetation to protect them from the frost in high altitude areas. They have learned this from their experiences of planting with and without cover. |

Source: Hermant R. Ojha and Basundhara Bhattarai, 2001 "Understanding community perspectives of silvicultural practices in the middle hills of Nepal", Forests, Trees and People Newsletter, No. 44 April 2001: 57

### 3.2 The conflict between grazing and regeneration of trees

Pasturing has been an important cause of deforestation. The young seedlings are eaten and never given the chance of growing into tall trees. Overcoming this problem is difficult but not impossible. Denmark provides cases where the problem was not solved. On forest commons the distant landlords owning the tall trees and the local peasants owning the pasture and the shrubs were unable or unwilling to cooperate. After the timber was harvested, grazing prevented trees from regenerating. Property rights can in this case be suspected of being a primary "cause" of deforestation. Parliamentary acts of enclosure dissolved the co-ownership of the commons and thus eliminated conflicts between owners with competing management goals.

One case study of forest management in England describes how medieval manors, with the same type of distribution of property rights as in Denmark, could manage grazing on forest commons by either pollarding or compartmentation with coppicing and fencing of new coppices and rotation of grazing to older coppices. But compartmentation and rotation required a reasonably "strong" and stable management regime. The rotation cycle described was 18 years with fencing during the first 9 years to keep out cattle. As English society changed the regime became difficult to sustain. It was replaced through the enclosure process.

In both Denmark and England the technical problems of managing interdependent activities of a group of stakeholders were "solved" by transforming the stakeholders into individual owners of separate parcels of land.

## 4. The Meaning of Management

Broadly one may trace a historical development of societal goals from subsistence survival of local communities through improved economic returns for the state, the large landowners, and the forest industries to the current global sustainable use paradigm. Always management implies

conscious decisions about how to relate goals, technology, resources and beneficiaries. Systems of management cannot be developed until management goals have been determined. Nor can management practices be evaluated independently of management goals. In grasslands, individuals interested in raising livestock for beef production will prefer a considerably lower stocking rate than individuals who keep livestock for milk production or as inputs for crop production. A dense population of wildlife is desirable for tourism, but threatens agricultural producers and those living in the vicinity. Potential management goals for forests include timber production, non-timber products with subsistence value, or biodiversity. The target species composition, density of vegetation, and distribution of plants of various ages and sizes varies accordingly. Timber producers favor uniform stands of trees that grow rapidly and have long, straights trunks. Such a forest is a disaster from the perspective of either the proponent of biodiversity or the person who relies upon forests for non-timber forest products. Both favor forests with much greater diversity. Management of a forest for non-timber forest products, however, favors species according to their perceived contribution to subsistence. When people seek to propagate and nurture forest species for subsistence, they often focus on fruit trees, plants with medicinal values, or those known to provide good fodder, building materials, or firewood. If biodiversity is the goal, unusual and rare species will be favored over others, regardless of their subsistence value.

Throughout history people have managed non-arable rural lands to benefit themselves or other people, not for the ecosystem. In the long run, however, the management has to accommodate ecosystem limitations. In a subsistence economy, practices that ensure long-term survival (over centuries) of the local community also prove that they work within the limits of the ecosystem. But the survival of a management practice does not necessarily mean it will continue to be ecologically sustainable if any of the external (e.g. climate change, market penetration) or internal factors (e.g. harvesting technology, distribution of property rights) affecting the resource system change.

Modernization and the intensification of market pressures weaken the link between forest usage and subsistence of the local community. Profits from extractive activities and jobs in industrial activities create affluence for some members of the community. The condition of the ecosystem becomes irrelevant for their standard of living; only its ability to produce marketable commodities matters. The local community could prosper despite destructive use of its non-arable lands. In many parts of the world these changes have led to severe problems for the poorer classes who often depend on a variety of inputs from the non-arable lands.

Increasingly the viability of the various ecosystems has come to be seen as important to the welfare of people in general. The trend is today described as being informed by such concepts as “sustainable forestry”, “ecological integrity”, “mimicking natural disturbances”, “ecosystem management”, and “people’s participation”. The practical implications of this shift in values are being worked out more or less by trials and errors rather than by an adequate understanding of the various forces affecting the dynamic of the resource usage system.

The fact that sustainable use has emerged as the most important goal for many in our time does not mean that concerns about economic return or even the survival of local communities using the resources have disappeared. The history of usage of a resource mirrors and lives on in the mixture of goals of the various stakeholders involved. Very rarely will there be unity among stakeholders in terms of goals.

The main problem of governing resources associated with non-arable rural lands is to devise management systems that respond to diverse local ecosystem conditions and diverse cultural values without compromising the global values of sustainable extraction and use.

## 5. Ecosystems and Resource Types

Non-arable rural land represents a residual category. Its resources and their usage are in important ways defined by the activities on arable lands. The value shifts noted above are in large part explained by the decline of the agricultural population and the technological changes of the agricultural activities. Thus non-arable land is defined by how it is *not* utilized rather than what it is. It encompasses a miscellany of lands, including forest, shrub land, and grassland.

### 5.1 Diversity of resources in non-arable rural lands

Forests differ from shrub lands and grasslands not in the presence of trees, shrubs, or grasses but in their relative dominance. The mix of vegetation may reflect ecological conditions or patterns of past disturbance, including human activities. Forests, shrub lands, and grasslands share many features. All three types of land contain numerous interspersed resources, including grasses, herbs, timber, dead wood, fruits, game, insects, soil, resin, and honey. Watershed protection, avalanche and land slide prevention, control of local climate, carbon sequestration, storage of biodiversity, routes for transit, and green space for recreation are but a few of the many, and not always apparent, services provided. Humans use all of these products and services.

#### *5.1.1 Consumptive Resources*

Trees

Timber represents one of the more important economic assets of the non-arable lands. In addition to wood suitable for building, trees provide firewood. Tree branches, leaves, and bark can be used as fodder or bedding material, and sometimes have important medicinal uses. Fruit and nut bearing trees contribute, sometimes substantially, to human and animal diets. Diverse animals rely upon trees for shelter.

Shrubs

The presence of many stems rather than a single long trunk or bole distinguishes shrubs from saplings. Some species grow as either a shrub or a tree, depending upon ecological conditions. Shrubs offer many of the same values associated with trees: fodder, bedding, fruits, habitat and shelter for game. Although the absence of a long trunk limits the value of shrubs for construction, they can serve as firebreaks or fencing.

Grasses and Other Herbaceous Plants

Grasses provide grazing and habitat for livestock and game. In some parts of the world, thatching grass retains considerable value for construction. Grasses also serve as bedding or green manure. Grasses and other herbaceous plants often supplement human diets as well. Medicinal plants figure among the most valuable resources available on non-arable land. Even when cultivation is possible, users often believe that plants grown in the wild have particularly strong medicinal properties.

