AN INSTITUTIONAL APPROACH TO APPROPRIATION AND PROVISION IN THE COMMONS

A CASE STUDY IN THE HIGHLANDS OF ERITREA

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Declaration

I, the undersigned, hereby declare that the work contained in this thesis is my own original work and that I have not previously in its entirety or in part submitted it at any University for a degree.

Signature: …… *Date:* ……

Abstract

The natural resources mainly land, forests, and grazing lands in the Highlands ago-ecological zone of Eritrea are in a severely degraded state. And much of these common pool resources comprise *commons* i.e. they are managed under the common property rights management regimes.

"*The tragedy of the commons*", model suggests that all *commons* will inexorably suffer overexploitation and degradation. Contrary to this deterministic proposition, however, common property theory argues that the *'tragedy'* is not due to inherent flaws in the common property rights management regimes, but because of institutional failure to control access to resources, and to make and enforce internal decisions for collective use. If the commons dilemma situation exists- i.e. 'tragedy', then the underlying problem is the degeneration of the existing common property rights resource management regime into open-access-like regime—a condition that can potentially trigger "the tragedy of the commons". The question of how to deal with the problem of the *commons* is, therefore, primarily an issue of the existence of efficient institutions.

The prevailing severe degradation of the common-pool resources in the Highlands of the country thus calls into question the robustness of the common property rights regimes that are in place for the governance of these resources. This thesis attempts to address this important problem specifically in relation to forest and grazing land common pool resources.

A case study based on a *single-case qualitative* and *exploratory-explanatory* research design was carried out in a village located in the Highlands of the country. Data were collected through various forms of interviews (semi-structured interviews, in-depth interviews, key informants interviews, group discussions, and informal conversational interviews), direct observation, and document review. The data, gathered largely through using these separate lines of enquiry, were crosschecked to provide a triangulation of methods and to strengthen the validity and reliability of the data.

The empirical findings reveal that existing common property rights management regimes for the management of the local common pool resources of the case study area have weakened over time. These findings indicate that, there is a significant incongruence between *appropriation* and *provision rules*. And this is manifested in terms of *appropriation externalities and demand side and supply side provision externalities.* This situation implies that existing local institutional arrangements i.e. *common property rights management regimes* in the case study area are not sufficiently robust to solve common pool resource *appropriation* and *provision* externalities.

Though generalisation cannot be made beyond the case that was studied, there are several lessons that may be drawn from this field analysis, which may have valid implications for the natural resources management challenges and opportunities of the entire Highlands ago-ecological zone of the country.

Opsomming

Die natuurlike hulpbronne, veral grond, woude en weiding in die Hooglande van Eritrea is erg gedegradeer. Baie van dié hulpbronne bestaan uit kommunale grond (*commons*) wat beteken dat dit volgens gedeelde-eiendomsreg-bestuurregimes bestuur word.

Volgens die model *The tragedy of the commons* sal alle kommunale grond genadeloos oorbenut en gedegradeer word. In teenstelling met dié deterministiese voorstel, sê die teorie egter dat die ‘tragedie’ nie die gevolg van inherente foute in die kommunale bestuurregimes is nie, maar die gevolg van die institusionele onvermoë om toegang tot hulpbronne te beheer en besluite ten opsigte van die algemene gebruik daarvan te neem en af te dwing. As die tragedie, dit wil sê die dilemma rakende kommunale eiendom, wel bestaan, is die kernoorsaak die verval van bestaande algemene regtebestuursprogramme in een wat onbeheerde toegang bied, 'n situasie wat die ‘tragedie’ aan die gang kan sit. Die probleem rakende die bestuur van kommunale grond is daarom hoofsaaklik een van 'n gebrek aan doeltreffende instellings.

Die voortdurende ernstige degradering van die gemeenskaplike hulpbronne in die land se Hoogland bevraagteken dus die lewenskragtigheid van die bestuurregimes wat tans daar toegepas word. Hierdie tesis poog om dié belangrike probleem te ondersoek, veral ten opsigte van woude en weiding op kommunale grond.

'n Gevallestudie gegrond op ’n *enkelgeval-kwalitatiewe* en *verkennende-verklarende* navorsingsontwerp is in 'n dorpie in Eritrea se Hoogland gedoen. Data is ingesamel met behulp van verskillende soorte onderhoude (semi-gestruktureerde onderhoude, diepgaande onderhoude, onderhoude met sleutelinformante, groepsbesprekings en informele gespreksonderhoude), direkte waarneming en ’n dokumentêre oorsig. Die data wat hoofsaaklik op hierdie maniere ingesamel is, is gekruiskontroleer om die metodes te yk en dit groter geldigheid en betroubaarheid te gee.

Die empiriese bevindinge het getoon dat die bestaande eiendomsreg-bestuurregimes in die gebied waar die gevallestudie gedoen is, mettertyd agteruitgegaan het. Die bevindinge het getoon dat beduidende teenstrydighede bestaan tussen die *reëls vir beskikbaarstelling* en *voorsiening*. Dit is duidelik uit die *eksternaliteïte rakende beskikbaarstelling sowel as rakende vraag en aanbod.* Dié toedrag van sake impliseer dat bestaande plaaslike institusionele reëlings, in die gebied waar die gevallestudie gedoen is, nie goed genoeg is om die kwessies wat uit die *beskikbaarstelling* en *voorsiening* van gedeelde hulpbronne spruit, op te los nie.

Hoewel dit nie moontlik is om veralgemenings buite die omvang van die gevallestudie te maak nie, is daar heelwat lesse uit dié veldontleding te leer wat geldige implikasies vir die uitdagings rakende natuurlike hulpbronbestuur en -geleenthede in die agro-ekologiese sone regdeur die land se Hoogland het.

To our firstborn son, Yoel

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Abbreviations

CFW	Cash for Work
CARP	Cultural Assets Rehabilitation Project
CHZ	Central Highlands Zone
CPR(s)	Common pool resource(s)
FAO	Food and Agriculture Organization/of the United Nations
FFW	Food for Work
FSS/GSE	Food Security Strategy, Government of the State of Eritrea
GDP	Gross national product
GSE	Government of the State of Eritrea
H	Highlands
IFWRR/MOA	Interim Forestry & Wildlife Resources Regulations - MOA
I-PRSP/GSE	Interim Poverty Reduction Strategy Paper - Government of the State of Eritrea
LPMI-E	Land Productivity Management Initiative – Eritrea
MOA	Ministry of Agriculture
MOLG	Ministry of Local Government
MOLWE/DL	Ministry of Land Water and Environment/Department of Land
NAP-E	National Action Plan – Eritrea
NEMP-E	National Environmental Management Plan for Eritrea
NIE	New Institutional Economics
NRCE	Natural Resources Consulting Engineers Inc.

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PART I: BACKGROUND OF THE STUDY & STATEMENT OF THE PROBLEM

1. Introduction

1.1. Background of the study

Agriculture in Eritrea is the mainstay of the national economy and the source of livelihood for the majority of the population. Over 70 percent of the country's population depends on agriculture for sustenance and development. The agricultural production system is based largely on small-scale peasant cultivators and on pastoralists at subsistence level.

Because of its social and economic importance in Eritrea, agriculture must be depended on for overall national development and for raising the standard of living of the rural population as a whole. Currently, however, productivity is so low that it does not provide sufficient income to the rural communities or ensure adequate food security. This sluggish rate of agricultural development has been attributed to a number of technical and institutional constraints.

Sustainable utilisation of the natural resource base and protection and conservation of the environment is central to agricultural development. In Eritrea, however, the degradation level of the natural resources is so grave that it has become a major problem. There is widespread evidence of serious soil erosion and degradation, forest destruction, and absolute disappearance of major wildlife species (World Bank, 1994; Gebremedhin, 1996; FAO, 1977; Gebremedhin, 2002). The Highlands of Eritrea, on which this research project is focused, are the worst affected part of the country and the unfavourable social and economic impact thereon has consequently been harsher.

The severe degradation of the natural resource base has contributed to serious ecological and social effects. This includes an adverse impact on the hydrological regime, leading to

reduction in the water-retention capacity of the watersheds; an increased silt load in rivers resulting in the rapid siltation of dams; loss of gene resources; loss of nutrients in the soil and hence reduced fertility. Moreover, it has resulted in declining yields from croplands and rangelands; declining returns to the land user; and farming adjusted to lower levels of productivity with less value at local and national level.

The cumulative effect of past and present mismanagement of the natural resources of Eritrea has been a significant reduction in the economic, social and environmental benefits to society, at local and national level, than would have been realised from better management of these resources. In view of this undesirable situation, one of the primary goals of the State of Eritrea's development policy has been to spearhead rehabilitation and conservation of its environment/natural resources. To halt and reverse the degradation of the natural resources, however, there needs to be efficient management of these resources.

In Eritrea, and predominantly in the Highlands, natural resources are affected by management regimes related to three broad categories of property rights: *common property, state-based property* and *private property*. In spite of these resource management regimes, the deterioration of the natural resources of the country, and the Highlands in particular, has continued unabated. Moreover, much of the common pool resources comprise commons i.e. they are managed under the *common property rights* management regime. It is against this background that this study is conducted.

This study tries to examine the efficiency of the *common property rights* management regime in place for the governance of local common pool resources in the Highlands of Eritrea using a case study approach.

1.2.Statement of the problem and research questions

Statement of the problem

Hardin's (1968) influential article the 'tragedy of the commons' has resulted in a great deal of research interest concerned with environment and natural resource degradation. The theory has been widely used to explain misuse of various resources such as fisheries, forests, overgrazing, air and water pollution, extinction of species, ground water depletion, and other problems of resource overexploitation. Moreover, the expression has come to symbolise the degradation of the environment to be expected whenever resources are held in common.

In the above-mentioned article, Hardin used the example of a pasture to which cattle herders have open access – a common pasture – to illustrate the logical structure of his model. Each herder receives a direct benefit from placing an animal on the pasture, whereas the costs for degrading the pasture are shared by all the herders. Due to this skewed benefit-cost ratio, all herders have the incentive to put as many cattle on the pasture as they can. Putting more animals on the pasture is the rational choice, yet the impending result is the degradation of the common pasture. For Hardin, "therein lies the tragedy." Driven by the self-centred rationality of seeking their own benefits, each herder inadvertently contributes to the demise of all–hardly a rational outcome. So, Hardin concludes, "freedom in the commons brings ruin for all."

Simply stated, according to Hardin's tragedy of the commons, individuals appropriating the commons are trapped in a commons dilemma—an instance where individual rational behaviour can cause long-range harm to the environment, others, and ultimately oneself. Forests and grazing lands (watersheds) are principal examples of commons that are critical for agricultural development and livelihoods of the rural population in the Highlands of Eritrea.

Critics argue that Hardin's tragedy of the commons is applicable only to open access resources where no property rights are assigned, and not to all commons[1]. They suggest that,

[1] The term 'commons' is an amalgam of two concepts and denotes both the common pool resources (natural resources) and the institutional arrangements (*common property rights*) created by humans to manage these

if there is a defined set of resource users, yet the commons dilemma exists, then the real problem is often the absence of or a weakened resource management regime. It is therefore suggested that Hardin's "The tragedy of the commons" is not due to inherent flaws in the common property rights management regimes, but because of institutional failure. The question of how to deal with the problem of the commons is, therefore, primarily an issue of the existence of effective institutions. Then the important and interesting task is to figure out how local resources in a particular community were and still are governed by what is referred to as *institutions* -- regulative devices, that define who is allowed to use what kind of resource at what time and under what circumstances.

In the Eritrean Highlands, most of the natural resources (common pool resources) are commons. The prevailing severe and unabated degradation of these resources calls into question the efficacy of the institutional arrangements in place for the governance of these resources. In the context of the present research, the important research problem concerns how efficient/robust the local common property rights management regimes in the Highlands of Eritrea are. This thesis will attempt to address this important problem specifically in relation to forest and grazing land common pool resources.

Research questions

Based on the foregoing discussion on the research background, problem statement, and the succeeding theoretical discourse, the *main* and *sub research questions* depicted in the following were formulated.

Main research question

What are the institutional arrangements for the management of local common pool resources (forests and pasturage) under common property rights in the Highlands of Eritrea in general and in the area where the case study was to be conducted in particular, and how robust/sustainable or fragile is this common property regime?

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resources. Thus, 'commons' refers to the common pool resources that are commonly used and managed under common property rights.

Sub research questions

To address the main research question, the following sub questions about the governance of forests and grazing lands in the Eritrean rural Highlands had to be answered. The sub questions were structured into four main categories based on the institutional analysis frameworks of commons investigated for this research *(see Sect. 3.5)* and *(Sect. 3.6.)*.

The sub research questions were outlined as follows:

1. **Physical and technical attributes of the local common pool resources**

   - What are the physical characteristics of the local common pool resource systems and the attributes of the technologies associated with these resource systems;

   These were the issues of *jointness*—degrees of non-subtractability; *exclusion*—relative ease with which access to the resource system is limited; and *indivisibility*—the minimal scale on which effective coordination of resources and ecologically viable management can occur.

2. **Decision-making arrangements**

   - What are the rules that govern or regulate the appropriation and provision of the common pool resources under the common property rights regimes?
   - What are the rights and duties of eligible individuals with regard to appropriation and provision activities respectively to forests and grazing lands resource flows? This was aimed at investigating the congruence between the rules for distribution of benefits from appropriation and the costs imposed by provision rules in connection to the said resources;
   - Are these rules aimed at an efficient use of the resources or do they serve other social purposes, particularly that of ensuring fair access to these resources? This was a question of conservation vs. distribution;
   - What are the institutional arrangements aimed at controlling free-riding behaviour? This would be assessed in terms of monitoring, sanctioning, and conflict resolution institutional arrangements.

3. Patterns of interaction

- Are members of the community competing with one another to maximise their individual 'benefit' from the commons; are individuals obtaining more and investing less in the commons (*free-riding)*?
- Are the prevailing patterns of interaction (resulting from the strategies adopted by the resource users) cooperative or free-riding/conflict-oriented behaviours?
- Is equity based on the ability to contribute or benefit derived? What is the perception of the local people on the equity issue?

4. Outcome

- How robust or fragile is the common property right regime? *(Application of design principles)*
  - How clear are the boundaries defined in terms of resources and resource users?
  - How congruent are the benefits derived from appropriation rules with the costs imposed by provision rules; is there a match between restriction on harvest and regeneration/carrying capacity?
  - How broad is the participation in rule making and modification by those affected?
  - How is monitoring done and who is the monitor; whom are they accountable to?
  - Do graduated sanctions exist to counteract the violation of operational rules?
  - Do low cost and rapid conflict resolution mechanisms exist?
  - Are the rights to organise and manage resources of the local people challenged by external official agents?

1.3. The purpose of the study

A clear understanding of the functioning of local common pool resources management institutions, their limitations, and opportunities in shaping the environmental outcome is desirable to provide better guidance with regard to future natural resource management policies. In this study, it is therefore intended to investigate the existing common property rights regime for the management of local common pool resources in the case study area and

determine the state of this institution: *What state is it in now? That is, is it robust? Is it weakened?* More specifically the purpose was:

- To explore the rules that govern or regulate the local common pool resources held in common;
- To examine the appropriation and provision rules, which specify the rights and obligations of a resource user in maintaining the resource systems;
- To investigate the monitoring, sanctioning, and institutional conflict resolution arrangements that are designed to control free-riding behaviour;
- To determine the state of the local commons institution, meaning is it robust or weakened? Towards this end, a set of design principles developed by Ostrom (1990) was applied as a template criterion against which the attributes of the common property were compared with *(see Sect. 3.6.4)*.

The present thesis is based on a *single-case qualitative* and *exploratory-explanatory* research design. It was carried out in the farming community of Tsehaflam village, located in sub zone Serejaka, *Zoba*-maekel *(see Maps 1 & 2)* in Eritrea.

1.4. Significance of the study

Apart from academic purposes, it is hoped that the theoretical discourses and the empirical analysis contained in this research paper would also contribute to the ongoing policy debate on the governance of common pool/natural resource systems in Eritrea.

At present, the views held by various policy makers and professionals alike on the question of appropriate policy options aimed at sustainable common pool/natural resources management for the country are divergent and unresolved. It is hoped that this thesis, through its extensive theoretical arguments and case study findings, will allow insights into different policy options and thereby facilitate and contribute to the ongoing policy debate in the country.

1.5. Thesis structure

The thesis consists of eight chapters. The following paragraphs detail the purpose and content of each chapter.

Chapter 1 presents the introductory part of the paper in which is discussed the background of the study, statement of the problem and research questions, purpose of the study and the significance of the study. Chapter 2 *(rational choice theory)*, Chapter 3 *(institutional choice theory)*, and Chapter 4 *(co-management as a new approach of managing CPRs)* jointly constitute the theoretical framework of the study.

Chapter 2 is divided into three main sections. Section 1 provides an overview of the rational choice theory (one of the pillars of neoclassical economics). Then it briefly shows Hardin's '*Tragedy of the commons'* model (1968) to have been based on the neoclassical theory of individual choice and utility-maximising rationality for which the central construct is a rational self-interest agent model as applied to commons. Hardin's model, akin to the neoclassical theory upon which it is based, underplays the role of social institutions. In Section 2, clarification of key concepts in commons literature is provided, as this is essential to the theoretical discourses contained in the next section and to the rest of the chapters as well. It does this by unravelling the meanings of frequently confused terms and concepts in the literature. Then it discusses four types of goods, which include: private, public, club or toll goods, and common pool resources (CPRs). Section 3 examines the rational choice-based models—*the tragedy of the commons* and *prisoner's dilemma game.* This section begins with presenting Hardin's *"the tragedy of the commons"* model (1968), which predicts that all resources held in common will inevitably suffer overexploitation and ultimately decimation. To avoid this inexorable destruction of commons, according to this model, two policy prescriptions are proposed: private or state-control. The section also portrays Hardin's model, formalised as the *Prisoner's Dilemma Game*, suggesting that individual rational agents using commons will not cooperate so as to achieve collective benefits. Afterwards, this section presents a critique in which the deterministic prediction of the models is rejected and the universal applicability of their policy prescriptions is questioned. The conclusion reached in

this section converges in what Vink (1986:90) concluded: "even if a tragedy of the commons were logically possible, it would not be inevitable."

Chapter 3 presents institutional choice theory, espousing the idea that institutions matter in human interaction or economic co-ordination. This chapter is composed of six sections: Section 1 briefly outlines the core neoclassical assumptions and then shows that the new institutional economics extends neoclassical economics by modifying some of its core assumptions. The second section discusses social dilemmas (the tragedy of the commons) and externalities; it identifies the link between them and points out the implications. The third section explores the specific externalities associated with CPR settings and suggests '*institutions' as a solution* to the CPR dilemma. The fourth section defines institutions from new institutional economics perspectives and notes their role in human interaction and economic efficiency. The fifth section presents a framework for the analysis of commons. This framework is employed as a tool for collecting, collating, and analysing the field data. The sixth section explores the concept of property rights and discusses them in relation to common pool resources management. Design principles, *inter alia*, are discussed in this section and are used as template evaluative tools for the institutional status (robust/weakened) of the common property rights regimes in the case study area.

Chapter 4 explores the new paradigm shift, termed co-management, in natural resource management. This chapter begins with a brief review of the three property rights categories (private, state and common property) for the management of local CPRs and indicates that the recent paradigm shift is towards a hybrid approach (co-management) to the management of CPRs where local communities work in partnership with government. Following this introductory exposition, this co-management regime is defined in Section 2. Section 3 provides the rationale for this type of institutional arrangement. Lastly, in Section 4, a typology of co-management or the co-management continuum is discussed and schematic representation of this management continuum is presented.

Chapter 5 presents the methodology employed to collect and analyse the data used for this thesis. Section 1 provides a brief discussion of the objectives of the research project at hand and the nature of the phenomenon to be investigated—the commons, followed by an

explanation of the decision to adopt the case study research method for this study. A discussion on the case study as a research method and application of the recommended procedure in the current research is presented in Section 2. Following this section, a discussion on establishing rapport in the research site is presented. In Section 4, the issue of validity and the reliability of data collected using various research tools are explored. A discussion on 'conducting the fieldwork' is presented in Section 5. The method of data processing and analysis is discussed in conclusion.

Chapter 6 provides extensive information on the context, ranging from the natural resource base to policies targeted at natural resources development and conservation in the country. The purpose is to provide an overview of the country in general and a broad context for the case study in particular. The chapter discusses the natural resource base of the country, examines the significance of the agricultural sector and its challenges, and explores the status of the country's forests and pasturage resources. It also examines government policies directed towards forestry and pasturage CPRs and overviews the current management modalities for local CPRs. It furthermore examines recent trends in the management of CPRs, following the new interim regulations for the management of local CPRs, and a critique of these regulations is presented.

Chapter 7 presents the empirical study and has three subsections. The first section presents the introduction in which the purpose of the empirical study is explained. Following this, the background subsection describes the socioeconomic and adminstrative setup of the village of the case study and reviews the local CPR management modalities and the land tenure systems in the country and the village selected for the case study. Subsection three presents the main empirical findings of the case study analysis. Here, the physical and technical attributes of the local CPRs, institutional arrangements, and patterns of interaction are identified, described and analysed. The subsection furthermore presents an evaluation of the existing common property rights regime. Chapter 8 comprises the last part of the research paper and presents the conclusions and recommendation of the thesis.

PART II: THEORETICAL FRAMEWORK OF THE STUDY

2. Rational choice theory

"We are not ready to suspect any person of being defective in selfishness."

Adam Smith (as quoted in Dietz et al., 2002:4)

2.1. Introduction

Rational choice theory is one of the pillars of neoclassical economics and posits that all human decisions are motivated by a desire to maximise utility. As Scott (2000) and Fishwick (2002) suggest, this theory assumes the individual to be an actor with an initial concern only for his or her own welfare. The individual anticipates the outcomes of alternative courses of action and calculates that which will be best for him/her. The rational individual chooses the alternative that is likely to give him/her the greatest satisfaction. And according to Abell (1996), evolutionary theory is often used to justify self-regard, by claiming to show that self-regard survives in competitive environments.

The "*Tragedy of the Commons"* (Hardin, 1968), which constitutes the first part of the theoretical framework of this paper, is based on the neoclassical theory of individual choice and utility-maximising rationality. Accordingly, the central construct of the "Tragedy of the Commons" is a rational self-interested agent model as applied to commons. For Hardin, the inexorable logic of individual rationality leads to the tragedy of the commons. The tragedy-of-the-commons model has also been formalised in terms of the non-cooperative two-person prisoner's dilemma game, which also suggests that rational individuals can never cooperate so as to achieve collective benefit.

This chapter is devoted to discussions of the rational choice-based models—*the tragedy of the commons* and *prisoner's dilemma game*. The theoretical foundations and assumptions of these models are discussed, their policy implications are examined, and critiques on both of the models and their policy implications are presented. Before a discussion is initiated on these theories, clarification and discussion of key concepts that are related to commons and common pool resource systems and resource units will presented. This exercise will be very helpful for the subsequent main theoretical discourse and analysis of empirical field data.

2.2. Clarifying key concepts

Conceptual confusion and conflicting usage concerning theoretical terms applied to commons persist in the literature. According to Ostrom (2003), such confusion has led to misunderstandings in academic and policy debates. In this regard, Bromley (1991:92) has suggested that there can be no more important aspect of scholarship than that of concept and language. He further argued that, when scholars use the same words or terms to describe fundamentally different factual situations, ideas, or phenomena, intellectual progress is impeded rather than advanced. Likewise, McKean (1996), in connection with this issue has said, "Silly as it may seem, I am convinced that part of our problem is semantic."

According to Hess and Ostrom (2001), three basic confusions need to be untangled in the debate on the theory of commons. The source of confusion relates to the differences among, i) the nature of the goods (common pool *resources*) and a property regime (common property *regime*); ii) common property and open access regimes; and iii) resource systems and the flow of resource units.

It is therefore important that a clear set of definitions of key concepts be presented at the initial stage and used consistently throughout the paper. In line with this, and before turning to an in-depth discourse on the tragedy of the commons and the prisoner's dilemma *(Section 2.3)*, an effort will be made in the following subsection to unravel the various meanings of the most important terms and concepts mentioned above.

2.2.1. Common pool resources and common property

The term '*common-property resource,'* as noted by Hess and Ostrom (2001), was frequently used to describe a type of economic good that is better referred to as a '*common pool resource.'* For many scholars, the concept of a property regime and the nature of a good were thus conflated. Nevertheless, as Dietz *et al.* (2002) suggest, analytical advantages exist in separating the intrinsic nature of the resource or good valued by humans from the concept of the rules that may be used to govern and manage the behaviour and actions of humans using these resources, i.e. the property rights regime under which it is held.

The term "common property" implies a kind of management arrangement created by humans rather than a characteristic of the resource itself. The preferred term for resources from which it is hard to exclude users is 'common pool' resource. The term "common pool" focuses on the characteristics of the resource rather than on the human arrangements used to manage it. According to Dietz *et al*. (2002), a common pool resource is characterised by difficulty of exclusion or high exclusion costs and one person's consumption subtracting from the resource units available to others. Overuse of this type of resource leads to congestion or even destruction of it.

In line with the preceding statements in this paper, the term 'common pool resources' is adopted to refer to the inherent natural or physical qualities of resource systems and not to the social institutions that human beings have attached to them. On the other hand, 'Common property' or 'common property regime' is used to refer to a property rights arrangement in which a group of resource users share rights and duties towards a resource—referring to social institutions.

2.2.2. Common property and open access regimes

Concerning the second problematic term related to the theory of commons, Bromley (1991b:92) indicates that there is an unfortunate tradition of failing to recognise the critical distinction between common property (*res communes)* and non-property (r*es nullius)*—also known as open access. Because of this failure, the problem of common property and the problem of open access are often confused and are used interchangeably in the literature. In

the view of Feeny *et al*. (1990), and Baland and Platteau (1996), many of the misunderstandings found in the literature may be traced to this problem. Baland and Platteau (1996) give a typical example of the tradition of confusing these two distinct concepts by citing Comes and Sandler's (1983) argument on common property. Comes and Sandler (1983) say "Traditionally common property analyses demonstrate the overexploitation of the scarce fixed resource; the *average product* of the variable input, not its *marginal product*, is equated to the input's rental rate when access is free and the number of exploiters is large."

Common property and Open access, however, are essentially different. As defined by Bromley (1991b), (Baland & Platteau, 1996) and Feeny *et al.* (1998), the *common property regime* is an institutional arrangement in which the resources are assigned to an identified community of interdependent users. Non-members have a duty to abide by exclusion; individual members or "co-owners" have both rights and duties with respect to using rates and maintenance of the resource commonly owned.

Open access, on the other hand, is a situation of non-property where no one owns or regulates a resource. It is free and open to everyone and no one has a legal right to exclude anyone from using the resource (Burke, 2001). As suggested by Baland and Platteau (1996), when a given resource is free for all—open access, the agents' decision whether or not to 'enter' and start exploiting the resource is based on the comparison between the price of entry, which they have to bear, and the expected income they will get. Hence, as long as the net expected benefit is positive, they decide to enter and exploit the resource. Because of this skewed cost benefit ratio, resources will be overexploited and potentially destroyed.

2.2.3. Resource systems and the flow of resource units

The third source of confusion in commons literature is associated with the relationships between resource systems and flow of resource units. It is suggested that a distinction has to be made between the 'resource systems' and the flow of 'resource units' that it produces. According to Hess and Ostrom (2001), the resource system (or, alternatively, the stock or the facility) is what over time generates a flow of resource units or benefits that are appropriable and subtractable in use. Resource units are what individuals produce and/or appropriate from

a resource system. Examples of typical common pool resource systems or facilities and their resource units include (Ostrom, 1992; & Ostrom *et al*., 2002):

> (1) Grazing lands and tons of grasses grazed by animals; (2) a forest and the tons of timber and/or other removable biomass harvested; 3) fishing grounds and tons of fish; 4) a groundwater basin and the cubic meters of water withdrawn; and (5) an oil field and barrels of oil pumped.

Two attributes are essential in distinguishing the resource system from the resource units it produces—*subtractability* and *jointness* Ostrom *et al*., (2002). The former is a characteristic of the resource unit appropriated from a common pool resource system, for instance, the grass eaten/grazed by one animal from a pastureland is not there for another one. While the latter, i.e. *jointness* of use is a characteristic of the resource system. More than a single animal can graze simultaneously on the same pastureland.

The distinction between the resource stock and the flow of resources units is especially useful in connection with *renewable* resources, where one can define a regeneration rate. As noted by Ostrom *et al.,* (2002), as long as the number of resource units appropriated from a CPR does not exceed the regeneration rate, the resource stock will not be exhausted. Thus, it may be inferred from the foregoing that any effort aimed at sustainable use of a common pool resource requires devising institutional arrangements that both limit access to the resource system and the amount, timing and technology used to withdraw diverse resource units from the resource system.

2.2.4. Common pool resources and other goods

Economists used to categorise goods as either private or public. Based on this dichotomous classification, scholars distinguished between those goods (private goods) that the market could provide most efficiently and those goods (public goods) that would require government provision. As pointed out by Hess and Ostrom (2001), however, a major breakthrough came in the 1970s with the identification of two resource attributes that gave rise to the formulation of four broad categories of goods. These economically important attributes of resources are namely: *excludability*, and *subtractability*. Discussion on each of these attributes, as

suggested by Ostrom (1990) and Ostrom et al. (2002), are presented in the following paragraphs.

Excludability: this attribute of a resource refers to the degree to which access to the resource can be restricted. Goods of economic value differ in terms of how easy or costly it is to exclude or limit potential users from appropriating the flow of benefits. Given the intrinsic nature of the good, the capacity to exclude potential beneficiaries depends both on the technology of physical exclusion devices, such as barbed wire fences, backed by the existence and enforcement of various bundles of property rights that are feasible to defend in the legal system available to individuals within a country.

Subtractability: the goods that individuals value also differ in terms of the degree of subtractability to which one person's appropriation of a resource reduces the availability of that resource for others. For instance, if one user extracts a ton of grass from a pastureland, those units of grass are not available for other appropriators. On the other hand, one person's use of a weather forecast does not reduce the availability to others of the information in that forecast.

The identification of the above-mentioned fundamental properties of a resource evolved into the generation of a two-by-two typology of resources as shown in Table 2:1. The four kinds of goods so identified—private, public, and toll goods and common pool resources—are broad categories that contain considerable variation within them (Ostrom *et al*., 2002).

Table 2:1: Types of goods

		SUBTRACTABILITY	
		Low	*High*
EXCLUSION	*Difficult*	**Public goods** Sunset Common knowledge	**Common pool resources** Watersheds Irrigation systems
	Easy	**Toll or club goods** Day-care centres Country clubs	**Private goods** Doughnuts Personal computers

Source: Hess and Ostrom (2001)

Four types of goods: *private, toll, common pool & public goods*

Private goods and *toll* or *club goods* are among the resources depicted in Figure 2.1 to which *exclusion* is easy. Access to private goods is controlled by private property right entitlement. The mechanism by which access is controlled in the case of toll or club goods is through levying of tolls or the existence of membership restrictions. On the other hand, resources from which access is not easily controlled are public goods and common pool resources. Public goods include goods such as air and water, or public information systems such as emergency radio broadcasts or scenic vistas. Examples of common pool resources include fishing waters, ground water basins, watersheds, forests, public parks, etc (Carpenter, 1998).

As to the other attribute—*subtractability*—toll goods or club goods are rated low. One person's use of the club only slightly affects another club member's access. Private goods are highly subtractable, though, since what someone privatises by definition is not there for others.

Public goods are considered to be low in subtractability. One person's use will not appreciably limit use by another. If one person listens to the emergency broadcast programme, another's use of it most likely is not diminished. A common pool resource, on the other hand, is by definition high in subtractability: one person's use limits another's. On common land, the grass eaten by the animals of herder A is unavailable for the animals of herder B. Despite this characterisation of these resources, however, the system sensitivity between public goods and common pool resources exists because a grazing field that is very large, supporting very few herders and grazing animals, has almost no subtractability vis-à-vis each herder. The commons effectively is a public good. It is when the commons is appropriated by many herders and/or many animals that it becomes unequivocally a common pool resource (Carpenter, 1998).

Common pool resources

As indicated in the problem statement, the types of natural resources dealt with in this thesis are C*ommon pool resources* (CPRs). According to Ostrom and Gardner (1993), Ostrom *et al.* (1994), and Dietz *et al.* (2002), this class of resources are defined as resources sharing two

attributes of economic importance. First, it is costly to exclude individuals from using the resource through either physical barriers or legal instruments and second, the benefits consumed by one individual subtract from the benefits available to others. They share the first characteristics with pure public goods; the second attribute with pure private goods. Recognising this class of goods as goods that share these two important attributes enables scholars to identify the core problems facing individuals whenever more than one individual or group utilises such resources for an extended period of time.

As pointed out in the definition, common pool resources are characterised by the difficulty of developing physical or institutional means of excluding potential beneficiaries from them. Range and forestlands typically pose problems of exclusion. In view of this resource attribute, Hess and Ostrom (2001) argue that, unless effective institutional mechanisms are established to exclude non-authorized/ non-contributing beneficiaries from appropriating common pool resources, the strong temptation to free-ride on the efforts of others will lead to suboptimal investment for improving the resource, monitoring use, and sanctioning rule-breaking behaviour. In a more severe scenario, common pool resources without institutional arrangements for control are essentially open-access resources available to anyone and therefore unlikely to elicit investment in maintenance or protection.

It was also pointed out that the resource units harvested by one individual are not available to others—they are subtractable or rivalrous in terms of consumption, like private goods, and can thus be depleted (Ostrom & Gardner, 1993). Natural products like trees, grasses, water and wildlife are some examples of subtractable resources, and exclusion will be problematic and costly in most cases. If one individual uses more, less remains for another (Adhikari, 2001). These resources therefore are potentially subject to problems of congestion, overuse, pollution, or degradation and to potential destruction, unless harvesting or usage limits are devised and enforced.

The first attribute—difficulty of exclusion—stems from many factors, including the cost of parcelling or fencing the resource and the cost of designing and enforcing property rights to exclude access to the resource. If exclusion is not accomplished by the design of appropriate

institutional arrangements, free riding related to the provision of the common pool resource can be expected. After all, what rational actor would help to provide for the maintenance of a resource system, if non-contributors can gain the benefits just as well as contributors (Ostrom & Gardner, 1993)?

The second attribute—subtractability (or rivalry)—is the key to understanding the dynamics of how the "tragedy of the commons" or divergence between individual and collective rationality can occur. The resource units (like cubic meters of water, tons of fish, or bundles of fodder) that one person appropriates from a common pool resource are not available to others. Unless institutions change the incentives facing appropriators, one can expect substantial over expropriation (Ostrom & Gardner, 1993).

Difficulty of or failure in enforcing exclusion, combined with high subtractability, can lead to the common pool resource dilemma that Hardin calls the "tragedy of the commons" (Carpenter, 1998). According to Feeny, as cited in Hara (2003), a successful management regime for common pool resources (i.e., a solution to the "tragedy of the commons) will have to address two major classes of management issues. Firstly, the need to regulate access to the resource to handle the exclusion problem and, secondly, the level of exploitation among authorised users, which must be regulated to deal with the subtractability problem.

2.3. The tragedy of the commons

> "Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons. Freedom in a commons brings ruin to all."
>
> *Hardin (1968)*

> "Even if a tragedy of the commons were logically possible, it would not be inevitable."
>
> *Vink (1986:90)*

2.3.1. Introduction

The Tragedy of the Commons theory (Hardin 1968) suggests that all resources held in common will inevitably suffer overexploitation and degradation. To avoid the tragedy—the inexorable destruction of commons—two policy prescriptions are proposed by this model: the transfer of the resource either to government control or to private property.

Many countries—particularly developing nations—have followed these policy prescriptions extensively, predominantly the policy advice to nationalise grazing lands, forests, fisheries, and other natural resources. Nevertheless, as noted by several scholars (Baland & Platteau, 1996, Ostrom, 1998, Dietz *et al*., 2002), extensive research and experience show that this policy reform sometimes had disastrous results for the resources they were intended to protect and the resource users as well. Similarly, privatisation of natural resources is asserted to be associated with a number of difficulties (Ostrom, 1990; Kollock, 1998; Baland, 1996).

The Tragedy of the Commons model has often been formalised as the Prisoner's Dilemma game—simulating the inexorable attribute of the tragic exploitation of the commons. These two models result in the prediction that individual rational agents using commons will not cooperate so as to achieve collective benefits.

The tragedy of the commons model has been criticized on the basis of experiential evidence, empirical research and game-theoretic laboratory experiments (National Research Council 1986; Vink, 1986; Ostrom, 1990, 1998, 1999; Baland & Platteau, 1996; Feeny *et al.*, 1996;

Kollock, 1998; Walker *et al.*, 2000; and Dietz *et al.*, 2002). In the critique *(Section. 2.3.4)*, the deterministic prediction of the model is rejected and the universal applicability of its policy prescriptions is questioned. This assessment, however, does not lead to a sanguine assurance that commons problems can always be avoided, that escape from tragedy is always possible. The point is rather, as Vink (1986:90) aptly put it, "even if a tragedy of the commons were logically possible, it would not be inevitable".

In this section, the two theories of the commons dilemma—the Tragedy of the commons, and the Prisoner's dilemma game—are analysed and their policy prescriptions are examined. Following this, critiques of these models are explored.

2.3.2. The tragedy of the commons

Since Hardin's (1968) influential article, the expression "the tragedy of the commons" has come to symbolise the degradation of the environment that is to be expected whenever many individuals use a scarce resource in common.

To make his point about the need for major social change to deal with problems such as overpopulation, resource depletion, and air and water pollution, Hardin (1968) relied on a thought experiment. He asked the reader to imagine what would happen to a metaphorical village commons if each herder were to add a few animals to his herd. His metaphor highlighted the divergence between individual and collective rationality or between private and social marginal costs.

The concept of "the tragedy of the commons" was presented by Garrett Hardin in the following way:

> The tragedy of the commons develops in this way. Picture a pasture open to all. It is to be expected that each herdsman will try to keep as many cattle as possible on the commons. Such an arrangement may work reasonably satisfactorily for centuries because tribal wars, poaching, and disease keep the number of both man and beast well below the carrying capacity of the land. Finally, however, comes the day of reckoning, that is, the day when the long-desired goal of social stability becomes a reality. At this point, the inherent logic of the commons remorselessly generates tragedy.

As a rational being, each herdsman seeks to maximize his gain. Explicitly or implicitly, more or less consciously, he asks, "What is the utility to me of adding one more animal to my herd?" This utility has one negative and one positive component.

1. The positive component is a function of the increment of one animal. Since the herdsman receives all the proceeds from the sale of the additional animal, the positive utility is nearly +1.
2. The negative component is a function of the additional overgrazing created by one more animal. Since, however, the effects of overgrazing are shared by all the herdsmen, the negative utility for any particular decision-making herdsman is only a fraction of -1.

Adding together the component partial utilities, the rational herdsman concludes that the only sensible course for him to pursue is to add another animal to his herd. And another…. But this is the conclusion reached by each and every rational herdsman sharing a commons. Therein is the tragedy. Each man is locked into a system that compels him to increase his herd without limit—in a world that is limited. Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons. Freedom in a commons brings ruin to all (Hardin, 1968).

As Vink (1986) points out, to grasp the essence of Hardin's "tragedy of the commons" model (1968), it is essential to understand the context in which the term 'tragedy' is employed. According to him, Hardin (1968) calls his concept "the tragedy of the commons" using the word "tragedy" as the philosopher Whitehead used it *(1948): "The essence of dramatic tragedy is not unhappiness. It resides in the solemnity of the remorseless working of things."* Thus, the term 'tragedy' is used in the sense of something ineluctable, inexorable, which imposes its own logic on each player. It is used to capture the remorseless, deterministic, and destructive nature of the process as a whole.

The central proposition of Hardin's model is that the tragedy is the result of individual profit maximising strategy of herdsmen that herd their cattle on freely accessible pastures (the 'commons'). This self-interest maximising strategy leads to a situation where each herder receives a direct benefit from placing an animal on the pasture, whereas the costs for degrading the pasture are shared by all the herders i.e. marginal private cost is lower than

marginal social cost. The individual herder, being a rational decision maker, will add animals to the point where his private cost and benefit are equal.

Due to the divergence between private and social costs, as suggested by Hardin's model, all herders have the incentive to put as many cattle on the pasture as they can. Individuals who use self-restraint and reduce their herd size will only lose out to other herders who will correspondingly increase their herd. Putting more animals on the pasture is the rational choice, yet the impending result is the degradation of the common pasture (Hardin, 1968). For Hardin, this is the tragedy. By rationally seeking their own benefit, each herder inadvertently contributes to the demise of all—hardly a rational outcome. The "tragedy" of overgrazing results from each person's incentive to free ride regardless of the expected actions of others.[2] Hardin asserted that, ultimately, users of the commons harvest collective ruin.

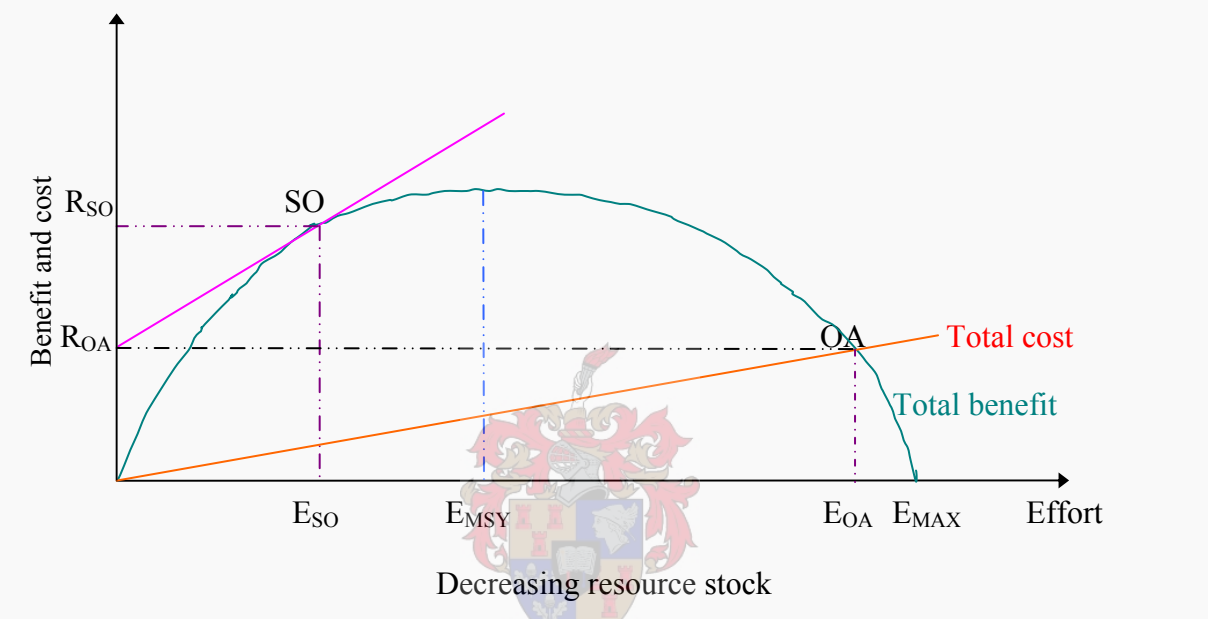
Hardin's model assumes the ubiquity of "free-riders". This model concludes that the free-riding problem makes voluntary contributions to the commons illogical. He argues that an appeal to the conscience alone will not stop the free use of the commons and argues that responsibility is created by institutions that are based on coercion. His message is that the tragedies are stopped only by depriving the user of the common of the freedom to manoeuvre by means of strict public control—nationalisation or the creation of individual transferable rights—private property. Thus, according to Hardin's model, environmental tragedy is inevitable unless commons are put under government control or private ownership.

The tragedy of the commons may be represented as illustrated in Figure 2:1. In this diagram, total benefits and total costs are depicted in the Y-axis, while the effort expended in harvesting the resource is depicted in the X-axis. The amount of effort expended in harvesting the resource (let us say cutting down trees for fuel) is monotonically and inversely related to the remaining stock of trees. The total benefit curve is drawn as an inverted U,

[2] The free rider problem results when an individual shirks responsibility of contributing to resource management but takes the benefit of resource use. It is often argued that the incentive for such behaviour is logical from the point of view of narrow self-interest. Such narrow logic leads to an outcome in which the group as a whole is made worse off (Ford Runge, 1985).

indicating that there is a critical stock of trees or effort level, beyond which the tree population starts to diminish. The harvest at this critical level, denoted as E_{MSY} in the diagram, is known as maximum sustainable yield and expending effort beyond this level depletes the resource stock.

Figure 2:1: The tragedy of the commons



Source: Mason (1996:32)

Now let us assume that the forest resource is under 'commons' regime, i.e. 'open to all'. In this case, it is to be expected that each individual will try to harvest as many trees as possible from the commons to maximise his own self-interest. In other words, the individual appropriator, being a rational decision maker, will continue to harvest trees to the point where his total cost and benefit are equal. He will cease expending effort beyond E_{OA} that is when total costs exceed total benefits— to the right of point OA in the diagram.

Hardin's policy prescription aimed at preventing the occurrence of the overexploitation (tragedy) modelled in the diagram is to put the resource system under state control (social planner) or privatise it (grant to a single owner). In terms of the diagram (Figure 2.1),

Hardin's solution would keep effort expended at $E_{SO,}$ resulting in point SO where the difference between total costs and total benefits is the largest.

In many countries—particularly in developing nations—theories underlying policies governing the use and conservation of common pool resources, such as forests, watersheds, rangelands, and fisheries, have been based on the "tragedy of the commons" model.

2.3.3. The Prisoner's dilemma

The theory that Hardin (1968) sketched—The Tragedy of the Commons—has often been formalised as "The prisoner's dilemma", a game which is well known in mathematical game theory (Dawes, 1973; 1975, cited in Ostrom, 1990; Runge, 1985; Vink, 1986; Baland & Platteau, 1996 & Dietz *et al.,* 2002).

The prisoner's dilemma simulates the "locked in", remorseless quality which Hardin conceptualised as the tragic exploitation of the commons. The prisoner's dilemma is characterised as a two-person, one-shot and non-cooperative game in which the players possess complete information, i.e. both players know the full structure of the payoff matrix that mathematically describes the game of which they are a part. On the other hand, in this non-cooperative game, participants lack information about each other's choice; communication among the players is forbidden or impossible; and they only have two choices: to either cooperate (not confess) or defect (confess).

The prisoner's dilemma (PD) game is illustrated in the pay-off matrix in Table 2.2 (Vink, 1986). To cooperate (not confessing) or defect (confessing) represent the choices that each of the prisoners have to make. The payoffs (years of incarceration) indicated in the brackets are the outcome from a particular coincidence of choices by each person, for the first and second prisoners respectively.

Table 2:2: Pay-off matrix – prisoner's dilemma

Player 1 (First Prisoner's choices)	**Player 2** (Second Prisoner's choices)	
	Cooperate (not confessing)	Defect (confessing)
Cooperate (not confessing)	(1, 1) (R, R)	(10, 0) (S, T)
Defect (confessing)	(0, 10) (T, S)	(5, 5) (P, P)

R= reward for mutual cooperation, S= sucker's payoff T= temptation to defect, P= punishment for mutual defection

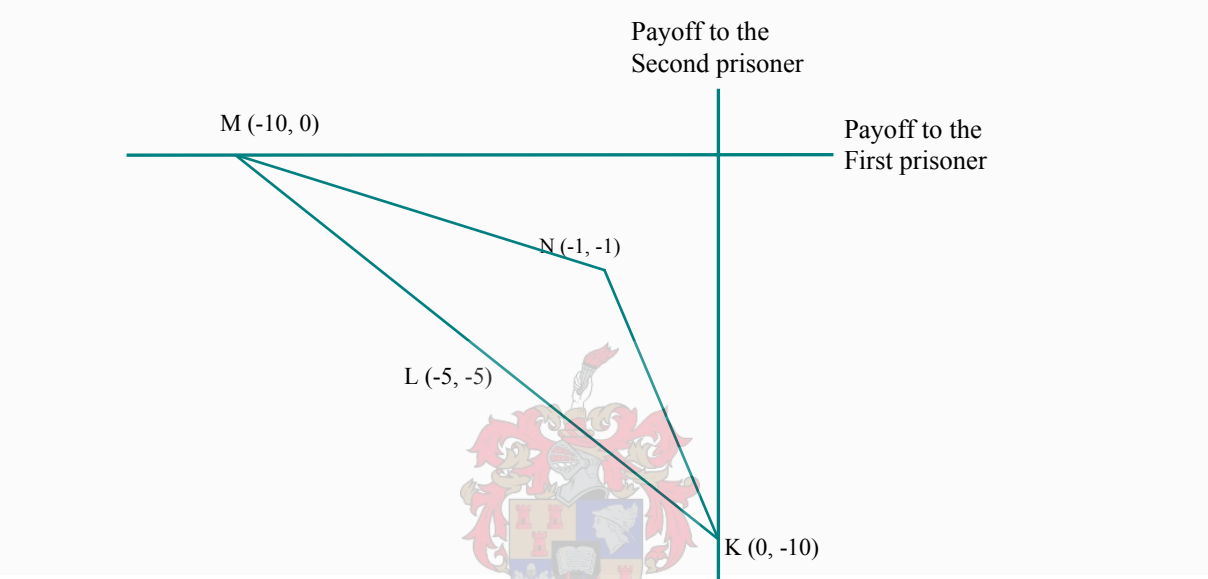
Source: Adapted from Vink (1986:79)

The classical prisoner's dilemma game can be portrayed as follows: In the canonical formulation, two men are put into custody on suspicion of committing a certain crime. These two individuals are the only witness to the crime that was committed and cannot be convicted of this crime unless at least one of them confesses and implicates the other. The police put each man in a separate cell and interrogate them separately: they have no opportunity to communicate, and are urged to confess. The payoffs as the result of a particular coincidence of choices by each person are as follows: If neither confesses, based on circumstantial evidence, both receive light sentences (1, 1). If one defects (confesses) and the other denies (not confessing), the confessor goes free while the non-informer receives a very heavy sentence (0, 10), (10, 0); if both defect (confess), they both face long jail terms (5, 5).

If the two players (prisoners) know that they are involved in a non-repeating game—i.e. a one-shot PD game, then Player 1 calculates as follows: Player 2 might either cooperate or defect. If Player 2 cooperates, then I am better-off defecting and receiving 0 years of incarceration rather than 10, if Player 2 defects, then I am still better off defecting, since I receive a five-year sentence rather than 10. When both players think this way, they are pushed into the defect/defect cell, ending up receiving sentences of five years.

The pay-off of the prisoner's dilemma described above may further be illustrated with the help of Figure 2.2, where the payoff for the first prisoner is measured on the abscissa, and for the second prisoner on the ordinate. Years of imprisonment are measured with negative numbers, in brackets, with the payoff for the first prisoner appearing first.

Figure 2:2: An illustration of the pay-off matrix for the prisoner's dilemma game



Source: Shubik (as adapted and cited by Vink, 1986: 80)

The Pareto optimal surface is MNK, the 'best' outcome is N (neither confessing) but unstable, while the result of a play (with actual outcome) is L. This latter outcome, which represents a defect/defect choice is stable and constitutes a *Nash equilibrium.*[3] In other words, this equilibrium is non-Pareto optimal and is said to constitute a dilemma (Vink, 1986).

Runge (1985) and Vink (1986) argue that, faced with the above set of payoffs and assuming each player is motivated by a desire to maximise self-interest, the course of action

[3] When a game has at least one of a player's arrows pointing to a box and at least one arrow of the other player pointing to the same box, then the pair of strategies is said to be in a Nash Equilibrium after J. Nash 1953. The Nash Equilibrium is thus defined as any pair of strategies with the property that each player maximises her or his payoff given the actions of the other player (Vanessa Pérez-Cirera, 2001).

represented by the pair (1,1)—i.e. the 'best' strategy—is unstable or not in equilibrium. The rational strategy for each prisoner (player) is to defect (5,5), irrespective of what the other does, producing a result less desirable to each than if both had cooperated (denied). Goetze (1994) and Baland and Platteau (1996) point out that this defect/defect outcome is stable and constitutes the *Nash equilibrium,* despite the presence of a superior outcome. It is equilibrium in that no one has an incentive to change his/her behaviour (Kollock, 1998). This non-cooperative equilibrium is Pareto-inferior (Vink, 1986), as there is another outcome that makes at least one person better off without making anyone worse off. As Goetze (1994) suggests, this outcome is the result obtained when individuals make rational, uncoordinated choices that maximise self-interest.

The classical PD game, through its locked-in structure, exemplifies the true meaning of tragedy. Vink (1986), citing Whitehead (1948), notes that the essence of dramatic tragedy is not unhappiness; it resides in the solemnity of the remorseless working of things. In this line of argument, Kollock (1998) suggests "a group of people facing a social dilemma may completely understand the situation, may appreciate how each of their actions contribute to a disastrous outcome, and still be unable to do anything about it."

Now let us examine exploitation of a commonly owned scarce resource by translating the Prisoner's dilemma into a commons resource game, namely Hardin's pasture commons. The game is a two-herder grazing game and the commons has a carrying capacity of 'L' number of animals. Each herder must choose one of two things. One is cooperative grazing on the commons, i.e. for each herder to have half of the total number of grazing animals (L/2). The second is to defect by exceeding that number (>L/2). The possible payoffs and the impact of their strategies on the commons are as follows: If both defect and exceed the cooperative grazing level, their action leads to tragic exploitation of the commons and receives no profit. If one defects and the other cooperates, the co-operator suffers the sucker's fate of lower productivity without the compensating profit of additional animals. The defector, on the other hand, gets the profit from additional animals minus the lowered productivity per animal of the commons. Lastly, if both stick to the cooperative grazing level, then the commons is conserved and animals remain productive. Nevertheless, as the prisoner's dilemma model

posits, the expected outcome is Pareto-inferior. Each herder will choose "rationally" to defect and graze at an exploitative level, leading to a situation in which all are made worse off. Therefore, defecting or free riding strictly dominates the cooperative grazing level for each individual.

Vink (1986) observes that the PD game simulates the tragedy of the commons hypothesis and its policy prescriptions are an internalisation of externalities.[4] In game theory terms, this involves a change in the payoff matrix, which harnesses individual rationality into collective rationality.

The tragedy of the commons and the classical prisoner's dilemma game with their underlying premise of dominant free rider behaviour, have been widely used to explain overgrazing, deforestation and other abuses of natural resources. It is important to note that the conclusion and the policy prescription of the two models converge in the recommendation of externally enforced regulation to try to reconcile individual rationality with collective welfare.

2.3.4. A critique of the tragedy of the commons

As discussed in the previous sections, Hardin, in his theory of "The tragedy of the Commons", argued that the overexploitation and, ultimately, destruction of resources held in common is inexorable. In view of this, Hardin suggested that only two solutions are possible to avoid the tragic decimation of the commons: government control, on the one hand, where governmental directives force individuals to perform in ways that promote the common good, or privatisation on the other, which internalises the externalities of common pool exploitation. These policy prescriptions imply government success/market success.

The tragedy of the commons hypothesis, which signifies the locked-in tragic exploitation of commons by non-cooperative rational individuals, has also been simulated by the classical Prisoner's dilemma (PD) game. In the PD game, each prefers that all others cooperate while

[4] Externalities, or spillovers, exist "when costs are imposed on others without their being fully compensated or when benefits are received by others for which these beneficiaries do not make full payment" (Clement A. Tisdell, 1994:45). Buchanan (as quoted in Kollock, 1998) also observed that externalities prevail "… whenever the behavior of a person affects the situation of other persons without the explicit agreement of that person or persons." Thus, externalities are uncompensated interdependencies.

he himself defects, so defection strictly dominates cooperation, leading to a unique, Pareto-inferior Nash equilibrium.

Hardin's hypothesis that all commons situations are like a prisoners' dilemma, which implies the deterministic nature of common pool resources appropriation, is challenged and the wisdom of the policies of this model is questioned. This challenge is based on theoretical discourse, empirical research, experiential evidence, and game-theoretic laboratory experiments with human subjects (National Research Council, 1986; Ostrom, 1990; 1998; 1999; Baland & Platteau, 1996; Feeny *et al*., 1996; Kollock, 1998; Walker *et al.*, 2000; & Dietz *et al.*, 2002). In this part of the thesis, the deterministic prediction of the model is rejected and the universal applicability of its policy prescriptions is questioned. As will be evident from the ensuing discourse, however, it will not lead to a sanguine assurance that commons problem can always be avoided, or that escape from tragedy is always possible.

The objective of this section thus is to examine the conceptual underpinnings, to appraise the theoretical adequacy, to explore the empirical validity, and to determine the generalisability of Hardin's model. To this end, theoretical, experimental and empirical/experiential evidence will be presented to try to provide a comprehensive critique of the tragedy of the commons hypothesis.

Critique on the underlying assumptions of the model

- **Critique 1: Repeated PD games with no predefined end point (experimental evidence)**

When the commons problem is conceptualised as the situation of a one-shot PD game—played only once or as repeated for a finite and known number of rounds or with a definite ending time, most theorists, for instance Runge (1986); Kollock (1998); Kopelman *et al*.; Falk *et al*., (2002); and Dietz *et al.,* (2002), predict that each player's dominant strategy is to defect, no matter what the other player chooses—the outcome is a Pareto-inferior Nash equilibrium.

As observed by Dietz *et al.* (2002), the idea that the one-shot PD sufficiently models most commons settings was a widely accepted wisdom until recently. An emerging consensus,

however, suggests otherwise. The theoretic experimental research summarised by Kopelman *et al*. and Falk *et al*. (2002), indicates that Hardin's predictions hold under a one-shot PD with no communication, but not necessarily in a situation where the game is played repeatedly, where there is no predefined end point, or where communication is possible. In the latter scenario, Vink (1986) asserts that experimental results show some free riding and some cooperative strategies among individual rational players and he argues that this inconsistency of outcomes is sufficient proof for the non-universality of the PD model.

In Kollock's (1998) view, the most influential strategic solution to social dilemmas is Axelrod's *The Evolution of Cooperation* (1984). In this book, (as cited in Kollock, 1998), Axelrod suggests that, in repeated games, i.e. non-occasional social relations, cooperative strategies are likely to emerge. Axelrod identified three requirements for the possibility of the emergence of cooperation. First, it is essential that individuals be involved in an ongoing relationship. If individuals have met only once, or equivalently, if this was the last time they would meet, the dominating strategy to defect in the 'prisoner's dilemma game' would make the pursuit of cooperation hopeless. If the partners would meet again in the future, cooperation at least has a chance. Second, individuals must be able to identify each other—communicate face to face. Third, individuals must have information about how the other person has behaved in the past. If identity is unknown or unstable and if there is no recollection or record of past interactions, individuals will be motivated to behave selfishly because they will not be accountable for their actions.

Runge (1986:55), referring to authors such as Axelrod, Taylor and R. Hardin, suggests that cooperation is consistent with self-interested behaviour in repeated games. He proposes that repeating the game opens the door to expectations of others' behaviour. The conditions for cooperation then turn on whether the players are sufficiently forward-looking and formulate a "tit-for-tat" rule, motivated by expectations of others' cooperation and fear of retaliation in the case of non-cooperation. In a tit-for-tat game, a player cooperates in the first round and thereafter simply reciprocates whatever his or her partner has done in the previous round. Since individuals using reciprocity in a mutually reinforcing cycle have an incentive to

acquire a trustworthy reputation and to trust other trustworthy individuals, social relations are likely to be created and maintained over time.

- **Critique 2: Independent decision making**

Runge (1998 & as cited in Dietz *et al.*, 2002) criticises Hardin's hypothesis that all commons situations are like the Prisoner's Dilemma situation and the inexorability of commons decimation. In these analyses, he rejects the presupposition of the model of independent decision making by individual agents. He concludes that the prisoner's dilemma does not necessarily reflect the mode of appropriation of resources held in common (common property) and asserted that the Pareto-inferior Nash equilibrium is a less likely outcome.

In Runge's view, the characteristics of the people (of developing countries) and the resources on which these people depend are the main factors that do not conform to the independent decision-making hypotheses. According to him, the majority of the common pool resource users in developing countries firstly live in the same villages where their ancestors had lived for generations and intend to continue to live in these places of their origin for generations to come. And, secondly, the widespread poverty facing many villagers, their critical dependency on a local agricultural and natural resource base and the randomness of distribution of these natural resources over both time and space, is faced by all. Given these attributes, he suggests that "It is implausible to assume that individuals have a dominant strategy of free riding". He suggests that the characteristics of village-level life in less developed countries result in interdependent village-level decision-making arrangements.