Other vegetation

Fungi, vines, lichen, and epiphytes also grow on non-arable land. Although some fungi, vines, and epiphytes can threaten other species, some species have considerable value. Many varieties of mushrooms are considered delicacies, and the rare beauty of orchids makes them subject to poaching. Vines produce wild grapes or berries, and can sometimes be used as twine.

Wildlife

Most wildlife lives on non-arable land. Humans deem some species to be nuisances, such as predators and insects that act as disease vectors (e.g., large cats, mosquitoes). Hunters

value other species as trophies or sources of food (e.g., butterflies, edible grubs, deer, and rabbits). The existence of wildlife enhances the value of non-arable land for nature appreciation. Animals affect plant life in non-arable land, for instance by pollinating plants, spreading seeds, and providing manure.

Inanimate Resources

Non-arable land consists of more than plant and animal life. Humans use sand, gravel, stones, and soil as building material and clay for pottery. Animal products such as honey and beeswax also hold value for humans.

*5.1.2 Non-consumptive Resources*

Biodiversity

As resource systems, forests, shrub lands, and grasslands represent important stores of biodiversity. Because species react differently to changing climate and other external conditions, biodiversity is believed to bolster the resilience of the ecosystem. The search for new medicines and improved crops also draws upon genetic diversity found in non-arable land.

Ecosystem services

The ecological services provided by non-arable land include watershed protection, protection of soils against erosion, prevention of avalanches and land slides, control of local climate, carbon sequestration, storage of biodiversity, and improvements in air quality.

Vacation and tourist services

Many people turn to non-arable land for recreational activities such as hiking, observing wildlife, or hunting. Appreciation of nature and the mystique of wilderness involve less active interaction with non-arable land but bring great satisfaction to many. Even if their visits to non-arable land are limited, many urban dwellers value the mere existence of undeveloped green space, especially areas with exotic species and considerable biodiversity.

Interdependencies among these goods and services make coordination of resource use important for sustainable management. Forests, shrub lands, and grasslands differ in the degree of interdependency among resources, the nature and degree of risk, time horizons for species reproduction, and prospects for regeneration.

**5.2 Interdependency among resources**

Ecosystems, including forests, shrub lands, and grasslands, are complex interdependent systems. Plants, animals, soils, and water interact with each other in ways that are not completely understood. Trees intercept moisture in the air, making it available for other vegetation and for restoration of the water table. The density of the tree canopy affects the penetration of sunlight, and thus influences the growth of plants with variable degrees of shade tolerance. The very presence of plants slows the movement of water over land, increasing water absorption and decreasing erosion. Dead biomass cycles nutrients back into the soils, affecting the ability of those soils to continue to support vegetation. Animals aid the growth of vegetation when they aerate soils, pollinate plants, and spread seeds. Disturbances, whether through fires, disease, wind damage, or human extraction, also influence species composition and rates of regeneration.

**5.3 Consequences of induced and variable stresses**

Grasslands and shrub lands experience more spatial and temporal variability in rainfall than do forests. Even in dry forests, the presence of trees increases the proportion of water intercepted and

thus available for the growth of vegetation and replenishment of watersheds. Unstable environmental conditions in grasslands and shrub lands increase the risk of localized collapse of the resource system. More stable climatic conditions mean that forest conditions generally change more gradually. Differences in the recovery of grasslands, shrub lands, and forests reflect evolutionary processes as well as climatic conditions. Grasslands have evolved with foraging and other forms of disturbance. In the absence of frequent disturbance or very poor soils, woody vegetation will become established.

Grasslands and shrub lands can experience rapid collapse as various species respond almost simultaneously to poor environmental conditions or overuse. Regeneration of shrub lands and grasslands can also occur rapidly. Recent research in range ecology claims that even dry grasslands can recover rapidly from apparently degraded conditions. In the absence of clear-cutting or massive natural disasters (e.g., volcanic eruptions, hurricanes, or infestations), crashes in forest systems rarely occur rapidly. Variation in the responsiveness of species to environmental conditions and patterns of use enhances the ability of forests to endure short- or medium term shocks. The degree of interdependencies among forest species, however, means that deterioration may gain momentum and become difficult to reverse. Once degraded, forests can be extremely difficult to regenerate. In the Amazon and other tropical areas, regeneration requires the survival of forest patches over a certain size. Even in more forgiving ecological zones, many forest species take a relatively long time to reach maturity and some species may never recover. Thus, collapse of shrub land and grassland systems may occur more rapidly and with more immediately catastrophic implications for livelihoods, but collapse of forest systems may be more enduring.

Interdependency among species and resource systems, responsiveness to shocks, and time periods for regeneration represent challenges for the management of non-arable rural land. Management strategies that focus on a single product or service run the risk of undermining other resources upon which the resource system as a whole depends. Sustainable management of non-arable land must take interdependencies among products and resource systems into account. The responsiveness of different types of non-arable land to shocks creates divergent patterns of risk. The rapid localized collapse and recovery of grasslands or shrub lands requires strategies for rapidly shifting sources of livelihood, either through mobility, alternative economic activities, or some form of consumption smoothing. Slower changes in forest conditions allow more time for adjusting economic strategies, but their cumulative nature and the difficulties of reversing deterioration increase the importance of avoiding mistakes. Differences in the life cycles of various species also influence management. The time horizons required for sustainable management depends upon the rate with which species of interest regenerate.

## 6. Social Systems and Ecosystems

Many of the issues associated with management of non-arable land reflect the interaction of complex natural systems with complex social systems. Non-arable land produces multiple goods and services that interact in naturally complex ways; the possibility of social differentiation in resource use only adds to the challenge of managing the natural complexity. The physical extent of non-arable land and the non-excludability of environmental services make these lands of interest to multiple communities at different levels of political organization. Management of non-arable lands depends upon interactions among political actors internationally, nationally, and locally. The socioeconomic consequences of management decisions reflect the nature of the goods, social differentiation in resource use, the distribution of benefits and costs associated with ecosystem services, and the challenges of interdependent decision-making.

### 6.1 Types of goods

The values and goals seen in the non-arable lands can be reinterpreted in terms of the kinds of goods perceived to inhere in land and renewable resources. These goods are of four types: private goods, common pool goods, club goods, and public goods.

**Table 4 A Typology of Goods**

| | Appropriators/ users are: | |
|---|---|---|
| Resource is | Excludable | Non-excludable |
| Subtractable | PRIVATE | COMMON POOL |
| Non-subtractable | CLUB | PUBLIC |

Source: adapted from Vincent Ostrom and Elinor Ostrom 1977. «Public Goods and Public Choices», pp. 7-49 in «Alternatives for Delivering Public Services: Toward Improved Performance», ed. E.S. Savas,; Boulder, Westview Press.

A resource is subtractable if harvesting or appropriating from the resource by one user diminishes the amount available for another user. The use of "private" and "public" as labels of goods should not be confounded with the same labels used about stakeholders (see section 7.3). Here they are labels used to denote analytical characteristics of a good important for the collective action problems experienced by stakeholders wanting to coordinate their goals. The most important difference is the type of externality generated by the appropriators of the good. An activity generates an externality if there is a material consequence for stakeholders not taking part in the activities generating the consequence. In common pool resources the externality is of the queuing type (first come, first served). Queuing causes competition among appropriators and distribution problems between those first in the queue and those last, but does not affect the utility of the good appropriated. In club goods the externality is of the crowding (or thinning) type (the last drop causing the overflow or the last tread to break causing the collapse). This type of externality produces distribution problems in relation to non-members and causes threshold effects in the utility of the good. By setting the number of club members to something under or over the threshold, the utility of the good can be preserved. But equity problems between members and non-members have to be addressed. Positive externalities, such as watershed protection and preservation of biodiversity, are often considered public goods. Distributional and management challenges arise from the discrepancy between costs borne by resource managers and the benefits enjoyed by others.

Real world goods such as pasture, wildlife, timber, or biodiversity will usually be a mixture of the various types of analytical goods, and thus the property rights to the resource need to solve the particular mix of externality problems found in each case. Problems of exclusion and subtractability, as well as the characteristics of externalities, are shaped in profound ways by the technology used in the appropriation of the good. What actually happens in non-arable lands depends not only on the institutions but also on the available technology, including knowledge about how to transform resources into something more desirable.

### 6.2 The social mapping of resources

The presence of multiple resources of human interest in non-arable rural land guarantees nothing about their utilization, much less the social mapping of their use. The social mapping of resource uses determines the realized distribution of benefits and reflects both the nature of the particular goods and services and the overarching social and political structure.

Although members of a community may utilize and depend upon land-based natural resources to a comparable extent, such homogeneity cannot and should not be assumed. Patterns of natural resource utilization are often socially differentiated. In many developing countries, for instance, men and women use different resources. Men might be responsible for grazing livestock and collecting building materials while women collect firewood, fruits, nuts, and medicinal herbs. Elsewhere, patterns of resource use reflect caste divisions or ethno-linguistic differences. Political power in rural areas historically rested upon control of access to natural resources. In Africa, even today, members of locally dominant ethno-linguistic groups and assimilated groups have better and more secure access to land-based resources than do immigrant populations – even if the "immigrants" have been present for generations.

The social mapping of resource uses influences management decisions in important ways. Specialization in resource use, for example, diminishes appreciation for systemic interactions, increasing the difficulty of coordinated management. Groups who only care about trees may prefer management strategies that are harmful to people who only care about non-timber forest products. Likewise, social interdependencies encourage coordination to allow for resource interdependencies despite economic specialization. Specialization may occur because people have different property rights. Even when property rights to land-based resources do not vary among actors, social differentiation in resource use may arise from operational decisions about how to use resources. Thus, social mapping of resource use reflects property rights, differences in skills, relative prices of goods, and variable access to inputs or markets.

**6.3 Economies of scope and scale**

The social mapping of resource use influences awareness of interdependencies among resources, which in turn affects the adoption of management strategies to obtain economies of scope or scale. Economies of scope exist when joint production of several goods costs less than production of the same goods by separate economic entities. When resources with human value are interspersed and interdependent, economies of scope can be achieved by managing resource systems for multiple purposes rather than for separate production of single goods.

Economies of scale exist when there is falling average unit cost from increasing volume of production. Scale is important for the ability to defend a resource system against incursions, and has implications for regeneration. Random distribution of rainfall and relatively low density of valuable resources in grasslands and shrub lands generate economies of scale. Economies of scale also exist in forests, although the relative density of vegetation in forests obscures them. Because species are often widely dispersed, access to marketable quantities of any particular species requires access to a relatively large area. For slow maturing species, long-term economic utilization depends upon the availability of plants of various ages, further increasing the number of plants – and thus the area - required for economic utilization.

When different segments of society use different goods and services, nobody may fully recognize the importance of interdependencies among these products. Management strategies that increase returns for timber production, for instance, interfere with harvesting of nuts, fruits, resins or waxes, and fodder and destroy habitat for wildlife. These losses may outweigh the benefits of increased timber extraction. Social differentiation in resource use decreases the likelihood that people who harvest any given good will recognize or value other goods and services associated with non-arable land. Broad social representation in decision-making can compensate for fragmentation of interests and may encourage collective action to deal with the problem. Such systems, however, often mirror or exacerbate existing social and political inequities. Decision-

makers are more likely to recognize and pursue the economies of scope and scale associated with management of intact resource systems for multiple and overlapping purposes when social differentiation of resource use is low. Other forms of social, political, or economic interdependencies might compensate for social differentiation in natural resource use.

### 6.4 Multiple communities as stakeholders

People from different communities might harvest resources in overlapping areas, or operate in physically distinct territories. In extensive resource systems or areas with low population densities, spatial separation need not require conscious action. Where resource systems are spatially smaller, especially relative to population, the development of territorial boundaries requires both conscious definition and enforcement. The definition and enforcement of territorial divisions - whether claimed by individuals, clans, settlements, or more encompassing political entities - represent an important part of the management challenge for non-arable land. Since boundaries can differ according to the resource in question (e.g., pasture versus fruits), the multiplicity of products and services provided by non-arable land complicates management.

The goods and services associated with non-arable lands attract interest beyond the settlements within or bordering the physical resource systems. Market pressures increase outside interest in extractive resources. Outside business interests, for instance, want to harvest valuable timber or engage in bio prospecting. Where poverty and landlessness exist, non-arable lands attract immigrants who seek to convert non-arable land for residences and crop production. National policies frequently encourage unsustainable rates of timber extraction or settlement on non-arable lands by outside interests because governments, especially in developing countries, tend to see non-arable land as resources best utilized through liquidation and re-investment in other sectors.

People beyond the local communities also have an interest in preserving non-arable land for the recreational and environmental services they provide. The contributions of non-arable land to watershed protection, climatic regulation, and the preservation of biodiversity benefit populations far removed from the resource systems in question. External beneficiaries include people who visit non-arable lands recreationally, but people need not see the resource or come into physical contact with it to benefit from the environmental externalities they produce. Settlements downhill benefit from the watershed protection and retention of soils by forests at higher altitude. Benefits from climatic regulation and the preservation of biodiversity spread even further, affecting people in other countries.