Runge's alternative hypothesis is that appropriators of commonly held resources in less developed countries face a repeated assurance game rather than a one-shot PD game. The incentive structure for all users in such a game is to adhere to a cooperative strategy by limiting their own use as long as others reciprocate by stinting. Further, he noted that village institutions are the mechanisms that ensure that the critical mass of the villagers prefers cooperation to defection by obligating members to conform to the agreed-on set of rules. Based on this, Runge modelled the game as an "assurance problem/coordination problem", rather than a dilemma. If everyone is assured that a critical mass of others will obey a common property agreement, then it is in each person's individual interest to do likewise,

since this outcome is preferred. Of course, common property institutions do not always provide this assurance. Runge's model asserts that free rider problem can be solved—not that it will be solved.

- **Experiential evidence of successful management of commonly used resources**

It is also possible to challenge Hardin's model of the characteristics of commons from experiential or empirical findings, in addition to the experimental and theoretical evidence discussed earlier. There are several examples of long-lasting and self-organised resource institutions in different corners of the world. Feeny *et al.* (1990) and Walker et *al.* (2000) have observed that extensive field research findings have shown that a surprising number of cases exist in various parts of the world in which users have been able to manage smaller common pool resources such as grazing lands, irrigation systems, and inshore fisheries sustainably. Such successful resource management was realised through restricting access to the resource and establishing rules among users themselves for its sustainable use and overcoming the divergence between individual and collective rationality.

Examples of successful local common pool resources management cited by Ostrom (1990) include Torbel in Switzerland and the villages of Hirano, Nagaike, and Yamanoka, Japan, in which hybrid systems of private and commonly owned institutions have been used to govern mountain meadows and forest products for hundreds of years. Carpenter (1998) also observes that the Menominee Tribe of Northeast Wisconsin and Michigan's Upper Peninsula has practiced sustainable forestry management for the past 140 years, even while the forests outside the reservation were being depleted.

The existence, from both field and laboratory settings, of ample evidence demonstrating the ability of local resource users to organise and govern local common pool resources effectively therefore has led to questioning the universality or validity of the conventional theories.

- **Critique 3: Confusing commons with open access**

Probably the most contested of the assumptions of Hardin's model is the idea that common property (commons) is the same as open access. According to some critics (Feeny *et al*.,

1990 & Ostrom, 1990), Hardin's prediction of the inexorability of overexploitation and ultimate decimation of resources held in common follows from the flawed assumption that commons provide open access. As Vink (1986) suggests, unravelling the serious confusion between these fundamentally different concepts has led to changes to the conclusion reached by the tragedy of the commons hypothesis.

The common property regime, as defined by Bromley (1991) and Feeny *et al*. (1998), is an institutional arrangement in which the resource is assigned to an identified community of interdependent users who have the right to exclude non-members from appropriating the resource while regulating the usage rate and maintenance of the commonly owned resource by members of the local community.

Open access, on the other hand, is characterised by non-existent, ill-defined, or unenforceable property rights over the use of the resources (Bromley, 1991). It represents a situation of non-property where no one owns or regulates a resource, and it is free and open to everyone, with no one having a legal right to exclude anyone from using the resource (Burke, 2001).

Bromley (cited in Ostrom, 1990), suggests that, in situations where no one has a property right—i.e. where there is open access to the resource flow, a clear prediction can be made about the outcome of this type of resource regime. If the benefits are greater than the costs of appropriating the resources, open access resources will be overexploited and potentially destroyed. Moreover, Libecap (1994); and Baland and Platteau (1996) point out that in open access situations, marginal private and social costs diverge, since individuals who use the resource do not have to consider the full social costs of their activities. Due to these externalities, the resulting outcome will be typically Pareto inefficient.

When property rights exist, however—whether common property, private property, or state property, unfailing prediction is not possible. Bromley (1991) argues that overexploitation and destruction depend on how well the property rights regime copes with problems of allocating the costs and benefits of managing and governing a particular resource.

Hardin's prediction of inevitable decimation of resources held under common property (commons) is flawed. The outcome of appropriation of resources governed under a common property rights regime cannot be predicted as opposed to the open access situation. Authors such as Ostrom and Bromley (cited in Feeny *et al*., 1996), argue that Hardin's tragedy of the commons often results, not from any inherent failure of common property management, but from institutional failure to control access to resources and to make and enforce internal decisions for collective use. By inference, it can also be suggested that when a commons (common property) regime degenerates into an open access regime due to the collapse of their institutions for various reasons, Hardin's prediction is most likely to occur.

In conclusion, it may be argued that the prediction that a resource held in common is destined for decimation is flawed. Common property resource regimes are not inherently defective; instead, properly functioning commons regimes with robust internally enforced rules are capable of managing resources sustainably and efficiently. But it may also be suggested that the problem that Hardin referred to "the commons" was really a problem of "open access".

Critique on the policy prescription of the model

The critiques presented thus far have focused on Hardin's model itself in terms of the assumptions it adheres to and the prediction it makes. In this section, the discussion will focus on the critique of the policy implications of the model. To this end, an in-depth appraisal of these policies will be presented by providing theoretical and experiential evidence.

The two policy options acclaimed by Hardin (1968) in order to avoid the ineluctable decimation of the commons are: Government control or privatisation of the commons. Hardin stressed that, by not acting in one of these two ways, we "acquiesce in the destruction of the commons" (Hardin, 1968). As will become clear from the ensuing discussion, however, while there is no doubt that these policies can, in some instances, induce responsible resource use, there are a number of reasons why such an approach is not guaranteed to prevent tragedy. Both options have been investigated in terms of their ability to adequately protect common pool resources and the critique is presented as follows.

- **Critique 1: Government control and its limitations in managing CPRs**

The policy advice to nationalise natural resources such as forests, grazing lands and in-shore fisheries, has been adopted extensively in many countries, particularly in developing countries (Ostrom, 1998; & Dietz *et al*., 2002). A typical policy prescription that promotes the centralisation of resources in these countries is the one proclaimed by authors such as Carruthers and Stoner (cited in Ostrom, 1998) in which they argued that, without public control, "overgrazing and soil erosion of communal pastures, or less fish at higher average cost" would result. They concluded that common property requires public control if economic efficiency is to result from their development."

In general, as noted by Grafton (2000:507), the adoption of state control over the nations' natural resources in less developed countries is based on the expectation that the centralised control of common pool resources would fix (or at least mitigate) the coordination failure inherent in their use. This argument implies that state-controlled resource management regimes cater for non-market benefits, distributional issues, and the use of a societal rate of time preference. Other forms of property rights are regarded as inferior to state property in terms of realising these objectives. It is also claimed that factors such as economies of scale in terms of processing of information, monitoring and enforcement and other management costs can only be achieved if the state controls.

Despite the potential benefits of state-controlled property rights over natural resources, ample evidence exists on the failure of such arrangements in developing countries, which has led to the widespread degradation of their common pool resources. As Feeny *et al.* (1990) pointed out state ownership of natural resources is seldom associated with successful management in these countries. According to Dietz *et al.* (2002), extensive research and experience since 1968 corroborate this claim. Moreover, Grafton (2000:507) observes that failure has been rampant, especially where state property rights have superseded indigenous property rights (common property) or private ownership.

In developing countries, the necessary financial means and the professional resource management infrastructure to adequately monitor sizable state-controlled natural resources are severely deficient (Feeny *et al.*, 1990; & Dietz *et al.*, 2002). With regard to this

limitation, Grafton (2000:507) remarked that it should not be surprising to learn that state-controlled regimes resemble open access. He further pointed out that the mere declaration of a state right (a *de jure* right) to common pool resources, or the abrogation of pre-existing rights, does not create a well-defined property right unless the state can ensure some exclusivity over the resource. To this extent, some of the criticisms directed at state-controlled rights are arguments against *de facto* open access.

State failure in governing common pool resources is also ascribed to the informational asymmetry between the state and users with regard to the resources and corruption of employees charged with enforcement (Baland & Platteau, 1996). Moral hazard is another problem that plays an important role in the sense that the government institution implementing actual resource management does not always face appropriate incentives to prevent excessive harvesting (Vyrastekova & Van Soest, 2002). Furthermore, it is argued that centralised solutions that employ powerful coercion may create antagonistic relationships between resource users and the state (Baland & Platteau, 1996).

In sum, it is suggested that nationalisation of common pool resources in developing countries that have abrogated indigenous property rights has led to the conversion of resources that had been under a *de facto* common property regime to a *de jure* government-property regime, but due to severe deficiencies in enforcement capability of the states, it has frequently reverted to a *de facto* open access regime.

Some experiential examples of government failure in CPRs management

The government of Nepal nationalised forests in 1957 by converting the *de facto* common property into *de jure* state property. However, this latter resource management regime degenerated into a *de facto* open access-like regime. Community members who lost their traditional ownership were forced to engage themselves in the law of capture. Contrary to the aims of the policy, deforestation accelerated instead of decelerated. To try to reverse this undesirable outcome, the government started experimenting with the re-creation of common-property rights in 1976 (Arnold & Campbell, 1986; and Bromley & Chapagain, 1984, cited in Feeny *et al*., 1990). Nationalisation of land in Senegal in 1964, which led to overgrazing on previously community-owned land, is another example (Grafton 2000:507). Both cases of

resource degradation resemble the losses associated with open access and occurred because the state superseded or abrogated pre-existing private and community rights.

Coming to African experience, Kenyan forest resource management is another vivid example of government failure in common pool resources management. Okowa-Bennun and Mwangi (1996) indicated that an assessment of state controlled forestlands provided a gloomy picture. The government has not been able to monitor these resources adequately and what is more disturbing is that government's own employees have also been involved in the illegal exploitation of these resources. Moreover, they suggested that, in the face of the inefficiency of the centralised resource regime, it has become necessary to explore the possibility of replacing state control with alternative property regimes or transferring some rights to local communities.

State ownership and control has proved to be an ineffective mechanism in many cases, particularly where the state superseded or abrogated pre-existing private and community rights. It may therefore be concluded that the policy prescription that government control is one of two universally applicable "solutions" to the "tragedy" is seriously challenged by historical experience.

- **Critique 2: Privatisation and its limitations in managing CPRs**

Privatisation, which is breaking the commons up into private parcels, is another commonly suggested solution to the tragedy of the commons. It is argued that this process creates the proper incentives for economic efficiency through establishing mutually exclusive rights to the exclusive use of the resource among members of the society. Moreover, it is suggested that this arrangement is the most effective way to make individuals internalise the externalities. Demsetz (1967) argued that, 'A primary function of property rights is that of guiding incentives to achieve a greater internalisation of externalities' (Demsetz, 1967: 348).

The argument in favour of privatisation is not only in terms of the economic efficiency it provides, but also in terms of its ability to promote sustainable utilisation of resources. It is argued that privatisation would provide individual users with incentives to protect what they clearly own themselves. According to Feeny *et al.* (1990), if the individual owner has

exclusive rights over a given resource and if those rights are tradable, then both the costs and benefits will accrue to the same owner and will be reflected in the market price of the resource, giving the owner the pecuniary incentive to refrain from destructive use and practise more responsible long-term care of the resource bases.

Nevertheless, despite the well established merits of privatisation in promoting efficient allocation of resources, this property right as a solution to the commons dilemma is challenged by many authors (such as Ostrom, 2003; Baland and Platteau, 1996; Tietenberg, 2002; Rose, 2002; & Dietz *et al.*, 2002). They argue that, in theory, for strictly private goods, where the cost of exclusion is relatively low and one person's consumption is subtractive from what is available to other, markets efficiently allocate these resources. As Ostrom (2003) notes, industrial and agricultural commodities clearly fit the definition of strict private goods. Nevertheless, as Ostrom (2003) suggests, these conditions are not met in common pool resources settings. This is due to the characteristics of such types of goods that the market cannot capture their full value and thereby create perverse incentives for owners.

Thus, while there is a strong belief that privatisation can usually promote efficient resource allocations in the case of strictly private goods, there are a number of reasons why privatisation is no panacea to common pool resources appropriation and provision problems. This is especially true for developing countries where transaction costs are high and informational asymmetry is severe. The following section discusses some of the prominent difficulties with regard to privatisation of common pool resources.

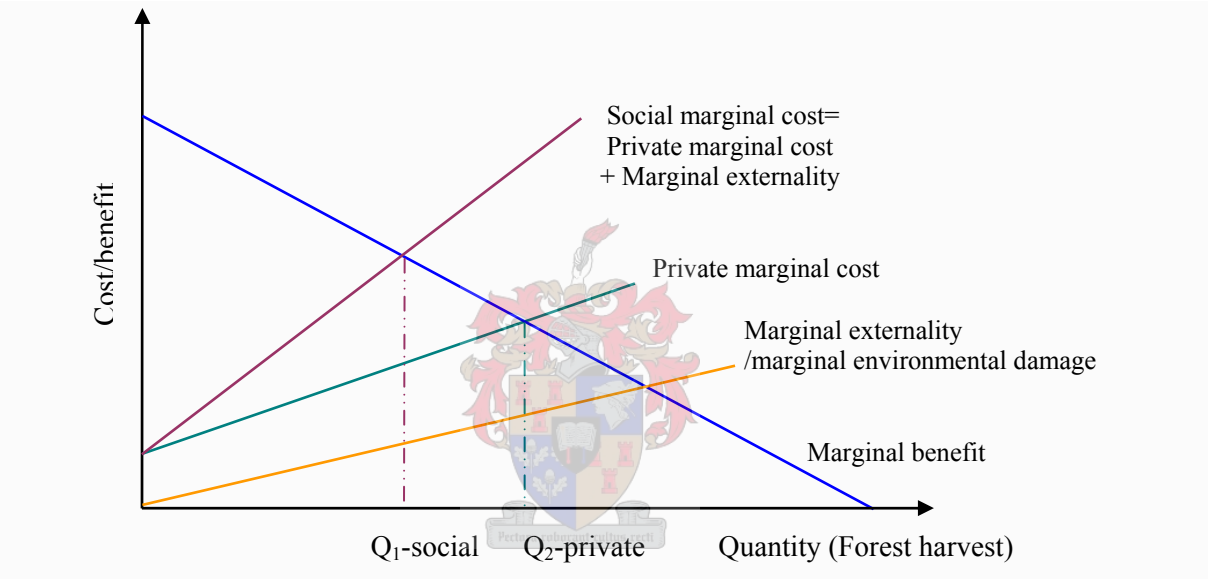
- *Incomplete market (market failure)*

Common pool resources produce positive externalities, for example, forests protect watersheds, and provide services such as flood control, carbon sequestration, and others, for which the individuals who hold rights cannot receive the value. Grafton (2000:505) suggests that this incomplete capture of the value of resources such as these may create perverse incentives leading to suboptimal decisions (over harvest of trees) by the individual owners.

This incomplete market, which constitutes one form of market failure, is represented in Figure 2.3. As pointed out earlier, the positive externalities that the CPRs produce cannot be

included in the price system of commodities and the private owner cannot be compensated for the environmental services he provides. Faced with such an adverse incentive structure, the rational decision of the individual owner would be to harvest Q_2 quantity of trees instead of the socially optimal Q_1. The gap between these levels of quantity of harvest represents a marginal externality or marginal environmental damage resulting from the depletion of the unpriced factor.

Figure 2:3: Market failure & environmental damage



Source: Adapted from Mason (1996) and Rosen (1999)

- *Privatisation is not necessarily consistent with sustainability*

It is argued that private property ownership with the right of alienation, through shifting resources from less productive to a more productive use, is crucial for the efficient use of resources. Nevertheless, this property right does not necessarily guarantee sustainable utilisation of natural resources. In the view of Schlager and Ostrom (1992) and Grafton (2000), owners who adopt a relatively high discount rate are most likely to be involved in overexploitation, resource abuse, and overcapitalisation.

Another incentive structure that may lead owners to overexploit natural resources is the issue of rate of return that can be procured from natural resources when it is compared with alternative investment opportunities. It is suggested that the temptation to exhaustively harvest a resource and invest in other opportunities with higher return will always remain. In other words, it is economically rational to liquidate the resource and invest the proceeds at the favourable financial rate. As Baland and Platteau (1996) suggest, individuals who hold private property involving natural resources may be individually led to degrade a resource when the rate of return on a conservation investment falls below the return achievable by allocating production factors to alternative uses.

The above proposition can be illustrated by taking a hypothetical example: suppose a privately owned natural resource, say, a certain slow-maturing tree species such as Olea Africana can fetch rates of return of 3.5% per annum, while the rate of return on other investment opportunities is, say, 10%. With such different rates of return, the rational choice or strategy of an individual owner, in pure economic terms, is simply to harvest exhaustively, move on, and invest the proceeds in ventures that fetch higher returns. Thus, although planting and harvesting *Olea Africana* sustainably makes ecological sense, it does not make economic sense under a private property regime. These rights permit the owner to maximize the present value of the resource, yet the resource is not protected from complete destruction.

A similar argument was given by Seabright (1993) when he suggested that the privatisation of forest lands for timber production may fail to internalise all the externalities involved, and lead to excess harvesting and inadequate replanting. According to Baland and Platteau (1996), striking illustrations of this situation are easy to find in many parts of the developing world in the forestry and fishery sectors where some species mature slowly.

- *Higher transaction costs of formalised private rights*

The advocacy for privatising resources that have hitherto been under common property management regimes rests on the idea that instating private ownership will guarantee efficient resource allocation. What must be noted, however, as suggested by Runge (1985) and Seabright (1993), is that, if a private property right is to function efficiently, the individual rights to exclude others must be based on a clear definition and assignment in

connection with the thing owned, together with a mechanism to adjudicate disputes when they arise. And yet, according to these authors, the fair enforcement of formalised private rights and duties may be lacking and prohibitively costly in the context of developing countries.

Grafton (2000:505) points out that the success of private rights posits that individuals who possess the property right can exclude other potential individual appropriators from the CPR at a cost less than the benefits of privatisation. He suggests, however, that, unlike private goods where the exclusion costs are relatively low, the exclusion costs for common pool resources may be excessively high, making privatisation costs exceed its benefits.

- *Incomplete contract*

Seabright (1993) suggests that private contractual rights are unlikely to be complete in the sense that many of the individual actions will remain unenforceable, either because they are unobservable by some of the affected parties or by the enforcing authorities, or because they are too complex to be specified in contractual form. This situation may give rise to exploitative resource use instead of sustainable management of resources.

- *The issue of equity/fairness in privatisation*

When viewed from the practical argument, privatisation has additional limitations. In the opinion of Jagger and Pender (2000) privatisation could face considerable challenge from individuals or groups in the community who have been denied fair share in the commons or who have lost their use right of the commons without adequate compensation. In this line of argument, Grafton (2000:506) suggests that privatisation of the commons may lead to a distribution of wealth and income, which may undermine the legitimacy of private rights. From the viewpoint of those who do not get their share, privatisation of the commons is unfair. In such situation, as suggested by Baland and Platteau (1996), the costs of enforcing exclusive property rights are likely to be high as the new distribution of property rights hurts some of the former resource users. The costs of enforcing exclusive property rights partly depend on the way distribution of wealth is affected.

Equity problem of privatisation not only arise from the way distribution of wealth is affected but also from the intrinsic nature of the resource system under consideration. Commons are typically heterogeneous in terms of their resource system productivity. In such resource systems, breaking the resource system among smallholders (i.e. privatisation) most likely leads to inequity—between those who received the best portion of the resource system and those who didn't" Mckean and Ostrom (1995:5). Inequitable distribution of wealth, as suggested by Oakerson (1986), potentially leads to costly conflict, culminating in a situation where all parties lose. For example, breaking forest system into small parcels would most likely lead to differences in economic benefit among resource users as the site is characterised by a diversity of resource flows. This economic inequity, in turn, may lead to conflict between local forest resource users.

- *Efficiency issue of privatisation of the commons*

Economic considerations also militate against privatisation of the commons. Mckean and Ostrom (1995) suggest that partitioning the resource system (commons) into small pieces and assigning them among smallholders often leads to diseconomies of scale (i.e. reduced efficiency), especially in terms of management costs. Privatisation—allocating small parcels of resources to individuals causes increased burden of each private holder in terms of guarding, fencing and maintenance costs (Ostrom, 2000). The cost of resource protection may be higher under private ownership than under a common property regime because private owners exert themselves to protect their holdings, whereas under a common property regime protection costs may be reduced by organizing collective action in patrolling and guarding community resource (Kijima *et. al*, 2000).

A typical example of increased burden of costs to individual holder is partitioning watershed grasses into individual patches. The privatisation of this commons (watershed grasses) would undoubtedly make it extremely difficult to check individual behaviour and free riding could consequently become rampant, potentially leading to conflict among resource users. Moreover, households would have to closely monitor/patrol their individual holdings to try to prevent free riding, which might result in substantial labour costs.

Lastly, in the opinion of Baland and Platteau (1996), the underlying argument in favour of privatisation emanates from the unscientific comparison between an idealised fully efficient private property system and the anarchical situation created by open access. They suggest that proper comparison would be between private property and properly functioning common property (as open access is not same as common property). They argue, moreover, that in the ideal situation of no transaction costs and no information asymmetry both of the latter regimes can lead to Pareto-optima equilibrium and hence are equivalent. Thus, they concluded, "a common property regime has no structural trait, which makes it inherently inefficient".

An experiential example of limitation of privatisation of CPRs

It is suggested that the shortcomings of full privatisation in the Kenyan context generally outweigh any merits it may have. Okowa-Bennun and Mwangi (1996) observe that privatisation introduces a profit interest in the management and conservation of a resource, which has public ramifications. They further say "There is little evidence in Kenya that privately owned forests have been managed with a long-term view". . . Eriksen *et al.* (1996: 210) also observe that, in Kenya, privatisation and fragmentation are leading to land uses that effectively exclude wildlife. This conversion of the common property rights management regime into private property rights breaks ecologically-designed migratory patterns of wildlife through fencing.

Following the preceding in-depth discussion on the limitation of privatisation, particularly in view of common pool resources and within the context of developing countries, it may be suggested that privatisation is no panacea to the commons dilemma (common pool resources problem) for it fails to solve the problem of externalities arising from the use of these types of resources.

Finally, despite the fact that criticism of Hardin's tragedy of the commons and the prisoner's dilemma (in terms of the underlying assumptions on which the models are based, and the policy options these models put forward), it is worthwhile to warn against the assumption that these models are wrong and should be discarded altogether. Instead, important lessons that should not be ignored are presented through the models. According to Ostrom (1990)

and Baland and Platteau (1996) observed behaviours and outcomes can be expected to approximate predicted behaviours and outcomes when conditions in the world approximate the conditions assumed in the models. They are successful in predicting outcomes in settings where a relatively large number of individuals make high demands on a single CPR, do not communicate with one another, or fail to establish institutions and act independently, taking only their own expected return into account. With such a scenario, the "tragedy of the commons" is likely to occur. For instance, when common property rights regimes degenerate into open access-type regimes due to various negative internal and external factors, the outcome is unlikely to be optimal and Hardin's prediction is most likely to hold.

2.4. Summary and conclusions

In this chapter, the 'tragedy of the commons' model as applied to common pool resources was analysed and it was shown that its hypothesis is based on the neoclassical theory of *individual choice utility-maximising rationality*. It was also shown that *open* or *free for all* access to commons is an implied but critical assumption within this model. Following this, it was pointed out that the tragedy of the commons model, underpinned by these two defining assumptions, posits the 'tragedy' as the result of a *self-centred utility-maximising strategy* of *rational individuals* that appropriate *freely accessible resources* (commons). Individuals driven by a self-centred rationality and seeking their own benefits inadvertently contribute to the demise of all …'freedom in a commons brings ruin for all', implying that overexploitation and ultimate decimation of resources held in common is inexorable. Based on this view, it was shown that the 'tragedy'—ineluctable decimation of resources—would be avoided only by depriving the user of commonly held resources of the freedom to manoeuvre by means of strict public control—nationalisation—or the creation of individual transferable rights—private property—, which internalises the externalities of common pool exploitation.

Many countries, particularly developing nations, have followed these policy prescriptions extensively. Nevertheless, extensive research and experience show that, in many instances, nationalisation of common pool resources such as forests and rangelands was disastrous for

the resources they were intended to protect and the resource users as well**.** Similarly, privatisation of common pool resources is asserted to be associated with a number of difficulties that lead to suboptimal outcomes.

The inadequacy or non-universality of the 'tragedy of the commons' model becomes more evident when it is formalised as the Prisoner's Dilemma game. This game involves individuals who are assumed to be engaging in a one-shot, non-cooperative game, with no communication among the players—participants lack information about each other's choice. Individuals in such a scenario who are driven by self-interested rationality are locked into collective irrationality, establishing a Pareto-inferior *Nash equilibrium*—an outcome obtained when individuals make rational, uncoordinated choices that maximise self-interest. An alternative way of expressing this outcome is to say that in a PD game, individual rational agents using the 'commons' will not cooperate so as to achieve collective benefits. Individuals facing the commons/ social dilemma may completely understand the situation, may appreciate how each of their actions contribute to a disastrous outcome, and still be unable to do anything about it.

The tragedy of the commons hypothesis that all commons situations are like a Prisoner's Dilemma game, suggesting that individuals driven by self-interest rationality are locked into a collective irrationality, is challenged and the wisdom of its policies is questioned on a number of grounds in this chapter.

Firstly, conceptualisation of the commons situation as a one-shot PD game with no communication, or as a repeated game but with a definite time of ending and no communication, does not model the commons problem. It was shown that game-theoretic laboratory experiments reveal that predictions from the tragedy of the commons model hold under either of the said two scenarios, but not necessarily in a situation where the game is played repeatedly, where there is no predefined endpoint, or where communication is possible. In this latter setting, individuals will not always free ride; instead, it is likely that cooperation evolves.

Secondly, the presupposition of the models of independent decision making by individual agents is implausible. It is shown that the Robinson Crusoe-like independent decision makers portrayed in the 'tragedy of the commons' hypothesis or the locked-in agents in the PD game do not reflect the true nature of village level decision making (in developing countries). The combination of relatively high levels of poverty, relatively high levels of randomness in the allocation of natural resources, and resulting uncertainty in individual levels of welfare necessitate interdependent decision making or a cooperative strategy through the establishment of village institutions. For the same reasons this shows the inseparability of costs emanating from the inherent externalities of common pool resources.

Thirdly, Hardin's prediction of overexploitation and inexorable decimation of resources held in common partly follows from the flawed assumption that the commons are characterised by open access. Contrary to this view, it has been shown that many commons in many parts of the world are not available for open access. Instead, they are subject to institutional arrangements by which the resources are assigned to an identified community of interdependent users who have the right to exclude non-members from appropriating the resource, while regulating usage and maintenance of the commonly-owned resource by members of the local community— *averting tragedy*.

Fourthly, extensive field research shows that there are several examples of long-lasting and self-organised resource institutions (commons) in different corners of the world. Such successful resource management was realised through restricting access to the resource and establishing rules among members for its sustainable use and for overcoming the divergence between individual and collective rationality.

The points outlined above illustrate that free riding is not an ubiquitous or inevitable phenomenon and the Robinson Crusoe-like independent decision-making hypothesis concerning the commons is shown to be implausible. Hence, the deterministic prediction of the tragedy of the commons and the PD game hypothesis is rejected. Nevertheless, the lessons of these models cannot be ignored. When existing common property rights resource management regimes degenerate into open-access type of regimes for various reasons, the 'tragedy of the commons' is likely to occur. Thus, the 'tragedy' results not from any inherent

failure of common property management, but from institutional failure to control access to resources, and to make and enforce internal decisions for collective use. This presupposition leads to the issue of institutions, the basic premise on which this thesis rests. The next chapter is devoted to an analysis of which the main theme will be 'with adequate institutions, coordination becomes a rational strategy— *averting tragedy.*'

3. Institutional choice theory: an institutional analysis of local CPR management

> Inferior outcomes do not necessarily arise from the strict dominance of free rider strategy but from the inability of interdependent individuals to coordinate and enforce actions in situations of strategic interdependence, thus with adequate institutions, cooperation becomes a rational strategy.
>
> *Runge (1984, 1986)*

3.1. Introduction

The rational agent model, upon which mainstream economic theory is founded, posits strict self-interest. Adam Smith (cited in Dietz *et al.*, 2002:4) is quoted as saying, "We are not ready to suspect any person of being defective in selfishness" (Smith, 1977). This presupposition underpins Hardin's 'The tragedy of the commons' model.

Neo-classical economics, in addition to assuming self-interest maximisation, unbounded rationality, and other core assumptions, assumes that no transaction costs are involved in human exchange and underplays the role of institutions. The new institutional economics (NIE), on the other hand, argues that there are transaction costs to market operations arising out of the need to define and enforce private property rights. Instances may thus arise where non-market arrangements (institutions) are optimal means of allocating resources among self-interested individuals. This theory advocates that economic coordination can never be merely a matter of price signalling in markets—institutions also matter.[5, 6]

The new institutional economics extend neo-classical economics by modifying the rationality postulate (unbounded into bounded rationality), assuming positive transaction costs, and

[5] Coase suggested that the decision whether to have a transaction within a firm or in the market place will be determined by transaction costs. He further proposed that the form of control—i.e. the firm or the market, which is chosen, would most likely be the one with the lowest transaction costs (Coase, 1937, as cited in K. Kuperan, Raja Abdullah, Robert S. Pomeroy, E. Genio and Albert Salamanca, 1998).

[6] North (1990) argues, "The neoclassical result of efficient markets only obtains when it is costless to transact but when it is costly to transact, institutions matter".

incorporating institutions as additional constraints, while subscribing to the self-interest (opportunism—self-interest with guile) assumption of neo-classical economics. The general hypothesis of the NIE is that institutions are transaction cost-minimising arrangements that a create incentives toward greater levels of coordination through curbing uncertainty in human exchanges.

The Robinson Crusoe-like non-communicating and independent decision-maker herdsmen portrayed in Hardin's 'The Tragedy of the Commons' (1968) parable is based on neo-classical economics. When this assumption of non-communicating locked-in setting of Hardin's model is formalised into the Prisoner's Dilemma game, it shows that rational agents will not cooperate so as to gain collective benefits.

This chapter, adopting the new institutional economics assumption, posits the existence of institutions and acknowledges the important role they play in fostering economic efficiency in general and insuring efficient and sustainable common pool resource use in particular. As argued in Chapter 2, Hardin's tragedy of the commons is not due to inherent flaws in the commons (common property), but rather because of institutional failure. Thus, the main theme that will be espoused in this chapter is that, when adequate institutions (institutions understood as rules that coordinate social relationships) harness individual rationality into collective good, the 'tragedy of the commons' can be averted.