Interests in non-arable land beyond the local level pose an additional problem for managing non-arable lands. Local decision-makers, even regional or national decision-makers, are unlikely to protect non-arable lands to the extent desired by international actors concerned about climate change and biodiversity. On the other hand, management decisions above the local level tend to overlook or underestimate the significance of non-marketed but extractive use of non-arable land. In practical terms, management of non-arable land requires the cooperation of people residing nearby and decisions that alienate local people are unlikely to succeed. Reconciliation of competing interests at different scales of political organization is yet another challenge for the management of non-arable land. Understanding the problems inherent in cooperation is a foundation for analyzing the governance of resources.

### 6.5 The theory of collective action

Collective action refers to the coordination of efforts by two or more individuals. Collective action becomes problematic for a group of people when their actions are interdependent: when one

person's reward is dependent on the actions of others. Independent choice in an interdependent situation is called a social dilemma. Thus social dilemmas are situations where what seems to be the best course of action from one stakeholders point of view will, if pursued by all stakeholders, lead to results considered by all to be worse than feasible alternatives. The exact character of a social dilemma is shaped by value systems, technology and resource characteristics.

In an ecosystem where more than one appropriator has rights of access and withdrawal the collective action problem appears at two levels:

1. First in recognizing the necessity of coordination and regulation of behavior, and
2. Second in agreeing on the rules of regulation, and on the system of monitoring and sanctioning behavior governed by the rules.

Rules and their systems of monitoring are called institutions. Institutions are public goods. Public goods, club goods and common pool goods are in simple models of collective action prone to under-supply due to incentives of free riding. The problem of supplying such goods at socially optimal levels has been extensively studied with formal models, experimental studies, and field studies. There is a discrepancy between theoretical predictions of standard models and observations from field studies. Observed levels of cooperation are higher than expected even though less than optimal. Experimental studies confirm this and suggest that the formal models could be improved by including concepts such as "trust", "reputation", and "reciprocity". A group with a higher level of trust, stronger norms about reciprocity, and members with better reputations for being trustworthy will more easily overcome social dilemmas and take collective action. The conclusion here is that self-governance of resource use is possible. But the requirement is that information about the resource base is adequate, and the power base of the local institution is seen as secure. This is seen as most easily achieved in a joint management system between local appropriator organizations and the state. The state has to provide reliable information about the ecosystem development and give the local management institution recognition as legitimate.

## 7. Understanding the management of natural resources

Analytical studies of the management of natural resources rely on contributions from many disciplines (theories of collective action, theories of neo-institutional economics, theories of the construction of social reality, theories of ecosystem dynamics). Currently they seem to be converging on the study of the creation, maintenance, and transformation of property rights to explain and understand empirical regularities in the rather frequent failures of natural resources management efforts.

### 7.1 Property rights as a key to improved management

Today it would seem reasonable to conclude that property rights to the resources are the key to successful management of non-arable lands (just as for arable and urban lands). If just one lesson is to be taken from recent scholarship on property rights, it must be that successful management can only be achieved if there is a measure of congruence between the rights and duties local communities agree upon and the rights and duties the state tries to enforce. A second lesson is that the law, regulations, and bylaws used must be low cost in their application. Unless people see clearly the benefits of law they will find ways of living outside the law making the management policies that much more costly and difficult - if not impossible - to implement.

### 7.2 Property rights in a complex world

But laws on property rights can never be written from scratch. Each area, landscape, or ecosystem has particular complexities and interactions making it unique. In writing law on property rights,

the complexities of the ecosystem, the complexity of the social system and the interaction of characteristics of the two must be taken account of. Linkages between non-arable lands and other parts of the landscape are also important. The quality of the resources within non-arable lands may depend critically on neighboring mountains, wetlands, deserts and drylands. Appropriate biodiversity measures, soil characteristics, and climate parameters may summarize the complexity of an ecosystem. The locally enforced use rights and customs pertaining to the various components of the ecosystem can summarize relevant complexities of the local social system. Market pressures, technological developments, state sector policies not directly related to non-arable lands, and demographic processes may summarize complexities of the large-scale society. Interactions of ecosystem, local social system, and large-scale society show up in the cultural valuations of components of the ecosystem as well as the landscape where the ecosystem is observed. All are relevant to the system of property rights needed for successful management.

### 7. 3 Who has rights and duties?

The allocation of rights and duties in relation to particular resources determines whose goals will count by how much in the choice of management goals, the timing and duration of extraction, the application of technology, and the intensity of effort expended to achieve the goals. Thus a management system involves decisions about the beneficiaries, timing, means, and purpose of human interaction with ecological systems. These dimensions of management can be summarized in a single question: "Who will benefit how much for how long and in what ways from which resource(s)?" In answering this question, people perform a series of balancing acts. They assign relative weights to various land-based goods and services, make decisions about the timing and duration of resource use, and determine the distribution of associated benefits and costs. Answering the "who" question will identify who will legitimately be able to withdraw resource units and make decisions about management. That is: it determines who holds property rights over the resources.

### 7.4 Bundles of rights

Property rights can be classified in various ways: according to type of management decisions involved, according to the management interests of the beneficiary of the resource, and according to management implications of cultural values.

A number of management decision rights can be distinguished: rights of access, rights of extraction, rights to make decisions about access and use, rights to exclude, and rights to alienate the resource. The various rights can be bundled in several ways. An individual, group, or organization may hold all of these rights over a resource as a bundle. Then they are called owners. Table 5 bundles the various decision rights in a hierarchy of roles useful in a production oriented management approach.

**Table 5 Holders of Different Bundles of Rights to Manage Resources**

| | Owner | Proprietor | Authorized Claimant | Authorized User | Authorized Entrant |
|---|---|---|---|---|---|
| Access | X | X | X | X | X |
| Withdrawal | X | X | X | X | |
| Management | X | X | X | | |
| Exclusion | X | X | | | |
| Alienation | X | | | | |

Source: Elinor Ostrom and Edella Schlager, 1996. "The Formation of Property Rights," pages 127 – 156 in Susan Hanna, Carl Folke, and Karl-Göran Mäler, eds., Rights to Nature. Washington, DC: Island Press, page 133.

The same decision rights can be defined and bundled in other ways. The land trust is an example of a different way of bundling decision rights into roles. The goal of the trust management is not production per se, but the interests of the beneficiary as outlined in the trust document of the settlor, the one who creates the trust (or as this can be inferred by the courts). The rights are bundled into rights of the trustee, the legal owner, and the rights of the beneficiary, the equitable owner. The trustee holds all the management rights as owner at law. But the rights must be exercised for the benefit of the beneficiary. Thus a trustee can by contract define bundles of rights similar to proprietor, claimant, user, or entrant as the task requires. The role of the beneficiary also includes the rights of the proprietor role but limited by the same document as the trustee: the trustee must see it as beneficial within the definition of the trust.