The next section discusses social dilemmas (the tragedy of the commons) and externalities; identifies the link between them; and points out the implications. Section three explores the specific externalities associated with CPR settings and argues that the solution to the CPR dilemma is the establishment of institutions, which ensure coordination among resource users in addressing the problems of appropriation and appropriation externalities. In Section four, a definition of institutions is presented and their role in human interaction is discusssed. Following this, in Section five, a framework for the analysis of common pool resources is presented. This framework is employed as a tool for collecting, collating and analysing the field data. Section six explores the concept of property rights and discusses them in relation to common pool resources management. Design principles, *inter alia*, are discussed in this section and are used as evaluation tools for the institutional status (robust/weakened) of the

common property rights regimes in the case study area of this research. The summary and conclusions are presented in Section seven.

3.2. Social dilemmas and externalities

The commons dilemma (the tragedy of the commons) is a subset of social dilemmas that refers to situations in which individuals make independent choices in an interdependent situation (Kopelman, 2002). This non-cooperative relationship between individual agents leads to the deterioration and ultimate collapse of a resource. Hardin's parable about herdsmen who share a common pasture— each with an incentive to raise the number of sheep grazing, but running the risk of ruining the pasture if each herdsman does so— illustrates the prototypical commons dilemma, where the dilemma is between maximising individual benefits and avoiding collective ruin.

Given the incentive structure of social dilemmas, the outcome of the rational individual's decision is inefficient (excess) appropriation of common pool resources culminating in a collective disaster—the tragedy of the commons. According to Kollock (1998), the potentially noxious outcomes of the commons dilemma stem from what economists refer to as externalities. Thus, the 'tragedy of the commons' can be interpreted as a result of pervasive externalities that make coordination among rational individuals difficult and costly. This tragedy can also be interpreted as stemming from high transaction costs which prevent individuals from entering into enforceable agreements that could make each of them better off. Nevertheless, if efficient rules / institutions are not established by the resource users for their common good so as to curb externalities (free riding) scarce resources will eventually be destroyed through the working of the tragedy of the commons.

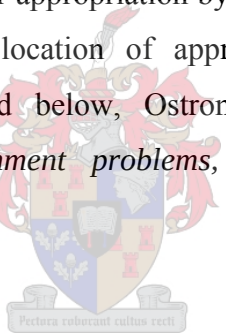
In this section, the link between the commons dilemma (tragedy of the commons) and externalities / transaction costs from where the tragedy derives was identified. The next task will be to examine the externality problems associated with common pool resources use. These externalities include problems of appropriation and provision.

3.3. Externalities in the CPR setting

Ostrom *et al.* (2002) suggest that the assortment of problems (externalities) faced by CPR appropriators can be usefully grouped into two broad categories: *appropriation* and *provision*. In the case of appropriation problems, the issues to be solved relate to denying access to potential non-authorised beneficiaries and allocating the subtractable flow among authorised users. Provision problems, on the other hand, are related to creating a resource, maintaining or improving the capabilities of production of the resource, or avoiding the destruction of the resource.

3.3.1. Appropriation problems

As pointed out earlier, addressing appropriation problem requires not just excluding non-authorised potential beneficiaries but also efficient allocation of resource units among eligible users. Efficient allocation (or appropriation by eligible resource users) in turn entails solutions to the optimal timing, location of appropriation and alternative harvesting technologies in use. As discussed below, Ostrom *et al*. (2002) employ the terms *appropriation externalities, assignment problems,* and *technological externalities* to differentiate these problems.



Appropriation externalities

The appropriation externality occurs when increased appropriation by one user reduces the return to other users for any given level of appropriation activity. For example, as one farmer increases his or her appropriation activity by putting more cattle in a given grazing plot, the amount of grass available for other cattle owners is reduced. If this externality is not properly addressed, it leads to overuse of resources into the appropriation process, which leads to overexploitation of the resources.

Assignment problems

The assignment problem occurs where common pool resources systems are characterised by heterogeneous distribution of resource flows that differ considerably in yield. Many grazing lands, for example, are characterised by heterogeneous patches where fodder is very good and others where it is not. In such cases, it is not only important to determine who is eligible

to appropriate from the CPR but also how to make appropriation assignments to beneficiaries in better or worse locations.

Assignment problems lead to suboptimal use of the CPR if it is not suitably accounted for. More often than not, conflict occurs over access to the good patches. In some instances, however, rules do exist to govern how appropriation activities are to be organised, which help to eliminate or reduce the occurrence of conflict.

Technological externalities

The presence of heterogeneous technologies employed by resource users creates technological externalities. This occurs when the employment of one technology imposes additional costs and/or reduces the productivity of the resource system for the users of other technologies. For example, if one group of fishermen uses dynamite in its fishing efforts, the cost to other fishermen rises because of this production technology. Many fishing communities solve this problem by establishing rules for allocating fishing grounds to alternative technologies in different seasons to reduce technological externalities.

3.3.2. Provision problems

Provision problems focus on two variables: (a) altering appropriation activities within an existing CPR that change the productive capacity of the resource system, which we may call its *demand*-side provision, or (b) contributing resources for the provision or maintenance of a CPR, which we may similarly call its *supply*-side provision.

Demand side

The source of *demand-side* provision problems involves the effect of appropriation of the productive capacity of the resource system. For example, increased grazing beyond some critical level will reduce grass stock to the extent that the productivity capacity of the grazing resource system is reduced. The solution to demand-side provision problems involves adopting lower discount rates or maximisation of the discounted present value of net returns. An alternative way of expressing this solution is to explain that reducing withdrawal rates sufficiently will preserve the resource system.

Supply side

The source of supply-side provision problems is associated with the intrinsic nature of the resource system, which influences the individual incentives to free ride on the contribution of others. This problem is similar to the problem of public goods provision; and maintenance or provision of a CPR resource system or facility is as problematic as pure public goods provision. A classic supply-side provision problem is that of the maintenance required to keep an irrigation system operating effectively. Solutions to supply-side provision problems involve providing the resource facility and rules to ensure the continued maintenance of this system.

Relationship between appropriation and provision

Classification of CPR problems into appropriation and provision problems is done for analytical purposes. In natural settings, however, appropriators often face appropriation and provision problems at the same time. This claim can be verified by the fact that any manmade CPR, such as an irrigation system, must be provided before anyone can appropriate it. This is also true for those CPRs provided by nature, such as watersheds or pasturelands and appropriators are required to contribute towards demand-side provision activities in the form of upgrading the resource or protecting the CPRs from encroachment by outsiders. On the other hand, supply-side provision activities related to maintenance of the resource affect the resource flow available for appropriation. Thus, the nature of the appropriation problem is affected by how well the provision problem is solved. Resource users are required to decide not only how much effort to make in appropriating the resource, but also how much effort to deliver in providing the resource.

The presence of these appropriation and provision externalities implies that there is a need for coordination among resource users, i.e. the solution to the CPRs dilemma is a coordinated strategy or creating adequate institutions. This approach suggested by Ostrom *et al.* (2002) involves creating institutions which stipulate (a) how much, when, where, and with what technology to withdraw resource units and/or (b) how much and/or when to invest in supply or maintenance inputs to the CPR facility or stock.

At this stage, it may be suggested that the solution to the CPR dilemma is the establishment of institutions or institutional arrangements that ensure coordination among resource users in addressing the problems of appropriation and provision externalities. Consequently, the next subject of discussion is the issue of institutions or institutional arrangements.

3.4. Institutions

In the preceding section, two categories of externality problems encountered by CPR appropriators (*appropriation* and *provision* problems) were discussed. After having examined the implications of these resource use problems, it was concluded that the solution to these commons dilemmas lies in coordinated strategy by the resource users. Coordinated strategy is realised through the establishment of efficient institutions. In this section, institutions will be defined and their application in the CPR situation will be explored.

Institutions defined

The concept of institutions (institutional arrangements) adopted here is in the context of the new institutional economics. Institutions, according to North's definition (1990: 384), are the "rules of the game in a society, the humanly devised constraints that shape human interaction." The rules include formal rules (written: codified in constitutions, statutes, regulations, plans and policies) and informal rules (unwritten, i.e. those that everyone knows about but which are not formalised in any way/norms, traditions, customs, value systems, religions, sociological trends, etc.) and 'their enforcement characteristics'. North (1990) also points out that, if efficient in their functioning, institutions provide more certainty in human interaction, i.e. they impart certainty and stability to social interaction and facilitate coordination or govern relationships between individuals or groups. They represent a major force in shaping human behaviour, and a fundamental way of solving collective action problems.

North (1990) distinguishes institutions from organisations. He defines organisation as 'groups of individuals bound by some common factors to achieve particular objectives'. In North's view, institutions can be considered as the rules of the game in a metaphorical representation, and organisations as being the players. The purpose of the rules is to define

the way the game is played, whereas the objectives of the team (players) within that set of rules is to win the game by a combination of skills, strategy, and coordination; by fair means and sometimes by foul means. Organisations can be political, such as a local council, economic, such as cooperative, social, such as a church, or educational, such as a school.

As discussed above, the general assumption is that institutions or institutional arrangements curb transaction costs by avoiding uncertainty, and facilitate cooperation and exchange among economic units. Nevertheless, as Adhikari (2001), referring to Olsson, suggests, institutions may increase transaction costs instead of curbing them when they are inefficient. Similarly, it is argued by North (1990) that not all institutions are efficient. Moreover, he suggested that institutions might even be captured by powerful groups to serve their particular interests.

CPRs and institutional arrangements

In the context of common pool resource management, institutions can be more specifically defined as a set of accepted social norms and rules for making decisions about resource use. According to Dietz *et al.* (2002), institutional arrangements define those who control the resource, or who have access to a resource, what can be harvested from it, who participates in key decisions about these issues, how conflicts are resolved, and how the resource is managed and exploited.

Oakerson (1986, 1990) and Ostrom (1990) classify institutional arrangements into three layers of rules: operational rules for governing resource use, collective choice rules for determining, enforcing and altering operational rules, and external institutional arrangements. Full discussion on these three levels of decision-making arrangements is contained in the institutional framework for commons in the next section.

3.5. A framework for the analysis of commons

In this section, a conceptual framework (Oakerson 1986, 1990) is presented. This framework is used in this study to collect information and analyse the commons (common pool resources and the institutions that govern these resources—common property rights management

regimes) in the case study area. The framework helps to arrange information into meaningful sets in order to examine relevant relationships between people and a resource that leads to an outcome and facilitates understanding of resource management problems.

Hardin's tragedy of the commons model is deterministic in nature—it predicts the inexorable destruction of all resources used in common. The model underplays the important role of local institutional arrangements in averting tragedy and its proposition is a simple one-to-one relationship between the rights regime and its outcome. Opposing this view, Oakerson (1986, 1990) and Feeny *et al*. (1990) suggest that, in order to understand the outcome, one needs to know the nature of the resource, the whole array of decision-making arrangements, and the nature of the interactions among users and regulators. This is what Oakerson's framework helps the researcher to accomplish. In an effort to answer the research question adequately, however, this framework is augmented by Ostrom's design principles, particularly for determining the outcome or state of the common property rights management regimes (*are they robust or fragile?*) that are currently in place for governing local common pool resources in the case study area.

Oakerson's framework (Figure 3.1) is a representation of the commons in its essentials and thus is a heuristic tool for thinking through the logic of a situation and considering alternative possibilities. The framework distinguishes four categories of attributes or variables that can be used to analyse the common pool resource situation: (1) the physical attributes of the resource and the technological solution to resource constraints; (2) the decision-making arrangements governing the relationships among resource users; (3) the mutual choice of strategies and consequent patterns of interaction among decision makers; and (4) outcomes. Having collected and sorted the data in this manner, the relationships become the principal focus of study. In the following, each of these component parts of the framework will be explained and, later on, the relationships among these attributes will be examined.

Physical and technical attributes

Problems of CPR use stem from the physical attributes of the resource or the technology employed for its harvest. The nature of interaction among resource users is highly influenced by the attributes of the resource system and available technology. These attributes provide critical information on the actions taken by appropriators and rules that they devised to maintain joint beneficial use of the commons. Oakerson identified three economic concepts for analysing these attributes: (1) *jointness* of consumption or supply, (2) *exclusion*, and (3) *indivisibility*.

Jointness: This refers to the relative capacity of the resource base (e.g. forest or grazing land) to support many appropriators simultaneously without mutual interference and without diminishing the aggregate yield of a resource available to the group. Jointness, in other words, refers to degrees of non-subtractability, that is, the degree to which more than a single consumer can make use of the same good. Thus jointness exists to the extent that various uses are compatible or even complementary; disjointness reflects incompatible and therefore subtractive uses (Messerschmidt, 1986:465). Relative jointness/disjointness, in turn, is a function of cultural perspective or definition, i.e., the meaningfulness (hence usefulness) of a resource in the context of the lives, needs, and wants of the various publics who use it (Messerschmidt, 1986:465). Common pool resources are characterised by partial subtractability, and the threshold at which use becomes subtractive varies from one situation to another.

Exclusion: This variable refers to the degree to which access of the potential appropriators to the resource can be controlled. The excludability level is a function of both the physical nature of a resource and available technology. Historically, for example, open range was difficult and expensive to fence; but the advent of barbed wire technology largely overcame this limitation. It is essential not to confuse the exclusion possibility set by nature and/or technology with an exclusion or non-exclusion policy. The exclusion dealt with here is concerned with the former and not the latter.

Indivisibility: This refers to the spatial boundaries of the common pool resources determining the minimal scale on which effective coordination can occur. Divisibility of the resource refers to the extent to which the resource can be divided amongst the users for management purposes. The relative indivisibility of a commons is mainly a question of scale, determined by specifying the physical boundaries within which the commons cannot be divided without significantly impairing its management potential or production value. For example, when forests are being managed not only for products that can be removed but also for ecological value, they can be considered as indivisible and may need to be managed at least at watershed level.

Decision-making arrangements

The second category of attributes consists of an assortment of rules—those rules that shape the choices made by both the individual members and the group in using the CPR as conditioned by the first set of attributes. The decision-making arrangements may be formal, written down and detailed, or informal.

Rules can apply at different levels of decision-making (institutional) arrangements. Oakerson's framework identifies three levels of analysis of these decision-making arrangements, delineated as *operational*, *collective choice*, and *external arrangements*.

Operational rules: These rules directly affect the day-to-day decisions made by the appropriator concerning the resource use. They are designed to safeguard the resource system by regulating the harvesting activities on the resource flow. They specify duration (i.e. time-partitioned use reflecting conditions of seasonality or potential congestion), type of use, where to harvest, how to harvest (method of harvesting), as well as the amount of the resource-flow that can be appropriated during a specified period. Moreover, operational rules stipulate who should monitor the action of others and how, and what contributions are required from each user. They govern and regulate common pool resource appropriation and provision. Indeed, the strength of operational rules can be gauged by their ability to ensure the sustainability of a resource system at a particular level over time. The rules, which affect behaviour at operational level, are derived from the collective choice level.

Collective choice rules: Operational rules are generated and enforced by another higher level of rules—the collective choice rules. Arbitration of any conflicts, enforcement of decisions, formulation and modification or change of existing operational rules, detection and sanctioning against rule violation, and holding officials accountable to users all fall under the jurisdiction of collective choice rules. These are the rules used by resource users, their officials, or external authorities for formulating the operational rules about how the resource should be managed. Institutional arrangements at this level also stipulate qualifications for participation in the management of the resource, and state what proportion of the group of appropriators must agree before a rule may be adopted.

The holders of rights at the operational level will not necessarily have the right to participate in collective choice actions (Schlager & Ostrom, 1992:251). According to these authors, it is this right to devise future operational level rights that make collective choice rights so powerful. Thus, it is essential that any analysis of common pool resources identify those members of the community who are involved in collective choice decision making in order to reveal and examine the relative power of different user groups.

External Arrangement-level rules: This level of decision-making arrangement refers to decision structures outside the immediate group that impinge on how the common pool resources are governed. They specify who is eligible to participate in the system, have access to a resource, and share the benefit of its use by formulating rules by which collective choice rules are created, enforced, and modified. For example, the national forestry, which establishes a national forestry agency, and the forestry administrative and management structure. This national institution has the mandate to empower lower level institutions to establish rules.

According to Oakerson (1986, 1990), decision-making arrangements external to the immediate user community of the common pool resources are relevant in most cases, but the connection varies widely. Some external arrangements may be mainly constitutional, establishing the capability of the community of users to engage in local collective choice. At the other extreme, a community may be substantially dependent on external decision makers

for the legislation and enforcement of operational rules, replacing common property arrangements with control by external officers.

Thus, operational rules are made within collective choice rules, which are in turn made within external arrangement/constitutional rules. These three layers of rules form a hierarchy, with the rules on a higher level deciding the degrees of freedom of those on the lower.

Patterns of interaction

While rules create incentive to cooperate, they do not guarantee that resource users will behave according to a particular pattern. Rules impose constraints on user behaviour but cannot determine the patterns of interaction. Instead, much of the ways resource appropriators interact with each other depend on the mutual choice of strategies by the members of a group. Rational individuals are tempted to exercise strategies that would maximise their self-interest within the limits set by the decision-making arrangements. They will take advantages opportunistically and will comply with the rules to the extent required by those who enforce the rules. Cooperation by an individual will be based on assurance that others will reciprocate, from which patterns of mutual action will emerge. In an effort to gauge this assurance, an individual resource user will monitor the behaviour of others in the first period. If he observes successful collective action, he will reciprocate by increasing the level of cooperation and compliance. His evaluation of the interaction and revision of his strategy will continue, based on new information about the resource and its users, the degree of reciprocity, and effectiveness of monitoring and enforcement.

In sum, given the physical attributes of the CPR and characteristics of the associated technology and the decision-making arrangements in place, individuals make choices from a set of different possible strategies in relation to the CPR and to one another. These choices of strategies give rise to the emergence of some pattern of interaction, which culminates in an outcome.[7]

[7] It should be noted that the physical and technological characteristics of the resource can indirectly affect outcomes through patterns of interaction, but can also directly affect the outcomes, independently of human

Outcome

According to Oakerson (1986; 1990), the preferred evaluative criteria for institutional performance or outcome of commons include *'efficiency' and 'equity'*. Authors such as Dietz *et al.* (2002) and Agarwal (2001), on the other hand, suggest that *'sustainability'* is also another appropriate option that may be employed as a criterion for the same purpose. The discussion on these three alternative evaluative criteria follows.

Efficiency

According to Oakerson (1986; 1990), efficiency has to do with whether appropriators have achieved an optimal rate of use. A less rigorous efficiency criterion is that appropriators are not exceeding the sustainable yield. In Oakerson's view, "If at least one person could be made better off, and no one worse off, by a modification in the use of the commons, then present outcomes are inefficient; conversely, the proposed change is efficient." The Pareto optimal principle suggests that allocative efficiency of a resource system has been attained when it is no longer possible to re-allocate the use of the resource so that one user will gain without loss to another. As suggested by several authors (Oakerson, 1986; 1990; Edwards & Steins 1998; Dietz *et al*., 2002), however, it is often difficult or impossible to implement efficiency measures in practice to determine whether aggregate use of the common pool resources is optimal.

Equity

Concerning the second criterion, equity, Oakerson (1986; 1990) suggests that inefficiency in the common pool resource is apt to be closely related to inequity. In the presence of inequities, collapse of collective action is a most likely outcome, resulting in inefficiency. This, in turn, can lead to costly conflict where all parties lose. The fundamental question of equity for Oakerson is this: are individuals reasonably and fairly compensated for their contribution towards the collective action? That is, is the distribution of costs roughly similar to the distribution of benefits?

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interaction. This is represented in the framework in Figure 3.1, where a line shows a direct link between the physical nature of the common and the technology available and outcomes of use.

Other factors that may contribute to a pattern of inequities among resource users include corruption and abuse of authority, arbitrary exclusion from the commons or selective enforcement of rules.

Sustainability

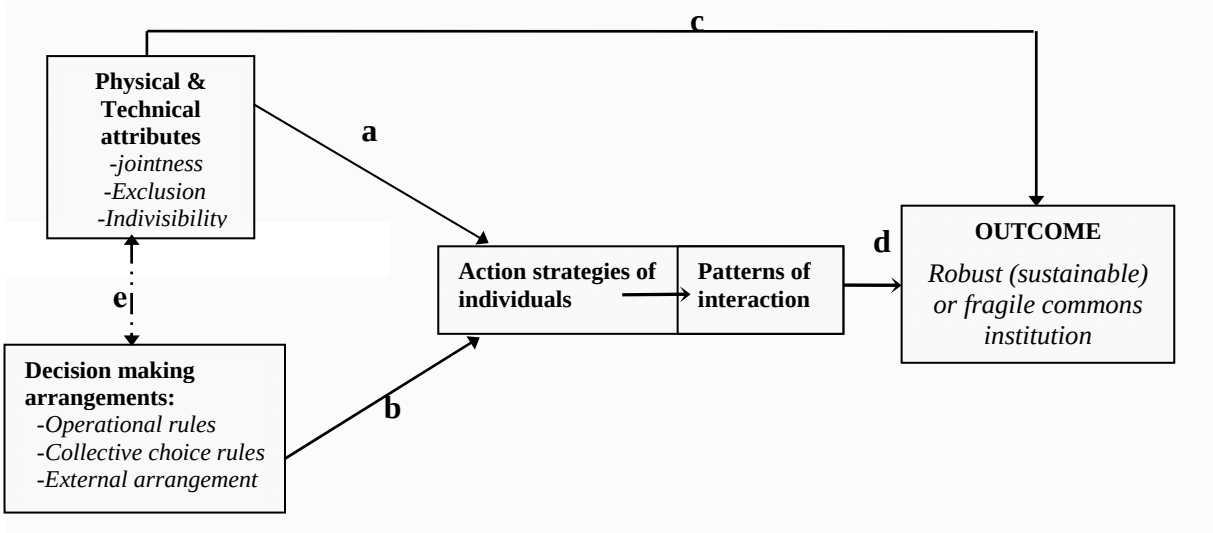
With regard to the third criterion, sustainability, Agrawal (2001; 2002; 2003) posits institutional sustainability as an alternative best option to evaluate the outcome of given common pool resources governance. His claim is based on the analysis and synthesis of the empirical literature of Ostrom (1990) and Baland and Platteau (1996). He observed that most of these studies have an implicit sense of successful institutions as those that last over time, constrain users to safeguard the resource, and produce fair outcomes. Dietz *et al*. (2002) also subscribe to the idea that *institutional sustainability* is a useful criterion for CPR outcome.

Therefore, because of the limitation of using efficiency as an evaluative criterion, this thesis will apply the concepts of *institutional sustainability* and *equity* as indicators of the status of the outcome related to the local common property in the case study area. In connection with these evaluative criteria, Ostrom's Design Principles *(see Section 3.6.4)* will be applied as a template against which the sustainability (robustness) of the local institutional arrangements for the governance of the common pool resources will be determined.

Relationships in the model

Figure 3.1 illustrates Oakerson's framework, depicting how each set of attributes relates to the others. Both the physical attributes and characteristics of the relevant technology of the CPR and decision-making arrangements affect patterns of interaction, which combine with physical and technological attributes to produce outcomes. Solid lines (a) and (b) represent weak causal connections; weak in the sense that individual behaviour is constrained, but not determined, by either the physical world or by rules. Solid lines (c) and (d) represent stronger causal relationships because human discretion is not involved as a dependent variable.

Figure 3:1: A framework for analysing the commons



Source: Adapted from Oakerson (1986:23)

It is suggested that outcome discloses the nature of the patterns of interaction among resource users. This pattern of interaction may be cooperative or free riding behaviours being exercised by the resource users, depending on the strategies adopted by the users. The latter behaviours result from the incongruence between the technical and physical nature of a commons and the decision-making arrangements used to govern its use. This is the relationship labelled (e) in Figure 3.1. The broken line is used to represent a non-causal association that exists between these attributes. The incongruence between these two elements potentially creates a perverse structure of incentives leading individuals into counterproductive patterns of interaction that generate deficient outcomes. Moreover, the incongruence may first be apparent in a lack of fit between operational rules and physical and technical attributes of the common pool resources.

3.6. Property rights regimes and common pool resources

3.6.1. Property rights defined

Commons (1968), cited in Schlager and Ostrom (1992:250), suggests, "A property right is an enforceable authority to undertake particular actions in a specific domain." Property rights assign benefit streams derived from the utilisation of a resource and entail rights for those holding them and a duty for all others to respect the rights (Bromley, 1991). According to Bromley, (1991), such entitlements therefore depend upon a socially organised structure of "institutional arrangements" that should include mechanisms for defining and enforcing the rights.

The possession of property rights should not be confused with owning a material object. Bromley (1991:92-93) notes that holding a property right refers to the *benefit stream that arises from that object or that resource* and not to an object or resource. Moreover, he explains, "When I purchase a piece of land, its price is a reflection of the present discounted value of its future benefit stream. By purchasing the land, I am really purchasing the benefit stream—*that* is, my property, the thing I actually own."

It is also essential to distinguish *de jure* property rights from those that are *de facto.* Schlager and Ostrom (1992:254) point out that, when rights of individuals or groups of individuals are granted and enforced by the state, such rights are *de jure* rights in that they are given lawful recognition by formal, legal instrumentalities. In some situations, the immediate resource users collectively define rights over the resources among themselves. Such rights are *de facto* as long as they do not hold state's recognition. Further, Schlager and Ostrom (1992) note that a collection of *de jure* and *de facto* property rights may exist in a single common pool resource setting and they may overlap, complement, or even conflict with one another.

3.6.2. Property right regimes

Idealised classification of property rights

Four types of property rights are described in this section. They include: open access (non-property), common property, private property, and state property. Baland and Platteau (1996)

noted that this classification is of a legal type in the sense that the underlying criterion is the nature of ownership (is the owner of the resource a private individual, the State, or a group or community, or open–free for all?).

Table 3.1 presents four possible natural resources regimes suggested by Bromley (1991); and Berkes, Bromely, Feeny *et al.* (as cited in Hara, 2003). They are defined by the structure of rights and duties that characterise an individual sphere of choices in using resources.

Table 3:1: Idealized types of property rights regimes relevant to CPRs

Property regime	Characteristics of and assumptions about the regime
Non-property	Access to resource is "open for all", no defined group of owners and benefit flow is available for anyone; individuals have privileges and rights with respect to usage rates but no responsibility for maintenance of the resource.
Common property	Usage right on the resource is assigned to an identified community of interdependent users who have a right to exclude non-members. Non-members have a duty to abide by exclusion; individual members of the "co-owners" have both rights and duties with respect to usage rates and maintenance of the asset commonly owned; individuals' behaviour is shaped by social norms and reciprocity towards meeting collective interest. Rights are often of equal access and unlikely to be exclusive or transferable; each member has a private right to the resource flow once captured and only a communal right to resource system or resource flow before it is captured.
State property	Rights are held exclusively by government; individuals have a duty to observe usage/access rules determined by a controlling/managing agency; agencies have a right to determine usage/access rules
Private property	Rights are assigned to individual owners; individuals have a right to undertake socially acceptable uses and have a duty to refrain from socially unacceptable uses; others ("non-owners") have a duty to abide by exclusion rule; rights are exclusive and transferable. Market prices are prime signals for access and harvesting rights over the flow or yield.

Source: Adapted from Bromley (1991) and Hara (2003)

While such typology can be helpful, as Edwards and Steins (1998:348) suggest, it can also signal a wrong message, which may imply that each resource system fits precisely into a single category. In reality, many resources can be classified under more than one definition of property rights. Bromley (1991:93) also acknowledges that such mutually exclusive categories tend to conceal important subtleties.

In response to the limitations displayed by the idealised typology, Schlager and Ostrom (1992: 252) suggest that this classification should be viewed in terms of the underlying rights and powers that are conferred through rules governing resources. When one compares different property regimes, one has to have an understanding of the rights held by resource users. Schlager and Ostrom (1992:252) formulated a useful conceptual schema in which they identified five property rights that are most relevant for the use of common pool resources. These rights include: access, withdrawal (extraction), management, exclusion, and alienation (transferability). Any of the idealised property rights thus has to be evaluated or viewed in terms of these five classes of "rights"—*bundles of rights*—in the common pool resources setting. Hence, what has to be noted is that the world of property rights is far more complex than simply government, private and common property. These terms better reflect the status and organisation of the holder of a particular right than the bundle of property rights held.

Bundles of rights

Each of the idealised classifications of institutional types referred to as common property, private property or state property has a wide diversity of subtypes, and many hybrids exist as well. When a resource is referred to as "state property", for example, it may mean that the resource is "owned" by a national state but users may have various rights to access, withdraw, manage, and determine who else is allowed to use the resource. Therefore, the rights of access, withdrawal, management, exclusion and alienation that constitute 'bundles of rights' could be assigned separately to different individuals. This can be viewed on a scale moving from the minimal right of access through possessing full ownership rights. All of these rights may be held by single individuals or by collectives. Ostrom (2003) observes that some attributes of common pool resources are conducive to exercising communal

proprietorship or ownership and others are conducive to individual rights of withdrawal, management, exclusion, and alienation.

The most relevant operational level rights identified by Schlager and Ostrom (1992:250) in connection with common pool resources are "access" and "withdrawal" rights. These are defined as:

Access:	the right to enter a defined physical property
Withdrawal:	the right to obtain the "products" of a resource

Individuals who hold rights of access are entitled to enter a resource and the rules in place related to this right stipulate the requirements that users must fulfil in order to exercise this right. Individuals who possess rights of access and withdrawal may or may not have entitlement in collective choice actions. The authority of individuals who possess rights at an operational level is restricted to exercising a right, while individuals who own rights at a collective choice level are empowered to participate in the definition of future rights to be exercised and this distinction is crucial. The authority to formulate future operational-level rights is what makes collective choice rights superior and powerful.

Rights within the collective choice level identified by Schlager and Ostrom (1992) and Ostrom (2003) include management, exclusion, and alienation. They are defined as follows:

Management:	the right to regulate operational-level rights of withdrawal
Exclusion:	the right to determine who will have access right, and how that right may be transferred
Alienation:	the right to sell or lease all or part of the above collective choice rights

The management right is an element of a collective choice right, which authorises its holders to formulate operational-level withdrawal rights aimed at regulating the use of a resource. The operational rights include the authority to determine how, when, and where harvesting from a resource may occur. The right of exclusion, on the other hand, is a collective choice right that empowers individuals who hold this right to work out operational-level rights of access. Exclusion right holders have the authority to define the qualifications that individuals

must meet in order to access a resource. The right of alienation is also a collective choice right but in addition to what exclusion right empowers, this right also authorises its holders to sell or lease all or part of the collective choice rights (rights of management and exclusion) to another individual or group.

These five classifications of rights can be arranged as shown in Table 3.2. This classification facilitates making a logical distinction among various classes of property rights holders related to common pool resources.

Table 3:2: Bundles of rights associated with positions

	Full owner	Proprietor	Authorised claimant	Authorised user	Authorised entrant
Access	✓	✓	✓	✓	✓
Withdrawal	✓	✓	✓	✓	
Management	✓	✓	✓		
Exclusion	✓	✓			
Alienation	✓				

Source: Adapted from Ostrom and Schlager (1992: 252)

As illustrated in Table 3.2, it is possible to have right of access (entry) without having withdrawal rights, to have withdrawal rights without management rights, to have management rights without exclusion rights, and to have exclusion rights without the rights of alienation. Hence, it is possible for individuals or collectives, as happens frequently, to hold well-defined property rights that include or do not include the full set of rights defined above.

Different bundles of property rights, whether they are *de facto* or *de jure*, affect the incentives that individuals face, the types of actions they take, and the outcomes they achieve. In the following section each of the ownership or entitlement types will be examined in association with the bundles of property rights that they enjoy and the corresponding incentives that titleholders face.

Full owners possess the right of alienation in addition to the bundle of rights held by a proprietor. This category of holders of rights may sell or lease part or the whole of their collective choice rights. Full ownership rights over common pool resources may be possessed by an individual, a private corporation, a government, or a communal group. The rights of alienation and exclusion present strong incentives to the holders of such rights to invest in the resources.

Proprietors possess collective choice rights to participate in management and exclusion. Individuals who hold this right (proprietors) are empowered to decide who may access resources and the way the resources are utilised. Nevertheless, they are short of the right to alienate either of these collective choice rights. In view of this definition, most of the property systems that are 'common property' regimes fall within this proprietors' category. Participants in common property rights possess four of the previously described rights but do not hold the right to sell their management and exclusion rights. Because proprietors can exclude unauthorised potential appropriators, they can capture for themselves and their offspring the benefit from investments they make in a resource.

Claimants possess the operational rights of access and withdrawal plus a collective choice right of managing a resource. However, they cannot specify who is eligible for access or alienate their rights of management. Claimants are more readily induced to undertake investment than authorised users. Without collective choice of exclusion, however, they cannot be assured of being rewarded for investing in withdrawal rights. Consequently, whether claimants exercise their rights of management depends upon whether they act within a set of circumstances that allows them to capture the benefits of coordinating their activities even without rights of exclusion.

Authorised users are defined as individuals who hold operational-level rights of access and withdrawal. The rights of this type of user are defined by others who hold collective choice rights of management and exclusion. Authorised users have no authority to devise their own harvesting rules or to exclude others from gaining access to the resource and they lack the authority to participate in collective action to change operational rules. Whether the incentives they face induce them to act so as to achieve efficient outcomes depends upon the

institutional design skills of those who hold the collective choice rights. Since authorised users do not design the rules they are expected to follow, they are less likely to agree to the necessity and legitimacy of the rules. Authorised users may engage in a game with rule enforcers, seeking to gain as much as possible.

Authorised entrants include most recreational users of national parks who buy an operational right in the form of an entrance fee and enjoy the natural beauty of the park, but do not have a right to harvest removable forest products.

In summary, owners have the greatest bundle of rights, including the right to exclude, the right to alienate, the right to manage, the right to withdraw, and the right to access and enjoy. Proprietors lack the right of transfer, claimants lack the right to exclude or transfer, authorised users have only the right of access and withdrawal, and authorised entrants have only the right of access.

All of the rights described can be held by single individuals or by collectives. As suggested by Grafton (2000:15), however, which mix of rights is desirable or how the stakeholders, including the state, share the bundle of rights and responsibilities among them depends on many factors. These factors may include the objectives of management of the resources, the physical characteristics of these resources, the benefits generated by the stock and flow of the resources, history, and the institutional environment.

3.6.3. The common property rights regime and CPR

Hardin's (1968) 'tragedy of the commons' assumes that commons are always subject to open access, or free for all. Based on this assumption, which is reinforced by the presupposition of self-interested maximising individual agent behaviour, he concludes that resources held in common will ineluctably be overexploited and destroyed. However, as shown in the Critique Section (2.3.4) the open access assumption is neither necessary nor historically accurate. Contrary to Hardin's assumption, Ostrom (1990) and Ostrom *et al.* (1994) argue that commons are often surrounded by local rules of access and enforcement mechanisms. Ostrom's (1990) extensive field research findings on common property rights shows that

groups often do find ways to regulate their own actions, and some of these arrangements have proven to be remarkably robust, lasting across several generations. Feeny *et al.* (1990) have also suggested, contrary to Hardin's assumption, that there is abundant evidence of the ability of social groups to design, utilise, and adapt mechanisms, often ingeniously, to allocate usage rights among members.

Based on her extensive empirical evidence of the ability of local people to manage their local resources, Ostrom (1990) proposed a third route, away from the tragedy of the commons:[8] the local regulation of access to and use of common property by those who actually use and have local knowledge of the resource. Ostrom (1990), however, warned that her optimism about common property should not imply that local communities inevitably manage their social dilemmas. She pointed out that there is no shortage of true tragedies as well as victories. The core of her argument is that it is inappropriate to conclude that the only way out of a commons dilemma is using either state control or privatisation of common pool resources.

Given the diversity of property right systems that could be utilised, an important question concerns why users of common pool resources elect to use a common property system. What are the attributes of common pool resources that are conducive to common proprietorship?

Relative advantages of the common property regime

It is argued that common property offers a way of parcelling the flow of harvestable benefit from an interactive resource system without parcelling the principal itself (see Table 3.3). Moreover, it is observed that this inherent characteristic of common property, i.e. the combination of individually parcelled rights to resource flow with shared rights to an intact stock is the main reason for its appearance among human institutions.

[8] State and private property rights are the two other mechanisms to avert tragedy as advocated by Hardin (1968).

Table 3:3: Stock and flow attributes of property rights regimes

	Individual property rights	Common property rights	Public property rights
Rights to flow	Parcelled	Parcelled	Intact
Rights to stock	Parcelled	Intact	Intact

Source: McKean (1996:20)

McKean and Ostrom (1995) identified a number of types of common pool resource situations in which placing property rights with groups can be more efficient than trying to allocate the rights, or the resource, to individuals. The potential advantages of self-governance of forest resources can be summarised as follows:

- Some resources are simply indivisible or, like many forest ecosystems, have to be managed in their entirety in order to maintain the interactive environment needed to produce some of their outputs (including mobile resources such as wildlife).
- In some large resource systems, such as range and woodland in arid areas, the location of the most productive zones can vary from year to year.
- In resource systems subjected to heavy population pressure or with congested and competing uses, coordination among users is essential to cope with problems caused by multiple uses or with interrelationships such as the effect of forest use in upland areas in a watershed on farmers and land use in lower areas.
- Group control and thus group enforcement of rules can be an efficient way of coping with the costs of monitoring otherwise porous boundaries and of enforcing restraints on use within those boundaries.

Likewise, in a classic study of the diversity of property rights systems used for many centuries by Swiss farmers, Netting (cited in Ostrom, 2003) observed that the same individuals fully divided their agricultural land into separate family-owned parcels, but that grazing lands located on the Alpine hillsides were organised into communal property systems. Based on this extensive study conducted on private and common property, Netting suggested that attributes of the resource affected which property rights systems were most

likely to be adopted by farmers. He identified five resource attributes that he considered most conducive to the development of common property rights (see Table 3:4):

Table 3:4: Resource attributes conducive to the development of common property rights

1. low value of production per unit of area;	Unsuitable lands for agricultural production due to scattered rainfall and steep slopes but which could be utilised for pasture and forest–-low value of production per unit area.
2. high variance in the availability of resource units on any one parcel;	By developing communal property rights to large parcels of such land, those who are members of the community are able to share environmental risks due to the unpredictability of rain-induced growth of grasses within any smaller region.
3. low returns from intensification of investment; 4. substantial economies of scale in utilising a large area; and	Herding and processing of milk products is subject to substantial economies of scale. If individual families develop means to share these reduced costs, all can save substantially.
5. substantial economies of scale in building infrastructure to utilise the large area.	Building the appropriate roads, retaining walls and processing facilities may also be done more economically if these efforts are shared.

Having shown that common property rights provide other possible solutions for social dilemmas and having stipulated their relative advantages in common pool resource settings, it is essential to note that, if these property rights are to be handled successfully, certain conditions must be met. These conditions, as identified by Ostrom (1990) are referred to as design principles. These conditions were isolated on the basis of community rights with a long history of successful management of common resources. The next section will deal with these design principles.

3.6.4. Design principles of robust common property rights

Hardin's "Tragedy of the Commons" paradigm (1968) can actually be challenged by examining how CPR institutions are operating. Ostrom's (1990) work illustrates this by analysing different CPR institutions and their management by local communities all over the

world. By analysing successfully operating, locally developed institutions that have shown sustainable use of natural resources such as forests, irrigation water, fisheries and pastures, Ostrom formulated seven so-called '*design principles'* that characterise all the robust (effective) CPR institutions plus an eighth principle used in larger, more complex cases.

By design principle, Ostrom means 'an essential element or condition that helps to account for the success of these institutions in sustaining the CPRs and gaining the compliance of generation after generation of appropriators to the rules in use' (1990:90). The author's conviction is that these principles form a core of necessary conditions for achieving institutional robustness in CPR settings.

Based on considerable research on common pool resources, Ostrom (1990) suggests that robust or long-term (sustainable) institutions are characterised by most of the design principles. Fragile institutions tend to be characterised by only some of these design principles, while failed institutions are characterised by very few of the principles. The eight design principles developed by Ostrom are summarised in Table 3.5, (*see next page*).

Table 3:5: Design principles exhibited by long-lasting CPR institutions

Principle	Description
1. Clearly defined boundaries	Individuals or households with rights to withdraw resource units from a common pool resource and the boundaries of the common pool resource system itself are clearly defined;
2. Congruence	**a**. The distribution of benefits from appropriation rules is roughly proportional to the costs imposed by provision rules; **b**. Appropriation rules restricting time, place, technology, and or/quantity of resource units are related to local conditions;
3. Collective choice arrangements	Most individuals affected by operational rules can participate in modifying operational rules;
4. Monitoring	Monitors, who actively audit common pool resource conditions and users' behaviour, are accountable to the users and/or are the users themselves;

Principle	Description
5. Graduate sanctions	Users who violate operational rules are likely to receive graduated sanctions, depending on the seriousness and context of the offence; from other users, from officials accountable to these users, or from both;
6.Conflict-resolution mechanisms	Users and their officials have rapid access to low-cost, local arenas to resolve conflict among users or between users and officials;
7. Minimal recognition of rights to organise	The rights of users to devise their own institutions are not challenged by external governmental authorities;
For common pool resources that are part of larger systems:	
8. Nested enterprises	Appropriation, provision, monitoring, enforcement, conflict resolution, and governance activities are organised in multiple layers of nested enterprises.

Source: Ostrom (1990:90)

Design principles work to enhance the participants' shared understanding of the structure of the resource and its users and of the benefits and costs involved in following a set of agreed-upon rules. This means that when the users of a resource design their own rules (*design principle 3*) to be enforced by local users or are accountable to them (*design principle 4*), using graduated sanctions (*design principle 5*) that define who has rights to withdraw from the resource (*design principle 1*) and that effectively assign costs proportionate to benefits (*design principle 2*), collective action and monitoring problems are solved in a reinforcing manner. The operation of these principles is then bolstered by the sixth design principle that points to the importance of access to rapid, low-cost, local arenas to resolve conflict among users or between users and officials. Moreover, the capability of local users to develop an ever more effective regime over time is affected by whether they have minimal recognition of the right to organise from a national or local government and this constitutes the seventh design principle. Finally, when common pool resources are somewhat larger, an eighth design principle tends to characterise successful systems: the presence of governance activities organised in multiple layers of nested enterprises.

Successful institutions for governing commons have emerged as a crucial issue of sustainability. Sustainable commons are strongly related to the capacity of the stakeholders to design and share institutions that are reinforced and continuously adapted in the face of evolving conditions. Thus, there is a need to evaluate existing institutions and the design principle is an important tool for such evaluation. In this study, the first seven design principles are used as criteria to evaluate the robustness of the institutions that govern the forest and grazing lands (watershed) in the case study area.

3.6.5. Recent changes affecting common property rights at village level

In contrast to Hardin's pessimistic view proposed as the tragedy of the commons, it is argued that local people can be more effective resource managers as they have more detailed site-specific knowledge, as well as social sanctioning mechanisms (institutions) that serve better as regulators of behaviour than formal external enforcement. This recognition of the characteristics of successful self-governing institutions has refocused the common property rights debate towards local communities (Ostrom, 1990). According to Runge (1985), Feeny et al. (1990) and Baland and Platteau (1996), however, modern pressures such as state intervention, increasing market orientation, commercialisation, technological change, human migration and population pressures are eroding these complex traditional systems. It is argued that these changes can transform existing systems of rules into situations of open access exploitation that more closely reflect Hardin's tragedy (Bromley & Cernea, 1989).

It is suggested that population growth and technological change, for instance, have increased pressures on natural resources to the extent that 'minimum' common property rules do not provide effective regulation. Population pressure may also decrease the possibility of 'assurance solution' to collective action problems, as there will be too many users to be trusted. Similarly, migration may reduce 'recurrence and noticeability', thereby lowering the average probability of cooperative solutions.

State intervention in the management of village-level natural resources has made customary rights highly insecure and is thereby destroying informal co-operation mechanisms. Wade (1988, as cited in Baland and Platteau, 1996) has suggested that state penetration of rural

areas may only undermine old systems of authority without permitting or establishing new ones, resulting in a hiatus of confidence

As local economies become increasingly integrated into the market, various adverse effects emerge, which affect collective action capabilities at community level, thereby lowering the average probability of cooperative solutions. Thus, market integration increasingly loosens individuals' ties with their traditional institutional arrangements. In the view of Baland and Platteau (1996) and Agrawal (2002), several aspects are involved here:

- Given that traditional rights and duties of the local communities are not tradable on a perfect market, overexploitation of resources is likely to follow. In terms of game-theoretical representation, the 'resource use' game they were playing increasingly shifts away from a game with no predefined endpoint to the finite N person PD game (Baland & Platteau, 1996).
- As enhanced economic integration gives rise to increased geographical mobility, the frequency of interaction with other rights holders over local-level resources diminishes, resulting in lower involvement in community affairs (Baland & Platteau, 1996).
- Market integration, by offering alternative opportunities to meet increasingly specialised needs, introduces new ways of resolving the risks that common property institutions are often designed to address. It limits the scope for interlinked long-term relationships—that is, the assurance game, which the members of the rural community were playing, gradually turns into a series of restricted N person PD games (Baland & Platteau, 1996; Agrawal, 2002).
- With new preferences and consumption patterns of goods and services, individual models of life are highly influenced by economic change and commercialisation. This new lifestyle dictates that individuals seek more cash income to meet their new needs—i.e. it modifies their rate of time preference in favour of present consumption. As a result, subsistence users are likely to increase harvesting levels or overexploit their resources for cash incomes as well (Baland & Platteau, 1996; Agrawal, 2002).

Common property regimes fail to provide for exclusion for other reasons also. In the view of Feeny *et al.* (1990), other causes of the failure of common property rights, in addition to what has been discussed earlier, include appropriation of the resources by political or militarily powerful groups, or land reform that disrupts existing communal management systems**.**

Thus, it may be suggested that local institutions, weakened by far-reaching economic and political changes, pressed by population growth and technological change, are unlikely to impose effective controls over local common pool resources use.

In view of the discussions thus far (in Chapters 2 and 3), none of the property regimes (state, private and even common property) seems to be effective when it stands alone, particularly in the context of developing countries. The prime factors for the inefficiencies of the state, private and common property are attributed to government failure, market failure and contextual change respectively.

A recent paradigm shift in the governance of local common pool resource systems is aimed at trying to work out a policy for shoring up the respective weaknesses of the state and communities, through an approach referred to as 'co-management' arrangements between government and rural communities. The next chapter is concerned with this management approach, which is seen to offer possibilities and promise for common pool resource governance.

3.7. Summary and conclusions

In this chapter, the institutional analysis perspective was employed to investigate the potentially destructive outcome of the commons dilemma and it was shown that the problems stem from externalities and are not due to inherent flaws in the regime governing common property rights.

It was shown that the 'tragedy of the commons' results from pervasive externalities that render coordination among rational individuals difficult and costly. This 'tragedy' was also interpreted as stemming from high transaction costs (due to externalities), which prevent individuals from entering into enforceable agreements that could improve the situation of all.

Afterwards, it was shown that, if no efficient rules /institutions are established by resource users to eliminate or curb externalities (free riding) then their scarce resources will eventually be decimated through the working of the tragedy of the commons. Thus, the failure to deal with transaction costs or the existence of uncompensated interdependencies/externalities leads to or is an institutional failure.

Two categories of externality (transaction cost) problems associated with common pool resource use were identified. These include *appropriation* and *provision problems.* It was shown that the solution to such externalities (the source of the CPR dilemma) is the establishment of *institutions* that ensure coordination among resource users—i.e. harnessing individual rationality into collective good.

According to North (1990), institutions are defined as the "rules of the game in a society, the humanly devised constraints that shape human interaction." If efficient in their functioning, institutions provide more certainty and stability to social interactions and facilitate coordination or govern relationships between individuals or groups.

Property rights are specific types of institutions or institutional arrangements. They are defined as the enforceable authority to undertake particular actions in a specific domain. Property rights assign benefit streams derived from the utilisation of a resource and entail rights for those holding such rights and duties for all others to respect the rights. The focus of this research paper is the 'common property rights regime'.[9]

Two conceptual frameworks—Oakerson's framework for analysing the commons and Ostrom's design principles were presented and discussed. Oakerson's *framework* will be used in arranging the field information into meaningful sets in order to examine relevant relationships between the local people and the resource and facilitate understanding of resource management problems, while Ostrom's *Design Principles* will be applied as a template against which the *sustainability* and *equity* of the local institutional arrangements

[9] Groups of individuals are considered to share common property rights when they have formed an organization that exercises at least the collective choice rights of management and exclusion in relationship to some defined resource system and the resource units produced by the system (Elinor Ostrom, 2003).

will be determined. The *Design Principles* form a core of necessary conditions for achieving institutional robustness in CPR settings. Robust or long-term (sustainable) institutions are characterised by most of the design principles. Fragile institutions tend to be characterised by only some of these design principles. Failed institutions are characterised by very few of the principles. The seven principles are:

- Clearly defined boundaries and resource users;
- Congruence between the benefits from appropriation rules and the costs imposed by provision rules and local conditions;
- Most individuals affected by a resource regime can participate in making and modifying their rules—collective choice arrangements;
- Monitors, who actively audit CPR conditions and appropriators' behaviour, are accountable to the appropriators and/or are the appropriators themselves;
- The application of graduated sanctions depending on the seriousness and context of the offence to violators of operational rules;
- Access to rapid, low-cost, local mediation to resolve conflict among users or between users and officials;
- Minimal recognition of rights to organise, i.e. the rights of appropriators to devise their own institutions, is not challenged by external governmental authorities.

The application of common property rights was pointed out as another viable alternative to state or private property rights management regime as a solution to the commons dilemma. It was also mentioned that recent changes in the context in which rural communities operate tend to make village level resource regulation more difficult than it was before. In view of this, the recent shift in the governance of local common pool resource systems is meant to try to work out an approach, in terms of policies for shoring up the respective weaknesses of the state and of communities (where common property rights are in place), through *'co-management'* arrangements between government and rural communities. The subject of the next chapter is concerned with this management approach.

4. Co-management as a new approach in managing CPRs

> "It may be useful to think in terms of policies for shoring up the respective weaknesses of states and communities in managing collective resources"[10]
>
> *Lawry (as quoted in Baland & Platteau, 1996)*

4.1. Introduction

In Chapter 2 *(Sect. 2.3.4)*, some of the most important limitations of state and private property rights over common pool resources were discussed and it was suggested that a solution to the commons dilemma should not be restricted to these property rights. Following this, it was pointed out in Chapter 3 *(Sect. 3.6.3)* that having common property rights was a viable alternative to the state or private property rights solution to the commons dilemma. It was also mentioned that changes in the context in which rural communities operate tend to make village level resource regulation more difficult than it was before (see Chapter 3, *Sect. 3.6.5*).

Despite the potential benefits of state control of common pool resources, this property right regime is seldom associated with successful resource management in developing countries. State failure has been rampant, especially where centralised control rights have superseded indigenous rights. By abrogating indigenous property rights (*de facto* rights), developing countries have nationalised a part of their common pool resources in trying to create state rights (*de jure* rights), but due to the deficiency of enforcement capabilities of these countries, there was frequent reversion to *de facto* open access—a necessary condition for complete rent dissipation. The prime causes of this situation are pervasive informational asymmetry between the state and users with regard to the resources; lack of adequate financial means and trained personnel; moral hazard; corruption; coercive implementation of

[10] The phrase *'collective resources'* is used here to mean common pool resources.

the *de jure* rights; and deficient monitoring of sizable and scattered state-controlled natural resources.

Private property rights (markets), in theory, efficiently allocate resources that are strictly private goods, where the cost of exclusion is relatively low and one person's consumption subtracts from what is available to another. Nevertheless, private property regimes (markets) are severely deficient in solving the commons dilemma, in that markets cannot capture the full value of common pool resources and thereby create perverse incentives for owners. The underlying cause of market failure is linked to the pervasive externalities arising in the use of common pool resources.

Finally, the third alternative route to avert 'tragedy', namely common property rights, despite its strong attributes, may be unrealistic in the context of the contemporary settings of the developing countries. Some of the large-scale and long-term changes occurring in the rural areas of these countries in terms of market integration, commercialisation, technological change, population pressure and migration are making community level governance of local common pool resources increasingly difficult.

So, the logical question to be asked is what other institutional mechanism or arrangement is available or can be thought of to escape the 'tragedy of the commons'? The recent paradigm shift to solve the commons dilemma involved devising policies that harness the complementarities between state and communities and thereby alleviate the respective weaknesses of these entities in governing local common pool resources, an approach which refers to 'co-management' arrangements between government and rural communities.

4.2.Co-management defined

The term 'co-management' refers to a shift in common pool resources management that supports the participation of resource users in decision making and management. According to Borrini-Feyerabend (2000:7) co-management may be defined as "a situation in which two or more social actors negotiate, define and guarantee amongst themselves a fair sharing of the management functions, entitlements and responsibilities for a given territory, area or set of natural resources". Co-management theory advocates a shift away from autocratic and

paternalistic modes of management to modes that rely on the joint effort of government agencies and users. Co-management therefore is an alternative management strategy that merges the interest of government with that of local communities and other stakeholders.

The main objective of co-management is the development of an agreement by all primary stakeholders that specifies their respective roles, responsibilities, and rights in the management of natural resources of concern. Hauck and Sowman (2003) (citing Hara, 1999 & Pomeroy, 1998), suggest that the nature of the distribution of the respective rights and the configuration of management responsibilities is influenced by a number of factors. These may include the extent of political support for user involvement, whether legislative provisions exist or not, as well as the capacity, skills and resources of respective partners.

Co-management can be seen as a continuum of a variety of partnership arrangement models and presupposes that parties have agreed on an arrangement, to some extent, but the arrangement often evolves. It can therefore be seen as a process rather than a fixed state (Beck, 2000, cited in Carlsson & Berkes, 2003). The concept co-management is often equated with joint management, shared management, multi-stakeholder management, etc.

4.3.Rationale for co-management

As argued in the preceding chapter, management of common pool resources by local users alone is most unlikely to be optimal in the contemporary world due to the recent contextual changes in which rural communities operate. It has also been argued that there is overwhelming evidence of government failure in managing local common pool resources; especially where this regime has superseded a pre-existing common property rights regime.

The recent regime that is emerging as an alternative management approach is co-management, which is seen to offer possibilities and promise in the common pool resources arena. This management approach is viewed as a dynamic partnership where the capacities and interests of local resource users and communities are complemented by the ability of the state to provide enabling policies and legislation, as well as enforcement and other assistance. As suggested by Borrini-Feyerabend (2000) & Grafton (2000), co-management presupposes

that communities and state have different capacities and comparative advantages in overcoming the many externalities that may flow from using common pool resources. Thus, co-management is oriented towards harnessing these complementarities.

The nature of complementarities between government and resource user/communities, which could serve as a base for co-management arrangements as suggested by Baland and Platteau (1996) include:

Government-side contribution

- The government can provide a legal framework that enables communities to acquire legally enforceable rights over certain resources;
- It can provide technical assistance for sustainable management schemes as adopted;
- The state can provide economic incentives, where relevant, to create positive incentive structures that would convince users to adopt sustainable instead of exploitative use of resources. This is especially relevant where the resources have already been substantially degraded and the users are subsistence-constrained villagers who do not have the financial means to rehabilitate and develop the resource;
- It can play an important role in resolving conflict stemming from externalities, that is, it can help multiple groups to solve conflicts arising from negative externalities;
- It can also contribute towards monitoring where decentralised monitoring is in need of external support.

The contribution of local communities

- Local resource users have a good knowledge of local ecology and deep understanding of local economic, social, and cultural conditions. Being closer to the resource, communities have an informational advantage compared to any centralised agency. They are therefore able to make a significant contribution in devising appropriate rules that reflect local settings. It is unlikely that a state agency will possess sufficient knowledge about the condition of the resource, its flow of use, and the identity of its users to be able to manage it directly in an efficient manner.

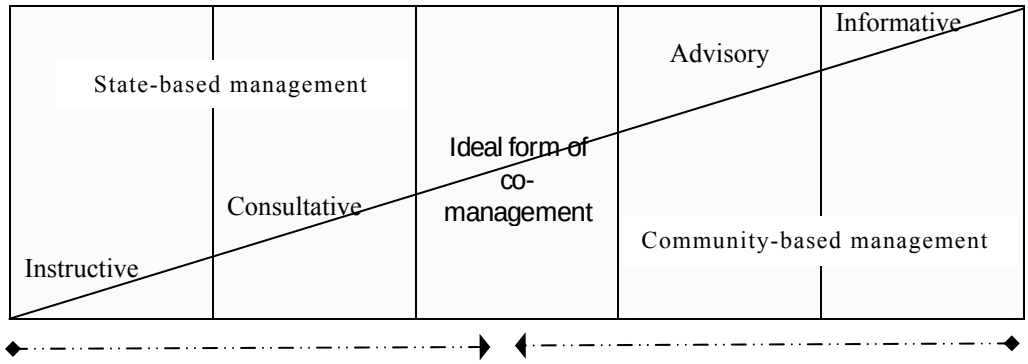
- Monitoring systems applied by user communities are significantly less costly than centralised control. Moreover, monitoring user behaviour may be imperfect when it is undertaken by the state alone.
- Conflicts that may arise among resource users can be resolved locally at low cost through a customary forum, as opposed to centralised arbitration.

In addition to the complementarities between the state and the local institutions, the congruence between the co-management structure and existing traditional social and cultural institutions should be ensured, as suggested by Agrawal (2002). It is believed that a viable environment for successful co-management is created when co-management arrangements strengthens and revitalises local institutions.

4.4.A typology of co-management

Authors such as McCay and Jontoft (1996) and Pinkerton and Weinstein (1995) cited by Hauck and Sowman (2003) observe that no single model of co-management has emerged, despite the fact that co-management arrangements have been implemented all over the world, and have been studied for a number of years. According to Hauck and Sowman (2003), this is because of differing local conditions, historical circumstances, needs and demands that occur within communities, as well as the diversity of governance arrangements that exists. Consequently, there is a broad spectrum of co-management arrangements that vary significantly in terms of degrees of responsibility and power sharing between government and community (Pinto da Silva, 2002) (see Fig. 4:1). According to Pomeroy and Williams, these range "from those in which the resource users are consulted by the government before regulations are introduced to those in which the resource users design, implement and enforce rules with advice from the government" (Pomeroy & Williams, as quoted by Hauck & Sowman, 2003). It has been suggested that the balance of power and responsibilities may change over time—co-management is a process and not a fixed state.

Figure 4:1: Spectrum (continuum) of co-management



Co-management is a process and not a fixed state

Source: Adapted from Sen and Neilson (cited in Pinto da Silva 2002:116)

The following describes the five co-management classifications presented graphically above (Pinto da Silva 2002, 2003):

Instructive: the State creates mechanisms for dialogue with users and informs them of government management decisions. This is characterised by minimal exchange of information between government and users and it is only different from centralised management in the sense that mechanisms exist for dialogue with users, but the process itself tends to comprise government informing users on the decisions they plan to make. Some suggest that, as this type of management is a top-down model, it should not be considered as a valid type of co-management due to the low level of interaction between government and resource users.

Informative: This refers to an arrangement whereby local communities shoulder more responsibility for management decisions, implementation and enforcement. Under this arrangement, the government delegates and decentralises decision making to user groups who, in return, inform government of decisions made at this level. This type of arrangement also falls short of ideal forms of co-management as the balance of power and responsibility is significantly skewed towards the user community.

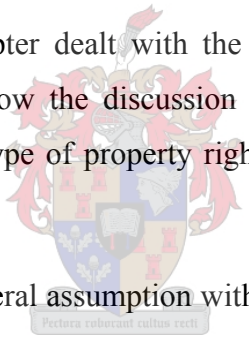
The truest Co-management: Arguably this type of management arrangement is the variation that best exemplifies the goals of co-management. Under this arrangement, government and users ideally co-operate as equal partners in decision making, therefore it is often referred to as the 'truest' form of co-management.

Consultative: This category of co-management is characterised by the existence of mechanisms for government to consult with users, although under these arrangements all final decisions are taken by government.

Advisory: This co-management concept is characterised by the *advisory* role that government plays in management decisions, where local communities have the primary responsibility for management.

Practical consideration in implementing Co-management

Thus far, discussions in this chapter dealt with the general description and the potential advantages of co-management. Now the discussion will focus on exploring the potential challenges of implementing this type of property right regime for managing local common pool resources.