Besides the various bundles of decision making rights there also are various ways of bundling the resources to which these decision-making rights apply. The most extensive bundling of resources occurs when ownership of the ground implies ownership of everything attached to the ground or flowing over the ground (dominium plenum). Development strategies frequently assume that those with rights to the ground also hold rights to all other land-based resources. But rights to resources can be differentiated by resource boundaries and held by a variety of actors. Individuals or groups may hold rights to access an area (e.g., a wildlife area) and extract resources (e.g., hunt game), for example, but a government body often has the authority to make decisions about quantity regulations (e.g., the maximum number of animals killed by hunters each year). The individual, group, or organization that holds rights to any given resource units (e.g., game) in a forest, shrub land, or grassland need not have rights to other resources units in that ecosystem (e.g., grasses, timber, fruit, flowers, resin, and deadwood). Many systems of rights of common can be seen as efforts to bundle rights to resources with the goal of making farms viable economic enterprises.

Those who decide on who will benefit, what kind of technology is appropriate, and how much they may harvest at any one time, also have to be informed of the constraints posed by the ecosystem dynamics. If the resources are insufficient for everybody, how do you limit the number of people with rights? If those with rights have incentives to overexploit the resource how do you stint their usage? If the state has limited capacity of monitoring and enforcement, how do you make regulations approach a self-enforcing regulation?

**7.5 Resource bundles and stinting of usage: a Norwegian example**

Let us look briefly at how some of these questions were solved in the management of resources in the non-arable rural lands traditionally held in common by the Norwegian people, and since 1857 statutory defined as “state” commons (the state owns the ground/soil), or “bygd” commons (a majority of commoners own the ground/soil).

The problem of limiting the number of commoners was solved by allocating rights of common, particularly to timber and pasture in the non-arable lands, only to those who had arable land. To further the viability of the farming units these rights of common were seen as inalienable from the arable lands (rights appendant). But the allocation of rights is not the same for all kinds of resources; some rights of common are seen as alienable personal rights (rights in gross), others are alienable wholly or conditionally even though they are vested in the arable land (rights appurtenant). Different rules were developed for different types of resources, and in different types of commons the same type of resource may have different rights.

To say that rights are vested in land may be confusing. Rights vesting in land mean that the cadastral unit is seen as a «subject» capable of holding rights like a legal person do. The statutory

"all person's rights" ("allemannsrettigheter") in the non-arable lands comprise basically of rights of way, bathing, camping (with a time limit) and picking of flowers, mushrooms, and berries.

The problem of stinting the rights of common to timber and pasture was solved by introducing the "needs" of the farm as criteria for extraction of these resources. The farmer was allowed to take only the timber needed for maintaining and developing agricultural activities on the arable land. Pasturing was limited to the number of animals he or she could feed on the farm during the winter, referred to as cattle "levant et couchant".

**Table 6 Resource Bundling in Norwegian Statutory Forest Commons**

| | Rights to resource withdrawal vest | | |
|---|---|---|---|
| Rights vested in | inalienable | alienable for a maximum of 10 years | alienable on conditions |
| land | timber,<br>fuel-wood,<br>pasture,<br>ground / soil | small game,<br>big game,<br>fish | |
| person | all person's rights | timber, fuel wood,<br>pasture,<br>small game, big game,<br>fish | ground / soil |

### 7.6 Property rights and stakeholders

In the Anglo-American world rights and duties in relation to land and resources are for historical reasons usually referred to as tenure rights. Here they will be called property rights. Property rights will also be taken to comprise the customary usufruct rights to resources as well as the statutory rights and duties enforced by state authorities.

Thus there are three types of rules defining property rights:

- Customary bundles of rights and duties of all stakeholders,
- Statutory bundles of rights and duties of owners, and
- Modifications of customary and statutory bundles of rights and duties by
  - Limiting the options of land owners (zoning regulations or land use planning),
  - Regulating the behavior of stakeholders, and
  - Regulating the use of technology.

Property rights in this meaning not only define owners (those with enforceable rights), but more generally "stakeholders" (anyone with a legitimate interest in a resource). Stakeholders without statutory property rights represent a difficulty for many legal systems. They usually do not have legal standing in court proceedings. During the last decades there has been a growing emphasis on citizen participation in the management of the environment. This has led to new approaches giving standing to stakeholders based on their representation of a general public interest. This process can be viewed as a step towards giving public goods legal protection.

It has proved useful to distinguish three categories of stakeholders

- Private individual
- Private collective (user associations, local communities, NGOs, and business corporations)
- Public state

The importance of the distinction lies in the differences in how goals are decided on and action plans formulated and acted upon. For individual actors, goals emerge through a cultural process. These are acted upon within the constraints posited by established property rights and the incentives of relative prices. Relative price is here seen as a general concept summarizing the relation between effort and benefit. People tend to choose the available action alternative promising the most benefit per unit of effort. Private collective actors are comprised of individuals each with their own goals. The formulation of collective goals as well as action plans is therefore subject to the problems of collective action. But also these actors are subject to the constraints of established property rights and the incentives of relative prices. The state is a particularly important stakeholder because it has the power to redefine property rights and relative prices in a variety of ways. The state is often an owner with direct responsibility for large areas of the non-arable rural lands. It is always a stakeholder in the sense of representing the public interest in how the various resources are used. In rule-of-law states its position as resource owner is subject to established property rights and procedural rules of law making. In other states the two roles of law maker and resource owner tend to become confounded.

Property rights become an effective part of the activities of stakeholders by some kind of legitimate, public register (cadastres, land registers, local records, even the memory of reputable men in public statements). The register will define the objects of ownership and link particular owners with particular objects. The legitimacy of the distribution of rights is furthered in two ways: firstly by the public character of the register, and secondly by established procedures for resolving conflicts about it. A legitimate register of property rights to resources will enable owners to use their resources as a generalized capital asset, and it will lower transaction costs significantly. If the register contradicts the common understanding of the distribution of rights or is not kept up to date, it will be illegitimate. Illegitimate registers undermine tenure security rather than enhance it.

**7.7 Changing property rights**

Property rights define interests and goals tied to the resource. The various stakeholders hold partial and limited views. Often their various goals are conflicting. In such situations the position of owner will have the advantage. Where the rule-of-law obtains, the owner can call upon the power of the state to enforce his or her will against opposing stakeholders. But the specific legal liberties and powers assigned to owners are always in flux. Contestation and renegotiation of property rights are especially notable in political debates, legitimate public decisions, and court proceedings. Political forces shape them and gradually change them. Also local discussions and conflicts among users, such as conflicts over externalities from any particular usage of a resource, feed into these political struggles. Today these struggles usually result in some form of regulation. By issuing regulations about how to use particular resources or how particular technologies can be applied or how particular areas are to be used, public authorities tries to lower the level of conflict, to accommodate the interests of stakeholders who are not owners, and in general to ensure a better overall return from the use of a resource.