As suggested in chapter 3, the general assumption with regard to institutions is that they curb transaction costs by avoiding uncertainty, and facilitate cooperation and exchange among economic units. As suggested by Olsson (cited in Adhikari 2001), however, institutions may increase transaction costs instead of curbing them when they are inefficient. Moreover, as North (1990) observed, institutions might even be captured by powerful groups to serve their particular interests.

Co-management, as any other form of institutional arrangement, is not immune to these kinds of shortcomings. Borrini-Ferebend (2000) for instance, while acknowledging that a successful co-management can integrate both economic and empowerment benefits to the local communities, he pointed out that encouraging collaboration may be difficult as there may be several practical problems that militate against it. In this line of argument, Carter &

Gronow (2005); and Pomeroy & Rivera-Guieb (2006), outline several factors that may limit the realization of the potential advantages of co-management in the ground, including:

- Sufficient political commitment may not exist to support co-management;
- Unease of political leaders and government officials to share power;
- Co-management may lead to shifts in 'power bases' (political, economic, social) that are not in the best interests of politically powerful partners; thus opposition from these parties;
- A possibility of unbalanced and inequitable sharing of power between government and communities;
- Capture of co-management by powerful groups (community elites and local politicians) to serve their particular interests.

Development of co-management is a process and it requires some essential ingredients to emerge and build up. Borrini-Feyerubend (2000) suggests the following core conditions for successful implementation of this type of institutional arrangement:

- full access to information on relevant issues and options, transparency and accountability that can undermine any asymmetries that may arise among resource users, other stakeholders,
- freedom of expressing views and organizing for action, time and resource to organize, fair system of representation, absence of social discrimination,
- political openness towards participatory democracy etc.
- serious political commitment, clear-cut policy objectives as well as policy guidelines, realistic institutional arrangements for collective tenure, and security of usage rights.

4.5. Summary and conclusions

This chapter, having recapitulated the limitations of state and private property regimes concerning common pool resources management and having reminded that the solution to the commons dilemma should not be restricted to these property rights regimes only, pointed out that common property right which constitutes another alternative management regime is under increasing pressure from recent contextual changes. Recent changes in the context in

which rural communities operate have tended to make village level resource regulation more difficult than it was before.

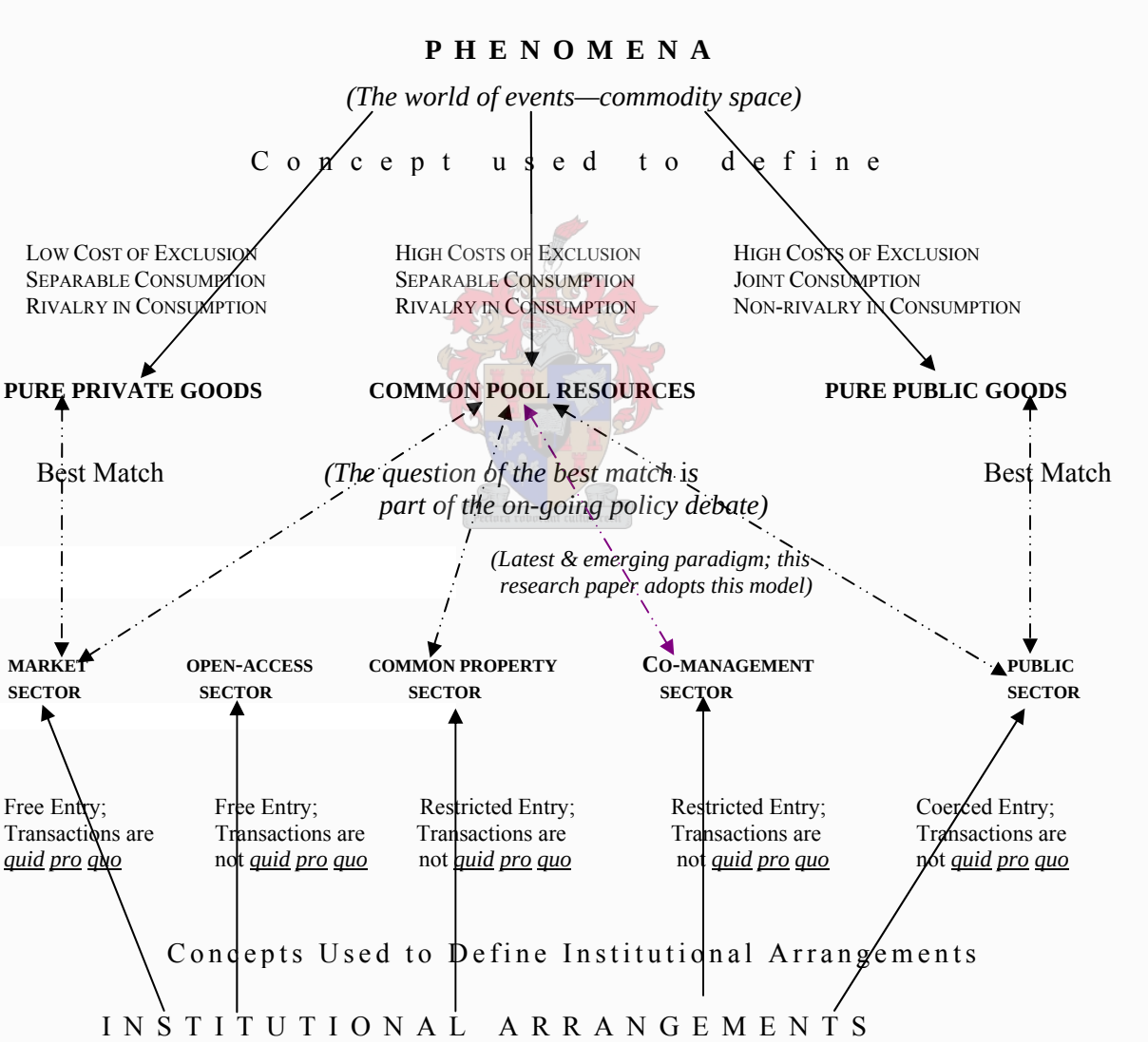
In view of the limitations of the three property rights regimes in terms of managing common pool resources, the shift is towards formulating an alternative institutional solution to the commons dilemma, involving harnessing the respective strengths of the state and communities in managing common pool resources, an approach which is referred to as 'co-management' arrangements between government and rural communities. Co-management presupposes that resource users and government have different capacities and comparative advantages and aims at harnessing these complementarities.

Co-management, according to Borrini-Feyerabend (2000:7), was defined as "a situation in which two or more social actors negotiate, define and guarantee amongst themselves a fair sharing of the management functions, entitlements and responsibilities for a given territory, area or set of natural resources". The nature of the distribution of the respective rights and the configuration of management responsibilities is influenced by a number of factors, which may include the extent of political support for user involvement, whether legislative provisions exist or not, as well as the capacity, skills and resources of respective partners. Thus, co-management can be looked upon as a continuum of a variety of partnership arrangement models. As suggested by Pomeroy & Williams (quoted in Hauck & Sowman, 2003), this continuum may range "from those in which the resource users are consulted by the government before regulations are introduced to those in which the resource users design, implement and enforce rules with advice from the government". It was suggested that the balance of power and responsibilities may change over time, as co-management is a process rather than a fixed state.

In addition to the complementarities between the state and the local institutions, the congruence between the co-management structure and existing traditional social and cultural institutions should be ensured. The belief is that viable environment for successful co-management is realised when co-management arrangements strengthens and revitalises local institutions. Moreover, for a successful implementation of co-management serious political commitment, clear-cut policy objectives as well as policy guidelines are essential.

The following schematic representation illustrates the concepts and theories and their policy prescriptions as discussed in the paper on the issue of good match between the resource system and the institutional arrangement used to govern the resource. Five types of arrangements that could be used to manage phenomena in the world are depicted in *Figure 4.2*. Out of these alternatives, as suggested in the theoretical discourse, this thesis subscribes to/adopts the *co-management* institutional arrangement as the best regime for the management of local common pool resources.

Figure 4:2: Goods (private, common pool & public goods) and institutional arrangements



Source: Adapted from Ostrom (1986: 606)

5. Methodological approach

> "The case study approach remains the preferred mode of analysis of most commons scholars."
>
> *Agrawal* (2002:71)

5.1. Introduction

This research project aimed at identifying the institutional arrangements for the management of local common pool resources, specifically focusing on forests and grazing lands under common property rights regimes in the case study area. The ultimate goal was to determine the efficacy or robustness of the local institutions. To arrive at this objective, however, demanded looking into the nature of the resource, the whole array of decision-making institutional arrangements, and the nature of the interaction among users and regulators. As argued in the theoretical sections of the paper (particularly in *Chapter 3, Sect. 3.5)*, both the physical and technological attributes of the CPR and decision-making institutional arrangements affect patterns of interaction to produce outcomes.

Given the interdependent relationships of the different attributes associated with CPR settings, the researcher adopted a case study research method, believing that this methodology would be more suitable than most other methods to produce evidence that could lead to understanding of the case and answer the research questions. Moreover, the research design adopted for the current research project was a *qualitative*, *exploratory-explanatory*, *single-case design* and closely followed recommendations by Yin (2002). A discussion on a case study as a research method and application of the recommended procedure in the current research follows.

5.2.Case study research

A case study comprises a research method involving an empirical investigation into a particular contemporary phenomenon within its real-life context, using multiple sources for evidence (Robson, 1993, cited in Pinto da Silva, 2002; Yin, 2002). Most empirical studies of commons adopt case study methods (Agrawal, 2002). The case study research method is claimed to facilitate an in-depth understanding of many interdependent and interrelated institutional arrangements.

Case studies can be of single or multiple-case design. Single-case study methodology was used in the current study. Case studies do not require a minimum number of cases, or random selection of cases. The researcher is called upon to work with the situation that presents itself in each case.

Yin (2002) has identified three specific case study designs: *Exploratory*, *Explanatory*, and *Descriptive*. He suggested that the nature of the research or sub-research questions posed (e.g., framed as "what", "how", "why") dictates the type of research design to be adopted. This study comprises several "what" questions. This type of research question justifies an exploratory study (Yin, 2002). The existence of several "how" questions in the questionnaires makes the study explanatory as well (Yin, 2002). In the current research project, a number of the research questions are structured as "how". Thus, because of the several "what" and "how" types of research questions of this thesis, the adopted methodology is of the *exploratory-explanatory* design type.

The exploratory strategy was used to identify the institutional arrangements in the case study area, while the explanatory strategy came from the need to determine how robust/sustainable and equitable the institutional arrangements for the management of the CPR were, to determine the extent to which the institutional arrangement reflected Ostrom's design principles.

Case study is known as a triangulated research strategy, meaning that it involves using multiple sources of data. This attribute constitutes its key strength as compared to other research methods. The rationale for triangulation is to increase the validity and reliability of

data by corroborating it with data gathered from other sources. Data that are collected are normally largely qualitative, but it may also be quantitative. Yin (2002) emphasised using multiple sources of evidence as the way to ensure construct validity.

Yin (2002) identified six primary sources of evidence for case study research: documentation, interviews, direct observation, archival records, participant observation, and physical artefacts. All need not be used in every case study (Yin, 2002). In this study, the first three types of sources were used, as they were found to be the most relevant.

A frequent criticism of case study methodology is that replication is not possible and that this renders it incapable of providing a generalising conclusion. The literature contains major refutations by several authors. Yin (2002), in particular, refuted that criticism by presenting a well-constructed explanation of the difference between analytic generalisation (case study strategy) and statistical generalisation: "In analytic generalization, previously developed theory is used as a template against which to compare the empirical results of the case study" (Yin, 2002). While *Oakerson's CPR analytical framework* was used to collect and arrange information into useful sets in order to examine relevant relationships between people and a resource that lead to an outcome in the current case study, *Ostrom's design principles* were used as a template against which the empirical data from the case study were compared. Yin (2002) stated that generalisation of case study results is made to theory and not to populations, whereas one, in statistical analysis, generalises to a population based on a sample that is representative of that population. Unlike random sample surveys, case studies are not representative of entire populations, nor do they claim to be. The case study researcher should take care not to generalise beyond cases similar to that which is studied.

Another important consideration in a case study is the issue of 'unit of analysis'. It defines the case. This could be an individual, groups, organisations, villages/communities, watersheds, or countries. This study used the case study village/community as the unit of analysis.

Finally, an important factor for successful case study implementation is sound case selection. Yin (2002) recommended that the selection should offer the opportunity to maximise what

could be learned when knowing that time is limited. Hence, the cases that are selected should be easy and willing subjects. A good instrumental case does not have to defend its typicality. Case selection for this research project was done in view of this recommendation.

5.3.Establishing rapport

It is essential that rapport be established with members of the community being researched at the outset. This is true especially in the primary data collection process based on purely or largely qualitative field research such as the present research project. Establishing rapport and trust help greatly to obtain adequate insiders' views and understanding of an area.

The researcher's earlier work relationship with the Head of the sub-zoba Serejeka Ministry of Agriculture Branch Office and his staff was very helpful in facilitating the establishment of rapport with members of the researched community and their officials. The researcher introduced himself to every interviewee as an employee of the Ministry of Agriculture and a postgraduate student who was trying to understand, and know more about, how they managed the local common pool resources. The working rule of the researcher, throughout the fieldwork, was to maintain a low-key approach and not pretend to possess any 'special knowledge and skills'. The researcher made maximum effort to be a good and reflective listener. Furthermore, he was socially and culturally aware of the community.

5.4.Validity and reliability

As pointed out in *Sect. 5.2,* the case study approach is known as a triangulated research strategy, because it involves using multiple lines of enquiry. As Yin (2002) noted, the unique strength of case study research is this ability to employ a variety of evidence. The rationale for triangulation is to increase the validity and reliability of data by corroborating it with data gathered from other sources. As Marshall and Rossman (cited in Pinto da Silva, 2002) suggest, limitations of one method can be compensated for by the strengths of a complementary method.

According to Yin (2002), not all sources of evidence need be used in every case study. In the present study, the major data-collection methods that were used included: interviews (semi-

structured, in-depth interviews, key informants, group discussions, and informal conversational interviews), direct observation, and document review. The data, gathered largely through using these separate lines of enquiry, were crosschecked to provide a triangulation of methods and to strengthen the validity and reliability of the data.

5.5. Conducting the fieldwork

The first field visits to sub-zoba Serejeka, where the researched village is located, were made in mid-March 2003 and lasted for about three weeks. These visits were mainly meant for the purpose of preliminary reconnaissance. Information obtained during this exploratory fieldwork helped towards refining/modifying research questions and shaping the content of the theoretical framework, and provided insight into the substantive and methodological concerns.

The fully-fledged fieldwork was carried out between June 25 and August 31, 2005. This was spearheaded towards collecting primary data, as there were virtually no secondary data pertinent to the village selected for the study. In the process of collecting data, various persons at various levels (ranging from village to national) were contacted and interviewed. While the village level data were used as input for the case study analysis, the national level information gave a broader perspective/context about national objectives with regard to the natural resource management *(see Appendices, List of persons met/interviewed)*.

At field level, interviewees were selected both 'on purpose', and 'non-purposely' from among individuals met in their homesteads, or while busy in their fields or travelling to or from fields, market or elsewhere. These interviewees provided their perception and attitude regarding local common pool resources governance, challenges, and opportunities. The interviews conducted at various levels and the field observations were guided by a checklist of questions or topics of interest derived from the research sub questions.

The researcher collected all the data for the study himself and no enumerators or interpreters were involved, as the researcher's mother tongue is the language spoken in the case research area. This is to say that the interactions in the course of the interviews and direct observation were between the researcher and the interviewees from among the local community. The

researcher also conducted several interviews with various experts, officials and extension agents working for the following Ministries and organisations: the Ministry of Agriculture, the Ministry of Land, Water and Environment—Department of Land, the Ministry of Local Government officials, and other organisations. Secondary data (mainly concerning national issues) were also obtained from these and other sources.

Interviews

Interviewing is among some of the most commonly used research methods to obtain qualitative information. Kuter and Yilmaz (2001) have pointed out that the widespread use of these research tools is due to their *flexible* and *participatory* attributes. They are flexible in a sense that the researcher has the freedom to change or modify part of the checklist of questions or change the asking order of the questions according to the reactions of the interviewee(s). The purpose is to ensure sufficient flexibility for the researcher to follow up interesting ideas. Interviews are also said to be participatory since they involve an interactive conversation between the researcher and the interviewee(s). In the view of Kuter and Yilmaz, "This is a big advantage when compared with the isolated effect of the questionnaires because the user shares the experience and he may have more tendencies to use the interface after the interview."

In this study, interviews were used widely, as will be evident below. The interview activities were guided by checklists of questions or topics for enquiry derived from the research sub questions.

As interviews are interactive in nature, the researcher has an opportunity to probe by posing questions such as "What do you mean by that?" Moreover, monosyllabic answers, i.e. 'yes' or 'no' answers can be pursued by probing questions. In the present study, probes were frequently used to try to find the underlying causes or reasons for the prevailing uses of natural resources and the institutional arrangements in place for their governance at the site of the research.

The information obtained through interviews may be recorded using notes, or they can be tape-recorded and transcribed later. Adopting Naidoo and Rolls' (2000) suggestion, this

research recorded the interviews by means of written notes only and no voice or video recording device was used. Moreover, the recording of notes during the interviews was brief, but elaborated immediately following every interviewing session. These strategies avoid the distraction of intensive note taking and recording devices during interviews. Accounts of the interviews and the observations that were collected were completed each day before the start of a new interview.

Depending on the type of information sought, interview techniques may be semi-structured or in-depth, and involve key informants, group discussions, or tightly structured interviewing. The present study adopted the first four types of interviewing methods. Brief discussions on each of these techniques are presented below.

Semi-structured interviews

The semi-structured interview is suitable where little is known about certain issues. It provides data that may subsequently lead to an in-depth interview. It involves the preparation of an interview guide (checklist) that lists key questions (open-ended) or themes that are to be explored during an interview (World Bank, 2005). This means that the interview starts with questions or issues that are more general; while the majority of questions that are more specific are created during the interview. Semi-structured interviewing allows both the interviewer and the respondent the flexibility to probe for details or discuss issues (Davis, 1990).

For the present study, the researcher employed this source of evidence extensively in an early cycle of the fieldwork to understand the general status of the local resources and institutions. It helped in identifying the most critical issues of local CPR governance that needed to be addressed further through an in-depth interview in the course of the research work. The checklists (open-ended questions or themes) developed for this purpose helped to guide the interview and ensured that similar issues were raised and discussed with various respondents, thereby ensuring inter-interview triangulation. However, this is not to say that the interview schedule was rigid; instead, the researcher was flexible in responding to the course of the interview while always adhering to the key themes of the interview. The researcher frequently employed probes to address issues adequately and unequivocally. The use of

open-ended semi-structured interviews allowed the respondents to elaborate on their experience or attitudes.

Numerous semi-structured interviews were carried out during the course of the fieldwork. Such interviews were conducted with Ministry of Agriculture experts based at Head-Office, and regionally and sub regionally. At research site level, interviews were conducted with the sub-zonal MOA Head and with some of his extension agents and local administrators. The major source of the field data is the interviews conducted with both men and women who were local farmers. These farmers, through these interviews, elaborated on their situations, attitudes, and experiences related to local natural resources and institutions. During all the interviewing sessions, only brief notes were recorded, but these were elaborated immediately following the interview.

In-depth interviews

In-depth interviewing takes the collected data from semi-structured interviews one step further by focusing on those that are judged to be critical issues (Naidoo and Rolls, 2000). This is to say that the in-depth interview tries to investigate critical issues identified through semi-structured interviews more closely and in detail. This type of interview is meant to probe and stimulate the interviewees to think rather than just give quick answers. It is guided by a checklist derived from the semi-structured interview data. Moreover, in this kind of interviewing technique only a few purposely selected persons are subjected to a detailed interview. Questions are open-ended and respondents are encouraged to express their own perceptions in their own words (World Bank, 2005).

Following many of the semi-structured interviews, several in-depth enquiries were carried out with various experts and local farmers. Interviewees' experiences and perceptions regarding the challenges and opportunities of local resource management were explored. As an outcome, the study was able to unearth the underlying problems or causes of the prevailing natural resource status and situation of the local institutions.

Key informants' interviews

Key informants are individuals who, because of professional training/knowledge and or/affiliation with particular organisations, agencies, or associations, or previous experience or social status in a community, are in a prime position to have valuable information such as insight into the functioning of the society, their problems, and needs (World Bank, 2005; Carter & Beaulieu, (undated). Key informants' interviews are used to collect information from such types of persons and are generally conducted on an individual basis.

The key informants in the field study for the present research consisted of elected local officials who explained the existing institutional set-up of their area and village elders who were very crucial in understanding the historical natural resource management in general and indigenous forest resource system in particular. Moreover, it included extension agents who provided enlightenment concerning local resource governance constraints; and senior experts from the Ministry of Agriculture who provided a national perspective on natural resource management and challenges encountered in managing these resources.

Group discussion

In all three types of interviews discussed above, the individual constitutes the unit of response and they are primarily concerned with an individual's understanding of a given issue. Group discussion, on the other hand, shifts the emphasis away from the individual and uses the dynamic of the collective discussion to gain research insights and augment our understanding of a topic. This method is more interested in the data that are collected and issues explored in the context of the group. In a group discussion, participants are invited to share and to discuss their opinions and feelings on the question or issues raised by the interviewer. Discussants interact, exchange, and influence one another during the discussion. The primary objective of group discussion is to elicit ideas, insights, and experiences in a social context where people stimulate each other and consider their own views along with the views of others. The interviewer facilitates the discussion and watches it so that it does not drift away from the main theme (World Bank, 2005). The advantage of group discussion is that information gained from one individual can be crosschecked with others and more than one opinion gathered. In

this manner, it also helps to overcome individual biases to a great extent because individual perceptions are discussed among the participants.

Group discussions could involve a large group (such as a community meeting), a small group representing a particular background and interest (such as purely farmers or individuals who are engaged in both farming and off-farm employment), or elderly persons (who are knowledgeable about customary laws), or women in terms of their role in natural resource use and management. This research method was used in the field data collection activities mainly involving groups of farmers from among the researched community. A large group of both male and female farmers who were involved with soil and water conservation structures were given issues related to forest management to discuss among themselves. In addition, on another occasion, a small group of elderly farmers also discussed local institutional issues.

Direct observations

Direct or firsthand observation is another important source of field evidence. It involves the systematic recording of ongoing activities or physical surroundings by a researcher within a clearly defined area (World Bank, 2005). This method allows the researcher to present a more comprehensive view of the research site by combining his/her own as well as other perceptions; it helps to understand and interpret the prevailing situation by providing personal knowledge and direct experience. Moreover, it allows the researcher to be aware of important things that participants may ignore or omit willingly or unwillingly in interviews.

In the present study, the researcher, accompanied by knowledgeable farmers, made several transect walks, i.e. direct observations in the research site with special emphasis on forest and grazing land areas. In the process, whatever data were collected through interviews were crosschecked with these direct observations where possible.

Document review

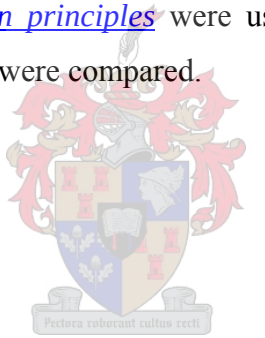
As virtually no secondary data pertinent to the study village existed, very little data collection was made from documented sources. The limited data were related to total land area of the researched village and its forestland resource. However, significant document reviews were made concerning the natural resources and agricultural systems of the Highlands. This

review provided a broader context for the case study area and ideas for questions that were included in the field data enquiry schedules.

5.6.Data processing and analysis

Data collected through the various research methods (interviews in combination with direct observation and documentation) were analysed by examining key themes or content and making frequency tallies. This analysis helped to establish patterns from the responses of the respondents, group discussants, and firsthand observations. The established patterns derived from using different research tools were crosschecked through triangulation. In this manner, the reliability and validity of the data were strengthened.

In the process of analysis, themes were categorised in line with *Oakerson's CPR analytical framework* to examine relevant relationships between people and a resource that led to an outcome. Finally, *Ostrom's design principles* were used as a template against which the empirical data from the case study were compared.



PART III: THE COUNTRY CONTEXT

6. Eritrea: an overview of the natural resource base, agricultural sector, and CPRs management

> "Eritrea has suffered significant environmental damage, through the degradation of its land, water, and forestry resources."
>
> *World Bank (1994: ii)*

6.1. Introduction

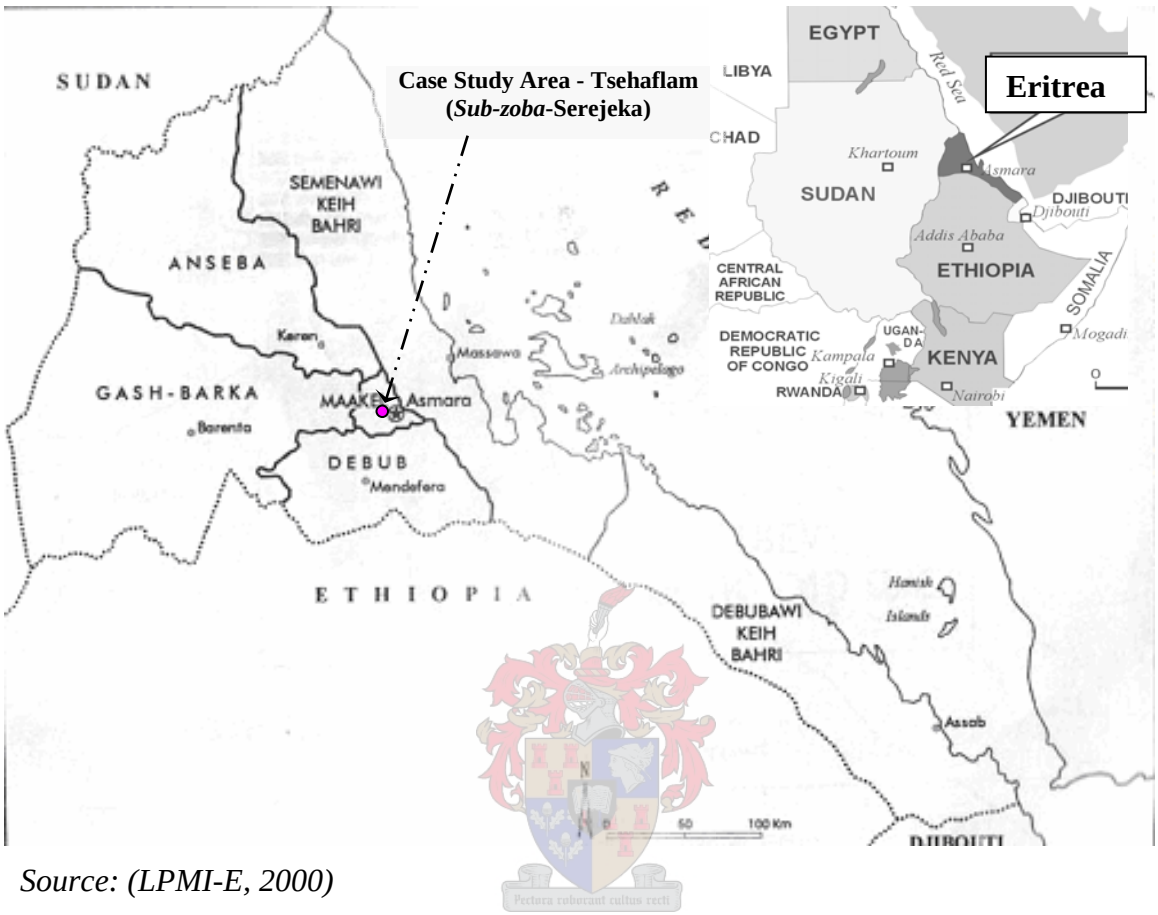
This chapter aims to present the country context with the purpose of providing a broad background to the case study. More specifically, it discusses the natural resource base of the country, examines the significance of the agricultural sector and its challenges, and explores the status of the country's forests and pasturage resources. It examines the policy directed at forestry and pasturage CPRs and overviews the current management modalities for local CPRs. Further, it examines recent trends in the management of CPRs following the new interim regulations for the management of local CPRs and a critique on these regulations is presented. The chapter ends with a summary and conclusions.

6.2. The territory, population, and historical overview

Territory and its inhabitants

Eritrea is strategically situated in the Horn of Africa facing the Middle East. It has a coastline of approximately 1,200 kilometres on the eastern side facing Yemen and Saudi Arabia across the Red Sea and borders on Sudan in the North and West, Ethiopia in the south, and Djibouti at the extreme south-eastern tip *(see Map 1)*. The territory of the country comprises *circa* 125,000 square kilometres (Gebremedhin, 1996; FAO 1997; & Castellani, 2000).

Map 1: Eritrea, administrative regions, and case study area



Source: (LPMI-E, 2000)

The population of the country is estimated at four million, of which about 3.6 million are resident. The people are equally divided between Christians and Muslims (I-PRSP/GSE, 2004). Eritrea is home to nine ethnic groups: Afar, Bilen, Hedareb, Kunama, Nara, Saho, Rashida, Tigre, and Tigrigna, each with its unique cultural heritage and language (Castellani, 2000; & I-PRSP/GSE, 2004). The country furthermore is divided into six administrative *zobas* (regions): Ma'ekel, Debub, Anseba, Semenawi Keih Bahri, Gash Barka, and Debubawi Keih Bahri *(see Map1)* (I-PRSP/GSE, 2004).

Historical overview

Eritrea was continuously colonised by foreign powers for about five centuries and their intervention was overlapping (Gebremedhin, 1996:1). Turks sent their occupying forces in

1517 and secured their occupation of Massawa port and the Red Sea coast for 300 years. In 1823, Egyptians entered the western part of the country and later on, by 1872, displaced the Turks at Massawa port by establishing their presence along the Red Sea and extending their occupation to the Highlands (Sherman, 1980, as cited in Gebremedhin, 1996). Italian colonisation of Eritrea started in 1890 and ended in 1941 when British forces defeated Italy during World War II. Following this, Eritrea came under British protection as a protectorate, until 1952. In 1952, Eritrea was forcibly joined with Ethiopia through the then League of Nations-imposed federal system of Government. In 1962, Ethiopia unilaterally abrogated the Federal Act and annexed Eritrea as its province. The Eritrean people opposing the unjust federal arrangement, which was followed by annexation of the country, started the armed struggle for freedom in 1961. After a protracted 30-year war against Ethiopian rule, Eritrea won its de facto independence in 1991, and became formally independent in 1993 (I-PRSP/GSE, 2004:4).