**7. 8 The theoretical study of property rights**

The academic study of property rights has concentrated on resolving the relative merits of simple systems of private individual rights compared to systems of common property. The first important result was to see the distinction between the open access resource and the resource managed as common property. While open access resources are without any management regime and tend to become destroyed as predicted by Garret Hardin's metaphor of "The tragedy of the commons", resources owned in common or as private individual property are indistinguishable in the theoretically simple situation of (1) perfect information, and (2) no transaction costs. However, it

is recognized that in the real world available information is far from perfect and transaction costs are considerable. Particularly information about the status of resources tends to be skewed towards the short term and directly observable. Slow and not so easily observed changes often come as surprises. This is as much a problem for local community management as it is for private individual and even state management. In addition, the larger the ecosystem to be managed is, the more complex the information is. And if it is available at all, the cost of implementing it in a management system is considerable.

## 8. Complexities and Interactions

In the non-arable rural lands, management decisions should take into account the complexities of the ecosystem, the complexity of the social system and the interaction of characteristics of the two. Linkages between non-arable lands and other parts of the landscape are also important. The quality of the resources within non-arable lands may depend critically on neighboring mountains, wetlands, deserts and drylands.

Appropriate biodiversity measures, soil characteristics, and climate parameters may summarize the complexity of an ecosystem. Property rights to the various components of the ecosystem can summarize the relevant complexities of the social system. Interactions of ecosystem and social system show up in the cultural valuations of components of the ecosystem as well as the landscape where the ecosystem is observed. In developed modern economies these valuations of the non-arable lands can be seen in

- The price of scarce commodities,
- The lists of threatened species, The public demand for recreational access to the landscape, and
- The public demand for ecosystem services.

In traditional economies it shows up in cultural interpretations of the forest and in the practical rules of use.

The flow of causation from changing values to the qualities of a particular ecosystem within a particular landscape can be very complex with several and nested feedback loops. The outcomes of policy interventions in an ongoing usage of an ecosystem are not easily predicted neither are the political consequences of feedback from the outcomes.

## 9. External Forces of Change.

The various driving forces external to the management system proper that affect land usage can roughly be divided into world market forces, state governance, demographic changes, the practices of local communities, and technological changes.

### 9.1. Market pressures

Access to, and demand from, external markets are among the most critical factors determining which resource will be threatened with overuse. Changes in the relative prices of goods derived from non-arable lands alter calculations about the value of preserving the resource, extracting the resource in a sustainable manner, or liquidating the resource base for immediate consumption or reinvestment in other sectors. In addition to changing the calculus of local actors, increased market value attracts attention from further afield. Non-local people who had no prior interest in non-arable lands are less likely to appreciate the economies of scope that promote multi-purpose management. The various locally devised systems for stinting usage of some scarce resource are numerous and sometimes ingenious. But even if they work well for the local community in isolation they may prove unsuitable as new market forces enter.

### 9.2. State governance

Distant forces are filtered and transformed by more local political bodies. The bureaucracy and political establishment of the state will study the possible impacts of distant world market forces and try to manage their impact on local communities. This is obviously the "optimal" practice from an academic point of view. But equally obvious: many governments around the world do not have the resources either in budget allocation, educated bureaucrats or legal capabilities to follow up on such a program. They may not even be interested in doing so. The shift in values is not uniform throughout the world and the capabilities of following up on new values are variable.

The perceived implications of distant forces will affect legislation, information programs, budget allocations, taxes, and subsidies. These policy changes will affect the relative prices local communities react to and modify the impacts of market prices. The state also promulgates its own agenda by the same types of instruments with their own impacts on relative prices. The instruments used by the state and the incentives of market prices are interpreted and transformed - or ignored - as the local communities implement their own ideas of how "their" non-arable lands ought to be managed. The state of the art is such that the outcome of market incentives and government regulations easily may be in the opposite direction of the intended. Technically such outcomes are described as market failures, policy failures, or institutional failures. The dynamic of market failures are tied to the existence of externalities and the production of public goods. Policy failures are tied to government regulations not tailored to the particulars of the market failures, and to lack of coordination of various policy interventions. Institutional failures occur when bureaucracies are unable to implement policies, local communities are unable or unwilling to comply, or institutions combine in ways that generate perverse incentives.

### 9.3. Demographic change and local practices

Demographic changes include changes in absolute population size, population density, and the mix of categories of people within a particular area. Rapid fluctuations in population size or density pose grave challenges for resource management. Unless accompanied by economic diversification, population growth increases demand for resources extracted from non-arable lands, threatening the sustainability of the resource system. Changing composition of a population also affects resource management. Where social differentiation in resource uses occur, changes in social composition shift the mix of resource uses. Given the interdependencies within forests, shrub lands, and grasslands, shifts in relative prominence of resource uses may have unforeseen consequences for the resource system as a whole.

People can respond to shifts in demand related to demographic change by adaptations in their management practices. They might limit access or regulate extraction of particular goods. Note, however, that rapid demographic change affects the capacity for collective action. To the extent that collective action builds upon trust associated with frequent face-to-face interactions, rapid population growth and shifts in the composition of a population through immigration and emigration limit prospects for successful collective action. If institutions for collective management of land-based resources do not predate demographic change, those changes undermine the ability of local actors to adapt their management practices at the same time that they increase the importance of adaptation.

### 9.4. Technology and organization

On the margin, if technology and organization are kept constant, population growth necessarily will increase the pressure on resources. But technology and organization are never constants in relation to population. Indeed, some argue that population pressure spurs technological innovation.

A meta-analysis of the relation between population and deforestation concludes that population pressure rarely acts alone to produce deforestation. To have a discernible impact population growth needs contingency factors or mediators. And even where statistically significant impacts are detected, their magnitude is quite modest. The tentative conclusion offered is that government policies, land distribution and access to credit and technology are important contingency and mediation factors.

Technological change can facilitate or undermine sustainable management. New technologies sometimes lead to the development of substitutes for natural resources, whether cultivable varieties or synthetics. More ready availability of substitutes decreases interest in wild varieties (unless wild varieties are deemed to be of higher quality). The lower value associated with extraction of wild varieties alleviates pressure on the natural resource, but may also decrease interest in preserving the resource system. Other technological changes alter the ease with which natural resources can be extracted, the ability and costs of monitoring resource use, and the utilization of natural resources. Resource-saving technological changes, such as improved stoves, decrease demand for firewood and charcoal, reducing pressure on woody vegetation. Other technical changes, such as chain saws for harvesting of timber, lower costs of extraction and increase pressure on the resource system.

Technology and organization also affect resource management indirectly, through the development of substitutes for products and jobs in the non-arable land. The changes are most easily traced through shifts in the relative prices of various products, including labor. As the return from activities other than resource extraction in the non-arable lands increases, the number of man-hours expended on work in the non-arable lands declines. The growth of forest stocks in the developed economies seems to have more to do with such shifts in relative prices, than with a policy of conservation. Even though afforestation has played a role in some countries, a large part of it has been natural regeneration on land abandoned by agriculture.