6.3.Natural resources base, land use and agro-ecological zones

Natural resources base and land use

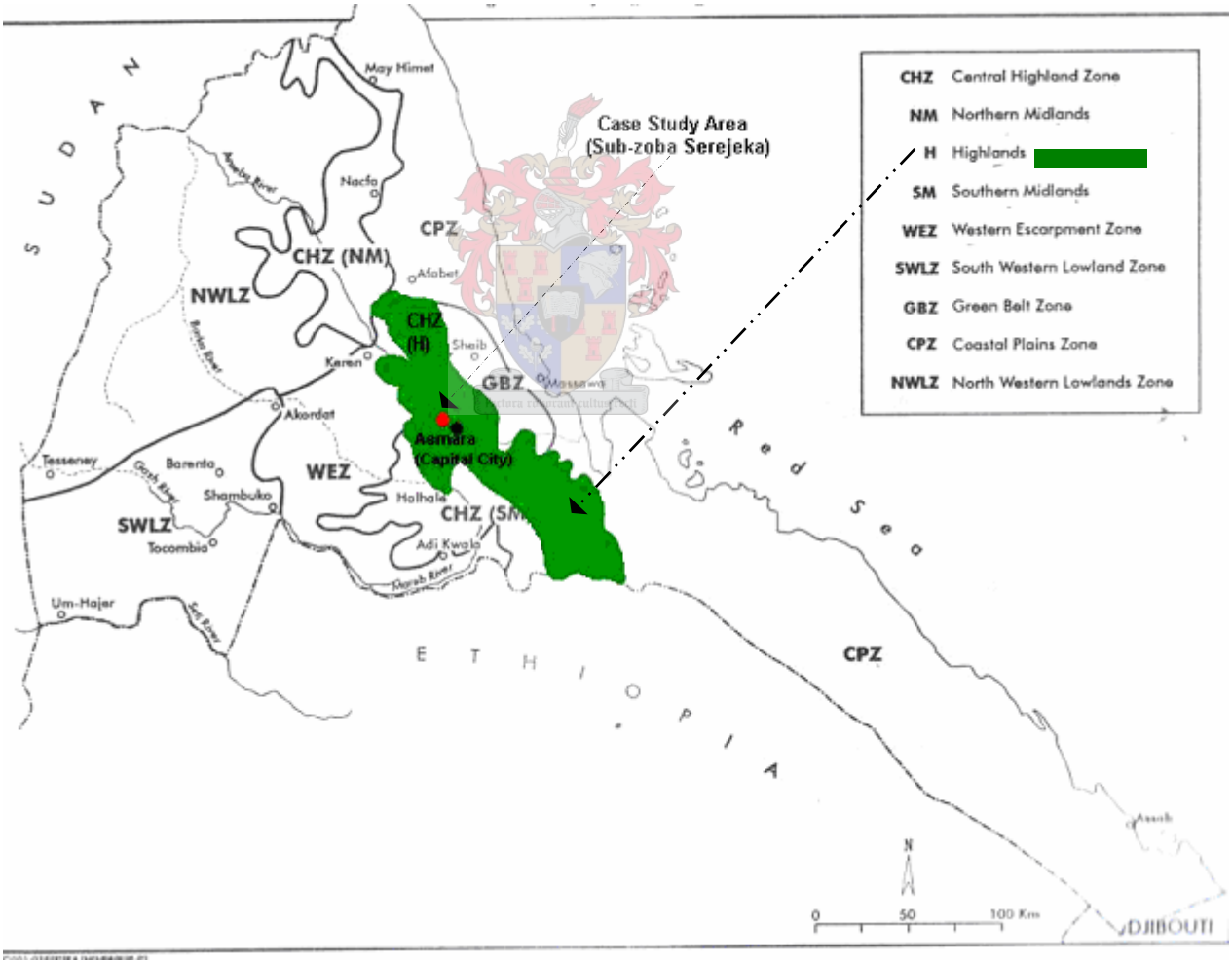
Eritrea is situated within the Sahelian rainfall belt of Sub-Saharan Africa and the rainfall it receives ranges from 700mm in the Southern Midlands to 200mm along the Red Sea Coast. The country is characterised by a varied topography with altitude ranging from 60 meters below sea level to over 3,000 meters above sea level. The Highlands have generally cool temperatures, while most of the western lowlands and coastal plains are mainly hot and dry.

The dominant land use in the country is as browsing and grazing land, which constitutes about 60 percent of the total land area, while another 33 percent is barren land. Less than seven percent of the land area is cultivated and rain-fed, while irrigated cropland accounts for 0.2 percent. Forested areas account for less than one percent of the area, and much of this has been highly disturbed (FAO, 1994; & LPMI-E, 2000). Land resources comprise about 3.7-4.5 ha per head of population (FAO, 1994), but with population pressure, especially in the Highlands where most agricultural production is concentrated, the average land holding per family is less than 1 ha (LPMI-E, 2000).

The agro-ecological zones

According to the Agricultural Sector Review (FAO 1994), Eritrea is divided into six major *agro-ecological zones* *(see Map 2)* on the basis of climate and soil parameters. These are the Central Highlands Zone (CHZ), Western Escarpment Zone (WEZ), North Western Lowland Zone (NWLZ), Southern Western Lowland Zone (SWLZ), Green Belt Zone (GBZ) and the Eastern Lowland Zone (ELZ). The CHZ is further divided into three sub zones namely the Highland or central plateau, Southern midland and northern midland (LPMI-E, 2000). A description of the salient features of the CHZ and its sub zones is given below. The case study area is located in the Highland/central plateau within the CHZ.

Map 2: Eritrea, agro-ecological zones and case study area



Source: (LPMI-E, 2000)

The Central Highland Zone (CHZ): The CHZ is over 1500m above sea level, with an annual rainfall that varies from less than 400 mm to more than 700 mm, and the climate, for the most part, is warm to cool semi-arid. It comprises three sub zones: i) *Highland (H):* over 2,000 m above sea level, 500-600 mm of rainfall, with very high population pressure; ii) *Southern Midland (SM):* situated 1,500-2000 m above sea level, less populated with a rainfall of more than 700mm; and iii) *Northern Midland (NM):* 1,500-2000 m above sea level, with an arid climate and annual rainfall of less than 400mm, and low population pressures (LPMI-E, 2000:7-8).

The CHZ is under the heaviest population pressure, with over 65% of the population living in this zone. This area has been settled the longest and rain-fed agriculture predominates. Intensive cultivation has been going on for centuries in many parts of this area and much of the natural vegetation has been cleared and replaced by open cropland or shrubs and other secondary vegetation. Its natural resources are highly depleted (World Bank, 1994; FAO, 1994; & Negassi et al., 2002). The people depend on crop production and raising of livestock for their livelihood. The dominant crops are wheat, barley, sorghum, maize, teff (*Eragrostis tef*), finger millet, horse beans and chickpeas. Cattle, sheep, goats, donkeys and poultry are the most common animal resources of the area (LPMI-E, 2000; & Negassi et al., 2002).

6.4.Significance and challenges of the agricultural sector

Eritrean society is predominantly agrarian, with over 70 percent of the total population depending on traditional farming, livestock production, and fishing for their livelihoods (World Bank, 1994; LPMI-E, 2000; NAP, 2002; & MOA, 2002). The contribution to GDP of the agricultural sector, including livestock and fisheries, is, however, very low relative to the size of the population engaged in the sector. According to the World Bank (1994, 1996), it accounts for only 26 percent (1992 figures) of GDP. Agricultural production is still at a very rudimentary level and agricultural technologies in use are very rude and inefficient (Gebremedhin, 1996). It is based predominately on rain-fed subsistence farming and pastoral livestock systems, relying primarily on family labour (World Bank, 1994; Gebremedhin, 1996; and NAP, 2002). In the most heavily populated parts of the Highlands, land holdings are as small as 0.5 ha. Farmers for the most part practise low input/low output agriculture

using rudimentary technologies. Fertilizer use is negligible and only a small area (around 22,000ha.) is irrigated (World Bank/ESP 1996: 3).

The country has suffered considerable environmental damage, in the form of land, water, and forestry resources degradation. The environmental degradation has severely impaired agricultural performance. Current per capita agricultural production is low, with the production level averaging less than one ton/ha for cereal being among the lowest in Africa (World Bank, 1994). Owing to the extremely low agricultural productivity and poverty, Eritrea is a food-insecure country. According to the FAO, the country produces only about half of its food needs in a year of 'adequate' rainfall (World Bank/ESP, 1996:7) and about 25 percent in poor years (FSS/GSE, 2004:2). There consequently is heavy dependency on food assistance (World Bank/ESP, 1996:7). It is a poor country with an estimated annual GDP of about US$ 180 per capita in 2002 (I-PRSP/GSE, 2004:5).

Livestock forms an important component in the agricultural production system in the country. Crop production and the livestock sector are closely interlinked. Access to draught animal power is a key constraint to increased production, but this, in turn, is dependent on access to adequate grazing areas. As crop cultivation has extended throughout the Highlands, woodlands for browsing and pasturage have declined, limiting herd sizes, and reducing productivity in agriculture (World Bank/ESP, 1996:11).

Decades of war have resulted in a weakened economy, damaged and dilapidated infrastructure, and deterioration of the human resource base. Agriculture, likewise, has been seriously affected (World Bank, 1994). Moreover, because of the dependency of the majority of the population on the agriculture sector, natural resources and environmental management problems assume great importance (World Bank/ESP, 1996). Owing to this reality, the Government of Eritrea, *inter alia*, has adopted strategies for environmental recovery, and for conservation to rehabilitate agriculture. Extensive soil and water conservation activities have been carried out in the *Central Highlands Zone* as part of this national scheme. These conservation activities include check-dam construction; catchment treatment through terracing and planting; and establishment of natural regeneration enclosure areas (Tikabo, 2003).

Agricultural sector policy of the country is generally based on three guiding principles: food security; environmental protection; and economic development of the sector (FAO, 1997:20).

6.5.Forests, woodlands and pasturage status

Natural forests and woodlands

It is reported that Eritrea was endowed with considerably more abundant and diversified flora and fauna a century ago. Due to unsustainable use and recurrent droughts, however, these natural resources have been severely degraded or decimated. The natural, woody vegetation, which, a century ago, was said to have covered some 30 percent of the total land area of the country, has been drastically reduced or destroyed. Currently the forest cover is less than one percent (World Bank, 1994; & NEMP-E, 1996).

Apart from the historical account of resource degradation, it is reported that degradation of CPRs in the country has continued unabated. The FAO (1997) and Naigzy (2002) observe that deforestation is still taking place, resulting in the degradation of the terrestrial environment, reducing plant cover of the natural ecosystem, and exposing the soil to erosion. In addition to these environmental disturbances, wood fuels have become difficult to obtain and animal dung is frequently burned for domestic energy rather than returned to the fields as fertilizers (Catterson, 1995:3).

Pasturage and browsing resources

The dominant land use in Eritrea is for browsing and grazing, with browsing and grazing land being said to constitute about 60 percent of the total land (FAO, 1994; & LPMI-E, 2000). The Highlands, however, share a smaller percentage of this land use. Woodlands for browsing and pasturage constitute a vital source of dry season feed. As crop cultivation has extended throughout the Highlands, however, these resources have declined, limiting herd sizes and reducing productivity in agriculture (World Bank/ESP, 1996:11). Moreover, overgrazing or over browsing is very widespread, especially in the Highland parts of the country where grazing land is limited, and has caused grave soil erosion (Bojo, 1996).

Access to draught animal power is a key constraint to increased production (World Bank/ESP, 1996:11) but this, in turn, according to this source, is dependent on access to

adequate grazing areas (World Bank/ESP, 1996:11). Scarcity of animal feed is, however, one of the major causes of generally low livestock production/productivity, especially in the Highlands, where limitation of grazing areas is severe (FAO, 1997: Annex 7:4).

Local people vs. Government authorities

A disparity of interests exists between the local communities and the Government concerning objectives regarding natural resources management. As suggested by FAO (1997: Annex: 1: 27), the major concerns of the local communities are the shortages of feed resources and firewood, while Government's objective encompasses environmental issues. If woodlands are to be developed and managed sustainably, however, both the communities' and Government's concerns have to be addressed appropriately. The management principles should therefore try to meet both conservation and production objectives. The environmental protection component will serve the purpose of conserving soil/protecting watersheds, sheltering fauna, conserving and enhancing biodiversity. These environmental values will in turn cater for needs of the local people in the form of grazing, fodder, poles, fuel wood, etc.

6.6. Forestry and wildlife policy

The Ministry of Agriculture, in addition to its proactive involvement in the biophysical measures towards tackling the alarming environmental degradation in the country, has also been involved in formulating policies on protection and sustainable use of natural resources.

The pre-existing policy—*Forest and Wildlife Conservation and Development No. 192/1980*—was inherited from the Ethiopian rule. Based on the Macro Policy of the State of Eritrea of 1994, the Government plans to issue new forestry and wildlife proclamation (LPMI, 2000). In line with this intention, the Government had drafted a proclamation regarding this issue in 1996 (FAO, 1997) and in 2005 it has redrafted this proclamation (GOE, 2005) and presented it for review by organizing a workshop where various stakeholders participated and discussed. This draft proclamation, however, is hitherto not ratified and proclaimed. As it stands now this draft policy aims at the conservation and protection of the environment and natural resources and establishing systems for their sustainable use. Moreover, the specific objectives of this draft proclamation are:

a) The conservation of threatened endangered species;

b) The conservation of indigenous species;

c) The establishment of protected areas;

d) The promotion of people's awareness and participation in the conservation and sustainable management of forests and wildlife.

In the meantime, Proclamation No. 192, 1980 of the Ethiopian rule remains operational with some modifications. Some of the main provisions of this Proclamation are outlined below (LPMI, 2000:107).

- areas of land, with or without woodland, can be declared closed for environmental purposes by the Government;
- no live tree can be cut without a license from the Government, unless that tree was planted by the person wanting to cut it, on his own land;
- no wild animal can be taken alive or killed, for any reason, unless with exceptional permission from the Government.

In view of the hiatus in connection with the development of a new and comprehensive policy for the forestry and wildlife sector, the Ministry of Agriculture has recently (2004) issued an Interim Forestry and Wildlife Resources Regulation (IFWRR) that will serve as a policy guideline/directive until the policy draft is finalised and proclaimed. The policy implications of this interim regulation that are pertinent to forests and pasturage resources are discussed and evaluated in *Sect. 6.9.*

6.7.Customary laws and natural resources management

The Eritrean customary laws—*Heggi Endaba (the laws of the fathers*)—were established some three centuries ago, around 1600 AD. They comprise indigenous legal and judicial systems produced and administered by rural communities themselves. These laws are characterised by the principles of consensus and mediation and are oriented towards addressing all aspects of rural community life (Naigzy, 2002:20).

The set of rules of the customary laws, *inter alia*, are concerned with natural resources management. Some examples of these rules, which are still in use by local communities in rural villages of Eritrea, include (DE/MOLWE, 1999; Naigzy, 2002; & CARP-E, 2000):

- Common pastures are closed for several months with the intention of creating reserves of forage for the dry seasons;
- Common grass pastures regulations should not be transgressed. Owners of animals have to wait until the time when restrictions are lifted; violators are punishable under the laws;
- Distribution of communal land is governed by regular rotation based on fairness;
- Construction of a house should be strictly within the areas allocated by the elders (three persons) selected to carry out such tasks. No construction is allowed on valuable cropland, pasturage, or forest land;
- Appropriation rules of trees/wood, firewood or dry wood for various purposes, including construction of houses;
- Guards for farmland and grassland (responsibility, trespassing animals);
- Common pool resources within the village territory exclusively for the inhabitants; no unauthorised access and withdrawal for outsiders;

In line with the broader social and economic changes, new state policies and rules of administration have been introduced continually in the rural communities' way of life. As suggested by CARP-E (2000:14), however, "It appears quite clear that the traditional legal culture still is a deeply rooted and a very living element in the local communities, preserving the unique feature grafted to it by an immemorial old tradition that has remained vital even after a century of foreign domination". The Eritrean government has also expressed the idea that customary laws could possibly contain elements of local governance and a basis for drafting new laws (CARP-E, 2000:27). Likewise, DE/MOLWE (1999:20) suggests that the fact that Eritrean customary laws reflect the cultural heritage and custom of the local resource users means that they can be essential assets in preparing policies and legislation related to natural/environmental management.

6.8. Local common pool resources management regimes

In this section, types of property rights for the management of local CPRs in the rural Highland Eritrea will be classified and discussed. The categorisation of the property rights is based on the position of the stakeholders in terms of quantity of operational rights and/or collective choice level rights that they possess in using and/or managing the resources *(see Sect. 3.5)* and *(Sect. 3.6.1*).

6.8.1. Common property rights management regime

In the highlands of Eritrea, the local communities manage their woodlands and grazing lands by setting up a temporary 'enclosure'/'closure'.[11]. This type of common pool resources management system is a traditional practice developed by the local people themselves, and as suggested by FAO (1997: Annex: 1: 27), the system is "probably as old as firewood and pasturage resources shortage were felt by the rural communities". It was applied for maintaining the production capacity of the resource system through exercising rules that govern the rational utilisation and protection techniques (FAO, 1997: Annex: 1: 13).

There are two modalities within the traditional temporary enclosure system of CPRs management, namely *hiza'eti be'eray*[12] *and hiza'eti gereb adi*[13]. In both of these indigenous common pool resources management regimes, the bundles of rights exercised by the local communities include operational (access and withdrawal) and collective choice rights (management and exclusion, but not the right of alienation). Accordingly, the resource users under these management systems may be classified as *Proprietors* and the regime as *pure common property rights*. In regard to monitoring of the grazing land or woodland enclosures, the local communities are responsible and it is effected either through a rotational guarding scheme in which it is mandatory for each household to take part, or by hiring permanent

[11] The term forest (or woodland, or grazing land) 'enclosure' or sometimes 'closure' is used to denote an area that has been put under full or partial protection by restricting human and livestock access for limited, and sometimes extended, periods in order to allow natural regeneration of grasses or woody vegetation depending on the duration of the closure. It is also applied to protect an area of high ecological/biodiversity value in the form of permanent enclosures (World Bank/ESP, 1996; FAO, 1997).

[12] *Hiza'eti be'eray* literally means grazing enclosure for oxen.
[13] *Hiza'eti gereb-adi* means village woodland enclosure.

guards whose salaries are paid collectively. A brief description of the two types of traditional enclosures follows.

Hiza'eti be'eray

This type of traditional practice of managing local common pool resources by means of setting up a seasonal enclosure is the most widespread in the highlands part of the country. It is a practice of excluding livestock and human access from a designated area for three to six months annually to allow natural regeneration of grasses to reserve grazing for the dry season.

Hiza'eti gereb-adi

In some parts of the highlands, communities practice a rotational woodland enclosure system. The main purpose of these enclosures is to give adequate time to some parts of their lands to have their woody vegetation sufficiently regenerated and developed for their future fuel wood needs and as a source of raw material for agricultural tools. In these types of enclosures, the proscription is mainly on cutting live woody vegetation. More often than not, woodland enclosures are open all year round, but only cattle (like oxen and cows), being considered less destructive, are permitted to enter.

6.8.2. State-based property rights management regime

Within this property rights regime, there are three modalities, which include: Hillside afforestation enclosures, temporary enclosures, and permanent enclosures. The former one involves heavy human intervention, while the latter two types are achieved through natural regeneration.

Hillside afforestation enclosures

Since independence in 1991, the Government of Eritrea has been vigorously engaged in a large-scale afforestation of degraded catchments in the highlands of the country. This is aimed at controlling soil erosion and ensuring environmental development and protection (World Bank/ESP, 1996& LPMI-E, 2000). In line with this effort, food-for-work and later Cash-for-Work have been widely used to finance terracing, primarily, while pit digging and tree planting on the hillsides for afforestation have frequently been carried out with the

annual free labour contribution of high school students under summer campaigns (FAO, 1997:Annex 5:1).

As noted by Negassi *et al.* (2002:34), afforestation schemes are primarily implemented on catchments that are severely degraded, with very little or no natural vegetation left. Such areas may not regenerate quickly if left to nature. Moreover, in situations where it is essential to obtain a good vegetation cover quickly, e.g. in dam catchment areas, hillside afforestation becomes a required strategy. The afforestation activity, however, needs to be augmented by putting the afforested site under closure. The primary objective of hillside afforestation schemes is soil and water conservation or environmental protection, while the secondary objectives include production of removable biomass such as poles, fuel wood, and fodder (FAO, 1997; & Negassi *et al*., 2002).

The principal tree species used in catchment plantations have been Eucalyptus species, although other species, such as *Acacias, Dodonea angustifolia, Grevillea robusta, Olea europea var. Africana, Azadhiracta indica,* and *Boswellia papyrifera*, latterly have been introduced increasingly (FAO, 1997; & FAO, 1998). The total plantation, according to the FAO of 1997 survey, is estimated at 14, 741 ha in 131 plantation sites (FAO, 1997: Annex 5:4).

The question who owns the afforested catchment has, thus far, no simple answer. The afforestation schemes were largely implemented without or, with severely deficient contractual agreements between the Government (MOA) and local communities that barely specify the authority, rights and responsibilities of each stakeholder. In the pre-existing land tenure systems (FAO, 1997) and the new land law as well (LPMI-E, 2000), the right of use and management of communal grazing lands, hillside areas and woodlands falls within the jurisdiction of the local communities.[14] When, however, the MOA asks the local community for a certain degraded watershed area for the purpose of government-initiated and funded afforestation schemes, the community cedes those areas to the Ministry of Agriculture for an undefined period (FAO, 1997: Annex 5:11). This ceding of land results in the loss of

[14] Nevertheless, according to the new land law, village rights over these resources are subject to government review or intervention if the need arises.

ownership rights, at least temporarily. As a result, it is more appropriate that these resources be classified as being under state or state-based property rights control. According to FAO (1997), local communities in state-based afforested sites are entitled with access and withdrawal rights only. These include the right to cut and carry grasses and collect deadwood. Communities are hardly involved in the management of the local CPRs. In view of this characterisation, the local communities are *authorised users*.

The FAO (1997) assessed the afforestation programme as partially successful and the reasons for this less desirable performance are attributed to technical (poor soils, inadequate rainfall for the species selected, defective seedlings) and institutional failures (poor start, inadequate follow-up maintenance, deficient monitoring and enforcement, and lack of rules for distributing benefits among users). Consequently, FAO (1997) suggested, "…the afforestation program for soil and water conservation needs major review, as past activities have not met all the fundamental objectives".

Government has occasionally handed over certain afforested sites, particularly in the *Zoba* Ma'ekel since 1995, to communities to be managed collectively. Now, according to the Interim Forestry and Wildlife Regulation issued by the MOA in 2004, it seems that the government is intending to proceed with this process on a large scale. This recent regulation aims not only at giving back the afforested catchments to communities but also at allocating the plantation site to individual families. This policy of handing over of common pool resources to communities and particularly the plan to parcel out afforested catchments and allocate land to individual families is evaluated in *Sect. 6.9*.

Natural regeneration enclosures

State-based forest and woodland enclosure management systems are akin to the traditional community-based enclosures practiced in the highlands of the country. As suggested by the FAO (1997: 8), Government policy related to the former seems to be inspired by the latter common pool resource management systems. This policy is widely promoted and implemented throughout the country under government initiatives nowadays.

Natural regeneration enclosures in forests and woodlands are viewed as an alternative to hillside afforestation schemes and are significantly more cost-effective than the latter systems (Catterson, 1995:25). The World Bank/ESP (1996:21) has pointed out that, due to the low and uncertain rainfall in many parts of the highlands, afforestation strategies are expensive and risky. Apart from the issue of cost, however, these types of resource management are also implemented for protection purposes in areas with high biodiversity value. These natural regeneration forest and woodland enclosures are now widely implemented by the government throughout the country. They are classified as state-managed/controlled enclosures and are of two forms : *temporary and permanent.* They are discussed below.

Temporary enclosure

Areas denominated as 'temporary enclosures' are those degraded communal lands where government has entered into an agreement with the local village councils that human and livestock access will be restricted for a specified time, usually for periods of four to seven years, whereupon full responsibility for management of the enclosures returns to the communities (Catterson, 1995; & FAO, 1997).

The objective of these types of enclosures is twofold: protection/conservation and production. The principal aim of these resource management systems from the Government viewpoint is conservation of the common pool resource system and environmental protection through the creation of a favourable arrangement via natural regeneration, whilst providing grasses, fuel wood, and other forest products for the local communities (Catterson, 1995; & FAO, 1997). From the local people's point of view, the priority seems to be the other way round. Their main concern is production of pasture resources and firewood and they hardly pay attention to other objectives like protection of endangered species, soil and water conservation, biological diversity, etc. These divergent objectives sometimes are a source of friction between government authorities and local resource user communities (FAO, 1997: Annex: 1:20-21; Annex: 1: 27).

According to the FAO survey of 1997, the total temporary woodland closure area in the country is estimated at 14, 500 ha, of which about 60% and 39% are located in Gash-Barka and Maekel regions respectively (FAO, 1997: Annex 1: 20 & Annex 1: Appendix 12:2).

Similar to hillside afforestation, the ownership of these enclosures falls within the jurisdiction of the state, at least until they are given back to the local people. The local communities' rights of usage related to these closures include access and withdrawal (grass collection through cut-and-carry, collection of deadwood and selective live tree cutting/thinning under close supervision of MOA personnel); the resource users may be classified as *authorised users*. Government-hired guards look after the enclosures.

When the state-based property rights management of CPRs is transferred to the local community, the rights regime automatically transforms into community-based property rights. Following this transfer, the recipient community will have to manage the handed over CPRs in accordance with the agreed upon arrangements between the resource user community and the MOA, and in conformity with other institutional MOA arrangements (policies, regulations, directives, etc.). Nevertheless, as indicated by the FAO (1997: Annex: 1: 20), the contracts that have been in use thus far are seriously deficient. They do not specify the objectives and the duration of the closures, the modalities of their management, the form and extent of their utilisation at the end of the protection period and the responsibility for the follow-up of the closure, including the salaries of guards.

Permanent enclosures

These are other variants of common pool resources management in the country that refer to those areas that have been put under closure for unlimited periods and are purely under state ownership. Human and animal access is restricted. Live tree cutting and new cultivation are proscribed, although pre-existing rights to cultivate are often respected. According to FAO (1997), the primary objective of these closures is the conservation of biological diversity including the maintenance of wildlife habitat. Key examples of these types of resource management include areas in the Semenawi Bahri and Bizen forest closures, which are important wildlife habitats**.** Government forest guards protect permanent forest closures and the role of local people living within and outside these closures in the management of these enclosures is very limited (FAO, 1997).

6.9. Recent policy changes in forest management

6.9.1. Introduction

As discussed in *Sect. 6.6*, the Forestry and Wildlife draft policy development has been stalled. Due to this, the Ministry of Agriculture has recently (2004) issued Interim Forestry and Wildlife Resources Regulations, which are said to be a revised version of the regulations that were in use previously. The revised regulations are meant to serve as policy guidelines/directives until the policy draft is finalised and proclaimed. The main tenets of the interim regulations that are pertinent to Forests and Pasturages are presented in the *Annex*. The central decrees of these regulations are two-fold:

1) The decision by the government to transfer state-based property rights over hillside afforestation and temporary natural regeneration enclosures to community-based or common property rights, and
2) eventual parcelling of handed-over hillside afforestation among individual families.

Thus, the transformation of property rights that stem from these regulations are: firstly, devolution of state-based CPR property rights management regimes into community-based property rights and, subsequently, the possibility of privatisation of these newly communalised CPRs.

It is also essential to note that the Government, since 1995, has occasionally handed over state-based hillside afforested sites to communities, particularly in *Zoba*-Maekel, as indicated in *Sect. 6.8.2*. At present, however, it seems that the Government is determined to go ahead with this process on a large scale and in a formal manner, as demonstrated by the issuing of the special Regulations which are the concern of this section.

In the following section, the interim regulations will be assessed using the theoretical framework discussed in Chapters 2, 3, and 4. The regulations are unlikely to ensure sustainable management of handed over CPRs, as will be evident from the ensuing discussion.

This section examines the implications of the property rights transfers from state-based to either common property or private ownership pursuant to the new interim regulations for the management of forests and pasturage in the country. The appropriateness of the new regulations is questioned on theoretical and experiential grounds. It is argued that merely relinquishing state control and transferring property rights to either community or private individuals does not guarantee sustainable management of CPRs.

As indicated, pursuant to the interim regulations for Forestry and Wildlife Resources, the government will relinquish its ownership of both the hillside afforestation enclosures and temporary natural regeneration enclosures. Two options of property rights regimes are envisaged to take over the existing state-based CPR regime. The implicit assumptions upon which the interim regulations seem to be based are outlined below and the criticism of these assumptions and their implications are discussed thereafter.

1) The first alternative posits that efficient management of local CPRs (forests and pasturage) can be ensured if communities are entrusted with the responsibility of managing their local CPRs, meaning that the depletion of forests may be brought to a halt if local communities are made responsible for managing their local CPRs, and
2) The second option postulates that local CPRs (forest and pasturage) would be better managed if they were privatised, suggesting that private proprietorship leads to efficient resource utilisation and conservation.

These assumptions are challenged and their implication for the sustainable management of local CPRs is examined by presenting theoretical and experiential evidence. In other words, the appropriateness of the new regulations for ensuring sustainable natural resources utilisation and conservation is questioned. The theoretical framework discussed in Chapters 2, 3, and 4 is used in this discourse.

6.9.2. Transfer of state-based to community-based property rights

Hardin's 'tragedy of the commons' model posits the prediction that resource users are unable to cooperate in order to achieve collective interest. Nevertheless, in contrast to this

pessimistic view, an optimistic outlook on the ability of local resource users to manage local CPRs sustainably is espoused by authors such as Ostrom (1992). In her influential book, "Governing the commons", of 1992, Ostrom argued theoretically and empirically that local resource users can be more effective resource managers because they have more detailed site-specific knowledge as well as social sanctioning mechanisms than formal external enforcement. However, this author has also noted that several conditions, which she termed *'design principles',* must be fulfilled for the emergence and survival of robust common-property institutions.