### 9.4. Local governance

Market forces, demographic change, and technological change are filtered and transformed by more local political bodies. The perceived implications of these other external forces affect legislation, information programs, budget allocations, taxes, and subsidies. Policy changes affect the relative prices local communities react to and modify the impacts of market prices. Government policies also influence relative prices for land-based resources directly.

Also the variety of resources and the inherent uncertainty about their dynamic trajectories, and the interaction of diverse resources across time and space suggest that only locally situated users will be able to observe shifts and respond rapidly enough to adapt rules and regulations to changed circumstances.

The balance between state governance and local governance must be seen as mutually supporting rather than rivaling factions.

## 10. Practical Advice for Management in a Diverse and Changing World

The main problem of governing resources of non-arable rural lands is to devise a management system to respond correctly to diverse local ecosystem conditions and diverse local cultural values without compromising the global values of sustainable extraction and use. As local resource

systems become integrated into a national or international economy, also management of resources in the non-arable lands is rapidly requiring specialist academic knowledge. The local or indigenous knowledge may not be sufficient as incentives and motivations change.

In the course of historical change the various management approaches often fail to adapt, and whole resource usage systems may collapse. Timber has for centuries been seen as an important commodity by the states of Western Europe, and fear of large-scale deforestation has from time to time been important. Because of this forestry has been regulated and people have had to develop methods to produce the right kinds and quantities of timber. Today the growing interest in landscape qualities, water availability, soil erosion, and tourist services, as well as concerns about biodiversity, carbon storage, and ethical aspects of nature protection, has led to a profound search for new management tools. At the start of the 21st century neither communities nor states can afford to develop management systems by trial and error. During times with extensive social change, the redesign of the management systems needs to be informed of what works well in different types of situations and contexts.

### 10.1 Sustainable forestry

The international search for practical guidelines to sustainable forestry has led to some tentative recommendations. The Food and Agricultural Organization suggests five changes likely to be encouraged as steps towards sustainable forest management in both natural and planted forests:

**Table 7 Recommended Directions for Changing Forestry Practices**

| |
|---|
| 1. More planting of native species and mixtures in forest plantations, |
| 2. Longer rotation ages or cutting cycles, |
| 3. Smaller overall cutting blocks, |
| 4. Reductions in the use of artificial inputs such as fertilizer and pesticides, and |
| 5. Requirements to leave larger areas untouched around watercourses and other sensitive areas. |

Source: FAO 1999. "Beyond Sustainable Forest management: Opportunities and Challenges for Improving Forest Management in the Next Millennium", Summary paper for World Bank Forestry Policy Implementation Review and Strategy, page 15, see
< http://www.fao.org/forestry/fon/fons/wbfpir/wb.stm>.

Adoption of these management practices would increase the likelihood of sustainable management and enhance the provision of ecological services by managed forest resources. Planting of native species and mixtures of species in forest plantations protects biodiversity and enhances natural resilience against disease and other natural shocks. Reduced use of artificial inputs and expansion of protected areas around sensitive areas protects water supply.

### 10.2 Management of common-pool resources

Institutions shape the distribution of costs and actions associated with the management and utilization of land-based resources, and thus the likelihood that sustainable management practices will be adopted. Development and sustenance of institutions that increase the share of benefits directed to those who bear the costs of management enhance the prospects for sustainability. Based on the study of common pool resources it has been suggested that to solve this problem an appropriator organization is necessary - but not sufficient. Elinor Ostrom's influential study identifies eight tentative conditions associated with long lasting and well working systems for managing common pool resources at the local level:

**Table 8 Characteristics of Long Lasting and Well Working Management Systems for Common-Pool Resources**

| |
|---|
| 1.Clearly defined boundaries: geographically of resource system and socially of user group(s) |
| 2.Congruence between appropriation and provision rules and local conditions |
| 3.Collective-choice arrangements are available for participants/ users |
| 4.Monitoring of behavior in the resource system by people responsible to the local community |
| 5.Sanctions of rule breaking are graduated |
| 6.Conflict resolution mechanisms are available with rapid access and at low cost |
| 7.Rights to organize the local resource usage has a minimal recognition by external authorities |
| 8.Nested enterprises if the local resource system is part of a larger system |

Source: Elinor Ostrom, 1990 "Governing the Commons. The Evolution of Institutions for Collective Action", Cambridge, Cambridge University Press, page 90.

The eight design principles describe characteristics of successful institutions. Some of these principles cannot really serve as the basis for practical recommendations. It may not be technically possible or politically desirable, for example, to create clear resource or social boundaries where they do not exist already. But other items in this list suggest actionable recommendations. Institutions can be designed, or modified, to graduate sanctions for the violation of rules or lower the costs of conflict resolution. Policies can grant or recognize the authority of resource users to make decisions about the management of land-based resources. The longevity of past institutions for resource management with these characteristics suggests that such changes can contribute to more sustainable management of non-arable lands.

### 10.3 Co-management of natural resources

The shift towards community-based management of natural resources is, at least in part, an effort to involve local resource users in management decision-making. Management arrangements that involve local resource users in decision-making make better use of local knowledge, can be more sensitive to heterogeneity in resource utilization, and are more likely to produce legitimate rules for management. The costs of monitoring and enforcing those rules tend to decrease as the legitimacy of the rules increase. Co-management arrangements split authority over various aspects of resource management between local actors and state agents. In some cases, co-management reflects nothing more than a compromise. State agents resist the devolution of authority over valuable resources, but recognize the infeasibility of totally excluding local actors from decision-making. Even if the distribution of authority reflects political considerations, co-management can serve the public interest. Retention of a role for the state increases the probability that externalities – including public goods - associated with non-arable lands are taken into consideration.

### 10.4 Management principles

The best management practice for non-arable rural lands seems to conform to the following principles:

- A co-management system with legal recognition of the interests of the local stakeholders, usually promulgated by some form of register of property rights and resources
- A multi-purpose management system recognizing the interdependencies and scale effects in the ecosystem as well as the diversity of stakeholders,
- A flexible management system that is sensitive to locally diverse and changing conditions and
- An equity management system with the goal of protecting the interests of the poorest stakeholders within the limits posed by rule-of-law and ecosystem limitations.

But even in the best of circumstances public authorities will have a long way to go before they approach the ultimate goal: the sustainable and equitable use of the resources. The tentative nature of the proposed guidelines, the limited knowledge about the diversity of resource, and the diversity of stakeholders suggest they often will get it wrong.

In the end outcomes will improve only if states learn from each effort and adapt according to experience the regulations, and statutory rights and duties of stakeholders.

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**Bibliography**
Abel, N. O. J. and P. M. Blaikie (1989) "Land Degradation, Stocking Rates and Conservation Policies in the Communal Rangelands of Botswana and Zimbabwe," *Land Degradation and Rehabilitation* 1: 101-123.

In the early 1970s, following Hardin's popularization of the tragedy of the commons model, many governments and international donors promoted enclosure of rangelands, huge reductions in stocking rates, and the development of capital-intensive ranches. Abel and Blaikie challenged this strategy on two fronts: viability given ecological conditions in arid grasslands and relevance for local management goals. The standard model for range management had been developed for temperate climates with relatively stable ecological conditions. The instability of ecological conditions in arid lands rewards changing herd sizes to track climatic conditions more than maintaining a stable stocking level. Likewise, mobility of herds utilizes geographically scattered rainfall better than stationary production within enclosed ranches. The ranch model assumes that people use the range primarily to raise cattle for beef production; people in arid areas often keep livestock primarily for the production of milk and as an input for crop production.

Baland, Jean-Marie and Jean-Philippe Platteau (1996) *Halting Degradation of Natural Resources: Is There a Role for Rural Communities?* Oxford: Clarendon Press.

Baland and Platteau synthesize two streams of research on the role for rural communities in natural resource management: economic theory, including game theoretical and experimental research, and empirical research in a variety of fields. They demonstrate that, in terms of economic efficiency, no single best regime for the management of localized natural resources exists. Conservation is not always justified or economically rational, given the value of the resource relative to other economic opportunities. When resource users run-down a resource and reinvest in more rewarding economic activities, this should not be considered a tragedy – unless they are failing to take into account positive externalities from that resource. Game theory indicates possibilities for decentralized cooperation, and empirical studies demonstrate that rural communities are able to devise institutions (e.g., rules, enforcement mechanisms) that support cooperation. Rural communities have a better track record at creating rules to address problems of access, through rules of exclusion and sharing, than at problems of conservation that require restricted use – in part because of a failure to recognize the link between their actions and ecological conditions, or to underestimate the severity of the consequences of unchanged practices.

Fairhead, J. and Melissa Leach (1996) *Misreading the African Landscape: Society and Ecology in a Forest-Savanna Mosaic*. Cambridge: Cambridge University Press.

Warnings of degradation of forests and other non-arable lands often reflect extrapolations based on short-term observations. In the Sahel, many observers from the colonial era through the present have interpreted the existence of forest patches as evidence of serious deforestation. The proximity of forest patches to villages suggested that population pressures contributed to deforestation. Discussions with villagers in Guinea, however, led Fairhead and Leach to suspect that villagers create forest patches in the savanna instead of converting forest into savanna. Analysis of aerial photographs substantiated their suspicions. New forests appeared in the savanna after the establishment of villages. When villages relocated, so did forest boundaries. These findings questioned the conventional wisdom about relations between human activities and forest degradation, and demonstrated the possibility for substantiating ethnographic findings with remotely sensed imagery.

Guha, Ramachandra (1989) *The Unquiet Woods: Ecological Change and Peasant Resistance in the Himalayas*. Oxford: Oxford University Press.

Guha links the Chipko Movement to struggles over forest resources in the Indian Himalayas over the past century. Guha sees conflicts over forests as an out growth of ecological conditions and efforts by the state to dominate peasant society. This volume essentially launched the field of environmental history in South Asia.

Hardin, Garrett (1968) "The Tragedy of the Commons," *Science* 162: 1243 - 1248.

This article popularized the notion that a tragedy of the commons threatens the sustainability of natural resource uses unless under private or state ownership. Hardin laid out the individual logic that results in overstocking of a pasture that is open to all. The "tragedy" metaphor rests upon an assumption that only three types of property arrangements exist: individual or private ownership, state or public ownership, and common or no ownership. By conflating common property with open access, Hardin overlooks the possibility of private but collective ownership and management of renewable natural resources. The article gave rise to research that demonstrates the existence and long-term viability of resource management under common property.

McDonnell, Mark J. and Steward T.A. Pickett (eds. 1993) *Humans as Components of Ecosystems. The Ecology of Subtle Human Effects and Populated Areas*, New York, Springer

This collection of essays is an effort by ecologists to find ways to integrate human activity into models of ecosystems and ecosystem dynamic. The editors emphasize that changes in human activity may have "subtle" as well as obvious effects as measured by ecosystem changes, and subtle changes in human activity may have obvious as well as "subtle" impacts on ecosystems. The collected essays explore the implications for ecosystem management and construction.

Netting, Robert McC. (1981) *Balancing on an Alp: Ecological Change and Continuity in a Swiss Mountain Community*. Cambridge and New York: Cambridge University Press.

People may respond to growing population pressure through extension or intensification of their resources uses, but these strategies have limits. Population growth is not inevitable, and calamity is not the only available check on population growth. Netting examines the evolution of the Swiss alp community of Törbel over several centuries to both substantiate the stability of its population and identify local institutions that contributed to that stability. Rules of inheritance, very strictly defined rules of citizenship, and the lack of attractive

opportunities outside of Törbel contributed to population stability. Risk and seasonality of production encouraged participation in the full array of activities associated with exploitation of the forests and pastures, which in turn contributed to shared interests in sustainable management of these resources for multiple uses.

Ostrom, Elinor (1990) *Governing the Commons: The Evolution of Institutions for Collective Action*. Political Economy of Institutions and Decisions. Cambridge: Cambridge University Press.

Previous challenges to "the tragedy of the commons" model demonstrated that common property exists and can be sustainable by identifying cases of success. Ostrom developed a database of case studies of common resource management that demonstrated that successful common property occurs in more than an isolated handful of cases, but also that cases of common property vary in their durability and the sustainability of their resource management. Ostrom identified a set of design principles associated with long-enduring instances of common resource management. These design principles continue to set the agenda for research on the conditions for common property.

Quiggin, John (1993) "Common Property, Equality, and Development," *World Development* 21, no. 7: 1123 – 1138.

Quiggin emphasizes that common property makes it easier to achieve economies of scope as well as economies of scale. Recognition that joint production of several resources of interest may be more efficient than separate production provides economic justification for both common property and management of lands for multiple uses. The success of group decision-making, upon which common property depends, reflects interactions between the clarity and flexibility of institutions and the complexity and stability of the resource management problem.

Rackham, Oliver (1989) *The Last Forest*, London, Phoenix, 1998

The book provides insight into the complexity of life in an ordinary forest ecosystem. It makes the intricate interactions of human usage and ecosystem come alive. Besides telling the history of Hatfield Forest, the book also treats the ecology of woods and plains, and of pollards and ancient trees. The intricate relations between the ecology of the Hatfield Forest with its timbers, coppices, pollards, pastures, fens, deer, and livestock, and the human usage of it by the lords of the manors, the Forest service, and the commoners become understandable. The importance of keeping track of the different life cycles of the various elements of the Forest is underlined.