Whilst subscribing to the idea that local people can be efficient resource managers of their local CPRs, several authors (Runge, 1985; Baland & Platteau, 1996; & Feeny *et al.,* 1990) have suggested that contemporary contextual changes in which rural communities operate tend to make village level resource regulations unrealistic or at least more difficult than before. An alternative way of expressing this suggestion is to say that the contextual changes are making difficult the maintenance and/or development of design principles that are essential conditions for the emergence or existence of durable common property rights. The contextual changes that are eroding the traditional institutions (weakening design principles) and making community level resource management increasingly less efficient include: modern pressures such as state intervention, increasing market orientation/opportunities, commercialisation, technological change, human migration and population pressures.

According to Baland and Platteau (1996), for instance, market integration affects collective actions negatively, resulting in a lower probability of cooperative solutions and thereby increasingly loosening individual ties with indigenous institutional arrangements. Likewise, state intervention in the management of village level natural resources has made customary rights highly insecure, thereby destroying informal co-operation mechanisms.

With regard to the state's administrative intervention, Wade (cited in Baland & Platteau, 1996) suggests that expansion of state into rural areas may undermine old systems of authority without permitting or establishing new ones, resulting in a hiatus of confidence. In this line of argument, Bakema (cited in Kiflemariam, 2001:6) also suggests that "…the superimposition of official modern laws on existing traditional local laws has created

confusion among rural population[s] and the erosion of the traditional management systems. The state has been too weak to adequately enforce its own legislation and yet customary law no longer protects the rural population. The breakdown of traditional norms and values has not been replaced by clear-cut government laws, and even less with efficient government control and fair sanctions."

Taking the Eritrean case specifically, it is suggested that the local institutions that propped up common property rights are increasingly facing the risk of weakening. According to CARP (2000), they are under the threat of modernisation and globalisation as in the rest of the world. In the view of Kiflemariam (2001:6), however, they have already been undermined. The general picture is, thus, as suggested by Bromley and Cernea (1989) and Ogolla and Mugabe (1996), the contemporary contextual changes that are taking place in the developing world, in many instances, can cause common property rights to degenerate into open access-like regimes that reflect Hardin's tragedy more closely.

The decline of local institutional arrangements due to the various factors discussed earlier therefore implies that policy initiatives aimed at sustainable resource utilisation, by granting local communities the mandate to take full responsibility for governing their local CPRs, must perforce revitalise and strengthen the local institutions that propped up the common property rights regimes. In light of this argument, effectiveness of transferring property rights from state-based to community-based property rights regimes for the management of CPRs depends on the existence of effective local institutions able to carry out such duties. Unfortunately, the existing capacity of the local institutions in the Highlands of Eritrea seems to be inadequate. The FAO (1997: Annex 10:4) for instance notes that, "Where enclosures were handed over to the villagers, the results so far are not encouraging", hinting at institutional failure. World Bank/ESP (1996:46-47) also suggests that the capacity of the local communities needs to be strengthened if they are to become involved in environmental protection. In view of these local institutional situations in the country and the global contextual changes, the implementation of the new regulation will only lead to a less promising management of the local CPRs. As Baland and Platteau (1996) put it,

> Local user communities must be given a fair chance to participate in the management of their natural resources. Yet, they ought not to be idealized, as they tend to be nowadays in certain circles, journals, and conferences: Just think of the present-day fad of many scientists and activists for community woodlot programs conceived as the magic key to rehabilitate and conserve forests. Unfortunately, there is presently no conclusive evidence that user communities can be 'the solution' to problems of resource depletion and ecological destruction.

6.9.3. Privatisation of state-based property rights

Privatisation of common pool resources is another commonly suggested solution to counter the failure of state-based or common property right regimes. The premise upon which this policy is based is that privatisation gives rise to proper incentive structures for economic efficiency through establishing mutually exclusive rights for the exclusive use of the resource in question among members of the society. In addition to ensuring economic efficiency, it is also suggested that privatisation promotes sustainable utilisation of resources i.e., private owners refrain from destructive use and take more responsible long-term care of the resource bases.

Despite the well-established merits of privatisation in promoting efficient allocation of resources, however, instituting such property rights as a solution for the commons dilemma is refuted. Privatisation is appropriately fit for strictly private goods, where the cost of exclusion or packaging is relatively low, and one person's consumption is subtractive from what is available to another. In this kind of scenario, the market is expected to efficiently capture the costs and benefits concomitant with the production, consumption, or transactions of those kinds of resources. The problem with privatisation arises with the decision to try to employ this type of property rights as a management regime for CPRs. These types of goods are characterised by low exclusivity (sharing this attribute with public goods) and high rivalry in consumption (sharing this attribute with private goods) *(Sect. 2.2.4.)*. These attributes do not enable the market to capture the full value of those types of goods, thereby creating perverse incentives for private owners—market failure.

Thus, while it is strongly believed that privatisation can usually promote efficient resource allocation in the case of strictly private goods, it fails to do so in the case of common pool

resources provision and appropriation. The underlying cause of market failure, in the case of CPRs, as suggested above, is linked to the externalities inherent in the use of common pool resources due to their physical attributes (jointness of consumption or supply, low exclusion, and indivisibility).

Forests (watersheds) are typical examples of common pool resources that are not fit for privatisation. Forest resource systems are characterised by rivalry in consumption (partial subtractability/disjointness), low exclusion, and indivisibility. Natural resource systems are fundamentally interactive; forests provide watershed control, and species are interdependent and may well be more productive in large units than in small ones. Moreover, uses in one zone of a given watershed immediately affect uses and productivity in another—if different persons own small adjacent patches of forest and pasture and make their decisions about resource use independently, they may well cause harm to each other and to other resource users located in the downstream areas—externalities. Thus, forests need to be managed in large units or as intact watersheds, particularly where they are being managed not only for products that can be removed but also for their environmental protection value. An institutional solution is a more viable option as opposed to market/privatisation arrangements in the case of CPRs such as watershed/forest systems.

Mckean (1996) has noted that many observers and policy makers have less faith in institutional solutions to the commons dilemma. Moreover, they consider such solutions as quaint and unworkable, and recommend privatisation. It is true that privatisation promotes economic efficiency as related to private goods but not for all types of goods. Hence, policy makers have to look into issues such as: What is the nature of the resource in question for privatisation? Is the resource divisible without disturbing its ecosystem? Does ecosystem boundary matter for that type of resource? Can potential non-authorised appropriators be excluded at a relatively low cost from benefiting from the resource?

The policy makers who push for “privatisation” seem to give no consideration to the nature of the resources involved. As Mckean (1996) suggests, these adherents of privatisation wrongly imagine that problematic “public goods” or “common pool goods” can be converted into non-problematic “private goods”, just by putting such goods under private property

rights regimes. However, one cannot force common pool goods or public goods into private goods by such moves. Mckean argues that the nature of the good is given by nature and what humans can manipulate are systems of rights. In addition, she points out that the identity of owning entities and change of property rights and change of hands of owners alone do not solve the commons dilemma. As Schlager and Ostrom (1992) argued, it is the congruence or 'good fit' between the nature of the resource and the property right in place that results in a desirable outcome for a given management regime. Failing to recognise both the nature of common pool resources and the property rights that go with these types of goods, policy makers recommend breaking up natural resource systems into environmentally inappropriate bits and pieces. This is a move of giving rights in the bits and pieces to individuals rather than maintaining resource systems as productive wholes and awarding rights to groups of individuals or stakeholders.

Forests serve a number of important societal functions that transcend individual concerns; their protection is best assured by the society as a whole. Forests provide goods, services, and amenities that are of a public nature and should not be left entirely in the hands of individuals whose principal goal is the maximisation of profits. For instance, the private user does not have a financial reason to protect forests for their roles in soil conservation, water catchment protection, climate amelioration, and preservation of biodiversity or aesthetic values. In Eritrea, the primary objective of natural resources conservation programmes is to ensure environmental services (e.g. protecting dams from sedimentation and damage to downstream irrigation structures; reduce floods and soil erosion on slopes and farming lands, increase groundwater) and environmental protection. The production of these services essentially requires intact resource systems (watersheds).

Based on the arguments presented on the implication of privatisation of CPRs and considering the environmental objectives of the country, it may assertively be suggested that the Government is overwriting the primary objectives it sets out for environmental protection when it allows privatisation of the local CPRs (forests) through decreeing the interim regulations. Further, it may also be suggested that this policy-change-induced resource

management regime (privatisation) will quite likely lead to suboptimal resource appropriation and provision.

Let us now look at some experiential examples of limitations of privatisation over common pool resources from both developing and developed countries. As an example of a developing country, Okowa-Bennun and Mwangi (1996: 185) say that, "There is little evidence in Kenya that privately owned forests have been managed with a long-term view." Privatisation in the Kenyan context, according to them, generally outweighs any merits it may have. They conclude that privatisation introduces a profit interest in the management and conservation of a resource, with public ramifications.

Likewise, Clawson (as cited in Okowa-Bennun and Mwangi, 1996:186) noted that, in the USA, the most serious problem for private forestry has been "…the lack of incentive on the part of the private forest owners to upgrade or maintain the quality of the external benefits their forests provide". According to Okowa-Bennun and Mwangi (1996) 38% of the unreserved forests in the USA are under some form of public ownership. In addition, reserved lands for national parks, fish and wildlife, defence and other uses contain extensive areas of forestlands. This extensive public ownership of forestland is reflected in the American society's concern over the consequences of private ownership of forests (Okowa-Bennun and Mwangi, 1996:186).

In view of the theoretical discourse presented, and considering the primary objectives of the natural resources management of the country, it may be argueed that the new interim regulation that decrees the privatisation of state-based CPRs will most likely lead to unsustainable resource management. Some may argue that, since the government possesses superior rights and retains the power to regulate the use of private holdings, the behaviour of private users can be controlled to follow sustainable resource utilisation and conservation. Nevertheless, such enforcement efforts will no doubt entail immense transaction costs that may outweigh the benefits of the privatisation itself. This is true, especially in the developing countries, including Eritrea, where transaction costs are extremely high, and informational asymmetry is severe.

Hence, it may be suggested that, despite its merits, privatisation of the state-based forests in Eritrea is a far from feasible alternative as a solution to the commons dilemma and is less likely to ensure ecological stewardship. Owing to these severe limitations, the new regulations are unlikely to be effective mechanisms for conserving and managing the country's forests and pasturage. In a worst scenario, these regulations may result in an accelerated rate of depletion of natural resources, through aggravating overexploitation and under-investment.

6.10. Summary and conclusion

In this chapter, the country's context was presented with the objective of providing an overview of the country in general and a broad background for the case study in particular. It was shown that Eritrean society is predominantly agrarian and that agricultural production is still at a very rudimentary level. More importantly, it was revealed that the country has suffered severe environmental damage, in terms of land, grazing land and forestry resources degradation. This environmental degradation has severely constrained the agricultural performance of the country. Current per capita agricultural production is very low, with the production level averaging less than 1 ton/ha for cereal, which is among the lowest in Africa.

The chapter, apart from a historical account, has also revealed that environmental deterioration has continued unabated, despite the large-scale physical and biological soil and water conservation efforts that are being carried out under government-initiated schemes. The major causes, which are proxy, for this undesirable outcome are said to be land clearing for agricultural land, cutting of trees for fuel wood and housing, and overgrazing or over browsing. But what is the underlying cause of this environmental problem? The hypothesis of the thesis, stemming from sound theoretical reasoning discussed in the preceding chapters two, three, and four, is that the observed overexploitation, degradation, or externalities in the Highlands of the country are the result of an institutional dilemma or failure. In order to understand whether these observed problems are in fact the result of ineffective institutional arrangements or institutional failure of the common property rights management of the local CPRs, a case study was carried in one village in the Highlands Zone, called Tsehaflam. The next chapter presents the empirical analysis and findings of the field study.

PART IV: THE CASE STUDY

7. Common pool resources management: the case of Tsehaflam

7.1.Introduction

As pointed out in the preceding chapter, the country has suffered considerable environmental damage, which extends to forest and grazing land commons. The Highlands ecological zone, which is the focus of the present study, is the worst affected in this regard. The objective of this research was to try to understand the underlying causes of the widespread deterioration of the commons (forest and grazing lands) found in this part of the country.

The hypothesis of the study, underpinned by the theoretical framework that was discussed, is that *the observed overexploitation, degradation, or externalities in the Highlands of the country are the result of an institutional dilemma or failure*. In order to understand whether these observed problems are in fact the result of ineffective institutional arrangements or institutional failure of the common property rights management of the local CPRs, a case study was carried out in the village of Tsehaflam in the Highlands Zone *(see Maps 1 & 2).* The purpose of this chapter is to present the empirical evidence gathered in this study.

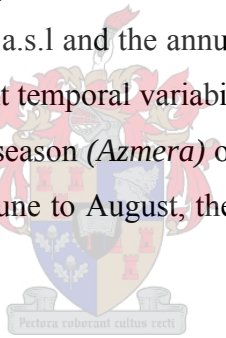
The rest of the chapter is organised as follows: subsection two presents the background of the case study village. Socio-cultural characteristics and the adminstrative setup are explored and the natural and agricultural resource base is examined. Further, the management modalities of local CPRs are outlined and land tenure systems in the country and the case study village are reviewed. Subsection three presents the main empirical findings of the case study analysis. The issues dealt with in this subsection are the physical and technical attributes of the local CPRs, institutional arrangements, and patterns of interaction. Furthermore, in this subsection, the existing common property rights regime is evaluated using Ostrom's *design principles* as a template against which the empirical data from the case study are compared.

7.2.Background study

7.2.1. Administrative and geographical location of Tsehaflam

The case study village, Tsehaflam, is situated within the Highlands ecological zone in *Zoba* Ma'ekel, *Sub-zoba* Serejeka, and is located 20 km north of Asmara along the main Asmara-Keren tarmac road. Administratively, Tsehaflam, together with one of the adjacent villages called Afdeyu, form a joint Area Administration (*Mimhidar kebabi*) *(see Sect.7.2.3).* The total population of Tsehaflam is about 1075, or 265 households, and their livelihood heavily depends on mixed crop-livestock subsistence farming, significantly supplemented with off-farm economic activities.

Tsehaflam's total land area is *circa* 562 hectares (DL/MOLWE, 2004) and the catchment of this village is part of or drains into Tokor, a tributary of the Anseba seasonal river. The topography of the area is undulating and the climate is temperate as it is in the Highlands. The elevation of the area is 2,250 m.a.s.l and the annual rainfall ranges from 400 to 600 mm (Negassi *et al.,* 2000) with significant temporal variability. The case study area has a bimodal rainfall pattern, with the short rainy season *(Azmera)* occurring during March to May and the main rainy season *(Kremti)* during June to August, the highest rainfall occurring in July and August.



7.2.2. The socio-economic characteristics of the village

The people of Tsehaflam, as it is in the Highlands of the country, live in a nucleated settlement. They are significantly engaged in a mixed crop-livestock, rain-fed subsistence agriculture with limited irrigated vegetable production activities. In addition, a large number of the villagers engage in off-farm activities to augment their livelihoods.

All interviewed farmers, as well as local administrators, indicated that agriculture is increasingly losing its role as a mainstay of the local economy. They pointed out that agriculture alone cannot support the local people nowadays. According to them there is a declining trend in local agricultural employment, and households, especially the younger generation, are increasingly shifting their time and labour allocation to off-farm activities. The reasons behinds this trend, according to these interviewees, include: decreasing land

holding size as the population increases; general declining returns from farming; and increased opportunities for different types of off-farm employment (masonry work, carpentry, petty trade, etc). Gaining an income from off-farm activities is said to be an essential survival strategy for most households. Those households (such as those of widowers, female-headed households, aged people, etc.) that cannot augment their livelihood by engaging in off-farm activities are largely dependent on food aid.

Owing to its location along the main road and its proximity to the capital city, Asmara, the village is well served with road transportation means. Several facilities are also found within the territory of the village and many others are located at the periphery of adjacent villages bordering on Tsehaflam village. All of these facilities are located not more than 1.5 km from one another. To mention some of the major facilities: the case study village has a tap water facility situated in the centre of the village and a hand pump located at the border of the adjoining village of Afdeyu. There is an elementary school in the village, which teaches up to 5th grade. The village is also connected to electric power. Moreover, there is a dam, which belongs to the case study village and a neighbouring village called Shimanugus La'elai.

Other higher-level educational facilities are located in the neighbouring villages and are attended by pupils from all the neighbouring villages, including Tsehaflam. These facilities include one junior school (6th-8th grades) in Afdeyu village and a secondary school located in Adikolom village. In addition to these, there is a health centre, which is situated at the border between Adikolom and La'elai shumanugus and is meant to serve the *sub-zoba* population. For marketing (buying and selling) of various goods and services, the case study village depends on local markets in Serejeka town and Asmara.

7.2.3. Village administration

The traditional administrative system

Historical accounts indicate that there has always more or less been intervention in the self-governance of the local communities by various external occupying forces in the country. Nevertheless, as it will be discussed later on, the autonomous self-governance of villages has

been significantly restrained through the intensification of interventions by recent governments during the last few decades.

In a discussion conducted with a group of village elders from Tsehaflam, the elders recalled that they used to administer themselves through their own customary laws with minimal state interventions some 30 to 40 years ago. This traditional administrative arrangement was called *Baito Adi* (village session). In the village session or *Baito Adi*, various issues related to natural resources management, social and economic affairs were debated in public under the principles of consensus and mediation. Moreover, the village sessions also used to deal with settling conflicts and restoring social peace, mainly through a procedure of conciliation.

Despite the democratic nature of the customary law, which was autonomously produced and administered by the local community, women were not entitled to participate in the *Baito* sessions and in the process of electing local officials.

During the Ethiopian Derg rule

When the Derg[15] came to power by overthrowing the Ethiopian Emperor in 1974, Eritrea, which then was under the rule of Ethiopia, was forced to adopt a new administrative setup in the rural areas (Kiflemariam, 2001). In line with this restructuring, as it was in many areas, the traditional administration system in Tsehaflam was abolished and replaced with a new socialist-oriented administration structure. The new system was laden with state politics and all social and economic matters, including land resource management decisions, were done through it. In sharp contrast to the traditional one, this administrative regime was a heavily top-down approach allowing little room for the local people's participation in the decision-making process. This move negatively affected the villagers' own traditional grassroots decision-making systems.

Administrative systems after independence

Immediately after independence

Following the independence of the country, the new Government of the State of Eritrea issued Proclamation no. 26/1992 aimed at establishing new regional administrations across

[15] Provisional Military Administrative Council (PMAC)

the country. In line with the provisions of the new Proclamation, local administration at area level was made up of three administrative pillars: a legislative *(Baito)*, an executive and a judiciary body.

The *Baito,* i.e. the legislative body, included all men and women residents of the Area/village over 18 years old. This law-making body followed a traditional practice that had been operating for centuries in the Highlands part of the country. In this *Baito* forum, various issues related to land distribution, management of local common pool resources; planning and implementing of various social and economic development activities were debated and resolved.

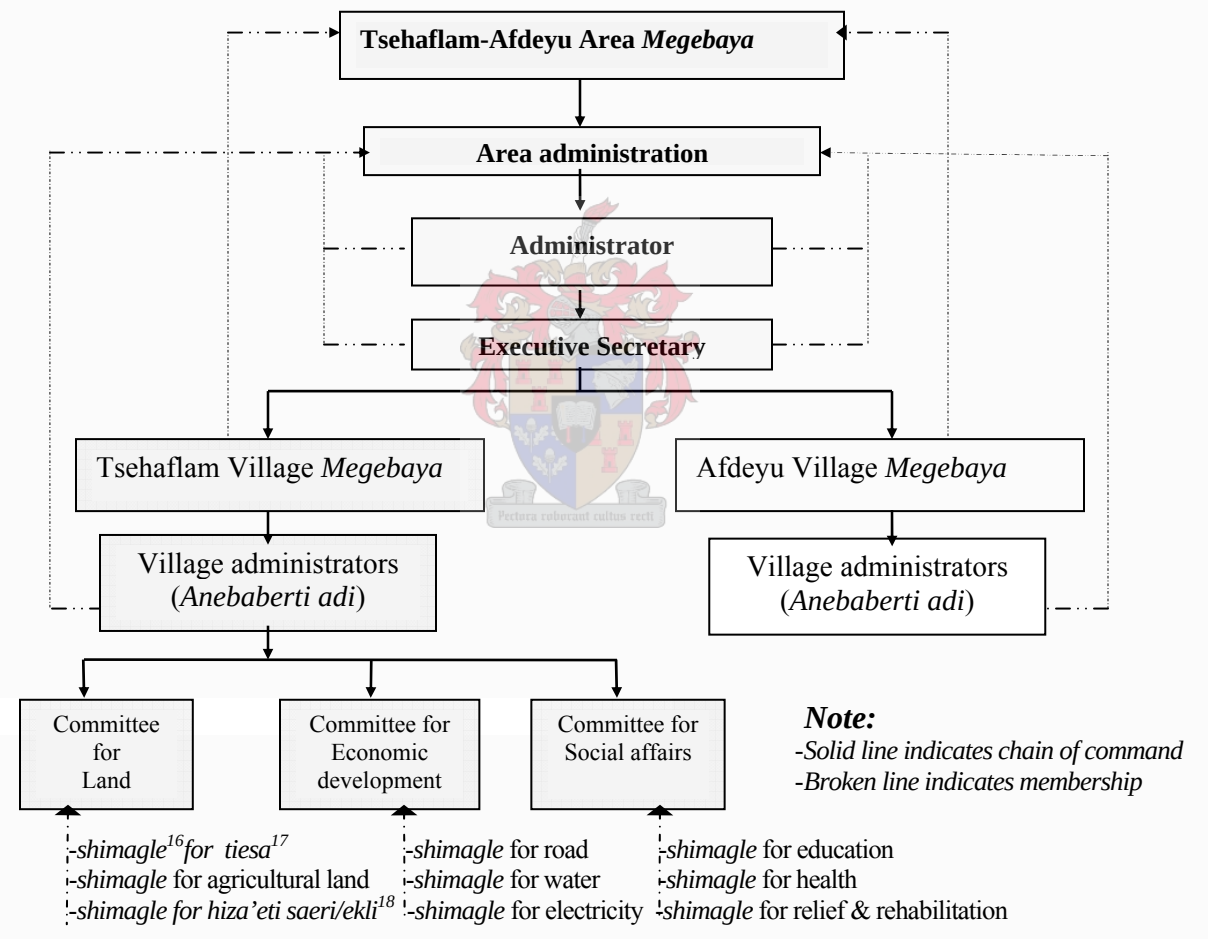
The office holders of the executive body of an Area, according to the Proclamation, used to come through two alternatives as the case may be: one option was appointment by a higher-level administrator and the second alternative was through election from among the concerned community by the local people. The choice was dependant on the discretion of higher-level administrators and the appointment option was exercised more often than not. Due to this direct appointment by higher officials, members of the executive body were seen more as government representatives and government policy implementers. They were also paid a government salary. The judiciary body was responsible for settling conflicts that might arise between individuals in the locality.

Current administration system

In 1996 a new restructuring of the administrative systems, replacing Proclamation no. 26/1992, was issued as "The Proclamation for the Establishment of Regional Administrations no 86/1996". In line with the provisions of this Proclamation, the country is divided into six administrative regions (*Zobas*). Each *Zoba* is divided into *Sub-zobas* (sub regions) and *Sub-zobas* are in turn divided into *Mimhidar Kebabis* or "Area"/Local Administration. A *Mimihidar Kebabi* is usually formed by two or more adjacent villages. For instance, Tsehaflam village–the case study area–together with one of the adjacent villages called Afdeyu, forms an Area/Local Administration.

The Area Administrative setup *(Mimihidar Kebabi)* consists of an administrator, an executive secretary, a three-person group of village administrators *(Anebaberti Adi)* from each village (see *Figure 7.1*), and a *Kebabi Megabaya* (local assembly). The Area (local) administrator and executive secretary are elected by *Kebabi Megabaya*, while *Anebaberti adi* (village administrators) are elected by their respective village assemblies (*Megabaya Adi)*. Area and village *Megabayas* comprise all (permanent) men and women area/village residents who are 18 years of age and above.

Figure 7:1: Area and village administration organization chart



[16] *Shimagle* signifies a committee mandated to perform specific jobs related to social, cultural, and economic activities of the village.
[17] *Tiesa* signifies a piece of land for housing
[18] Hiza'eti sa'eri/ekli means grass/crop enclosure

Pursuant to the Proclamation, the highest administrative authority rests with the Area/Local administrator who chairs all *Kebabi Megabaya* meetings. He/she is answerable to the *Sub-zoba* administrator concerning implementation of government policies and programme and is answerable to the local administration with regard to local issues. The administrator and the executive secretary, though elected by local *Megabaya*/people, are temporary salaried government employees who serve for two years.

According to the Proclamation (no. 86/96), the Area/local *Megabaya* is empowered "to discuss programs to be carried out in the area; to make comments and recommendations; and to approve programs requiring its participation". It "generally, hears, investigates and comments on performance reports presented by the administrator and passes on to the regional administration its objections and reservations thereon". It undertakes meetings every three months to listen to and discuss/debate reports from the administrator.

Village *Megabaya* as compared to Area *Megabaya* is limited to deal with its own village issues in compliance with the guidelines and policies of the Area Administration or Area *Megabaya* to which it belongs. The village *Megabaya* elects and forms at least three committees *(shimagles)*, which act as focal entities in the management/protection of various local natural (grazing lands and woodlands) and agricultural (farmlands) resources, and for planning and implementing other economic development activities. Members of these committees are elected by the village *Megabaya* and are obligated to serve for two years on a part-time basis, without any payment.

As can be realised from the Area/village administrative setup discussed above, the institutional arrangements governing the village also includes the institutions governing the local common pool resources. The institutional arrangements for the local common pool resources thus comprise a village-based organisation that regulates appropriation from and provision to these resources.

The objective of the new administrative setup, as suggested by the Proclamation (no. 86/96), is to introduce a new governance system by blending customary laws with that of the

governmental (modern) administration system, to enable every citizen in the country to participate in various political, social and economic decision-making processes of the nation.

7.2.4. Natural resources base and agricultural system in the village

Agricultural system

Tsehaflam village is characterised by a mixed crop-livestock subsistence farming system. The crops grown in the area are mainly cereals that rely on rain. The local farmers also practise irrigated vegetable production from dam water on a limited scale. In addition to these agriculture-based economic activities, significant numbers of villagers engage in off-farm activities to augment their livelihoods.

According to farmers in the area with whom group discussions were conducted, the current crop production levels, even in a good harvest year, are not sufficient to secure the livelihood of most families in the area. With regard to livestock enterprise, the discussants indicated that livestock are crucially important in the household farming system for different economic and social reasons: draught power (oxen), transportation (pack animals–donkeys), milk and milk products, meat, skins, as a source of cash income from sales of live animals, savings accounts, source of manure for fuel and fertilizer.

Livestock constitutes an integral part of the local farming system and so do grazing lands; the village is highly dependent on these resources for feed supply. However, the grazing areas of the case study village are severely eroded, indicating that the carrying capacity has been seriously undermined. In addition to grazing lands, other sources of livestock feed include grazing in the common fields (farming lands used for grazing after crop harvest) and straw. Feeding of animals is carried out through herding in grazing lands and common fields and by feeding with straw in the homestead. Straw is chiefly reserved for dry season feeding when grasses in the field become scarce.

Forests/woodlands and grazing land resources

The village of Tsehaflam is a typical example of the Highlands agro-ecological zone in terms of the severity of the degradation of its natural resources. Information obtained from direct

observation, discussions carried out with MOA field agents, local farmers and documented secondary sources revealed that soil erosion, soil nutrient depletion, moisture stress, deforestation and overgrazing are major environmental problems in the case study area.

Natural forest resources

Currently, there is virtually no real natural forest in the area; only a few remnants of the naturally grown indigenous tree species are left in a few pocket areas. According to the key elderly informants interviewed, the area used to be significantly covered with forest resources a century ago. These informants suggested that the main causes for the exhaustion of the natural forest cover of the area included cutting trees for construction of traditional houses *(Hidmo*),[19] which needed an excessive quantity of timber, fuel wood, and farm implements, and clearing of forests to extend agricultural land.

Owing to the degradation of the natural forests and woodlands, the local farmers are faced with a lack of forest products for various agricultural purposes and, more crucially, a severe shortage of fuel wood that has rendered the villagers increasingly dependent on animal dung for fuel, which otherwise would have been used for fertilizing the farmlands.

Watershed afforestation scheme

In an effort towards reversing the undesirable situation of natural resources degradation in the village, the government, in collaboration with the local administration, has been involved in rehabilitating and developing the forests of the area through implementing a watershed afforestation programme. As an outcome of this afforestation scheme, approximately 64 hectares of the upper catchment area of the village have been treated and planted with a variety of exotic and indigenous tree species. Out of the total number of trees grown in the afforested watershed (*circa* 127,700 trees) around 70% are eucalyptus trees and the remaining 30% comprises various tree species (such as *Acacia abyssinica*, *Acacia saligna, Olea africana, Schinus molle, and Acacia mollissima*) (Negassi et al., 2000:8-9). In addition

[19] According to NAP, 1995, conservative estimates indicate that about 100 trees are felled to construct one traditional *Hidmo* house. In addition, renovation is required now and then to replace the gradual damage to the support poles by insects (NAP, 1995:62).

to these wood resources, there is a good amount of naturally regenerated grasses in between the trees.

The watershed afforestation programme was government-initiated and financed and has been under its control. For the last few years, however, the government has allowed the local community to harvest matured eucalyptus trees and grasses from the watershed enclosure. This exercise is considered by the MOA as a partial handing over (or a step towards this) of the watershed to the local community. Based on the authorised right of use they have been granted, the local community are selling matured eucalyptus and grasses and have been utilising the cash from the sales to enhance their community fund towards various collective developmental activities.

Grazing resources

Livestock, and therefore grazing lands, are key resources in Tsehaflam. The grazing areas, however, are severely eroded, indicating that the current carrying capacity has been severely undermined. Despite the degraded state of the resource, however, the village is highly dependent on grazing land for the feed supply of its livestock in the face of limited feed alternatives.

A discussion with the *Shimagle meriet* (committee for land and pasturelands) and other community members confirmed that feed is a major livestock production problem in the area. The interviewees attributed this problem to the continuous shrinking of grazing land, which is increasingly converted into agricultural land to cope with the population increase. The *Sub-zoba* MOA branch office field agents for the area also gave their assessment, saying that the grazing land is heavily exploited, all grasses in the area are naturally grown grasses and no improved pastures have been introduced as yet.

In addition to the regular pasturelands, common fields (farmlands used for grazing after harvest) constitute another important source of feed for the local livestock. For this reason, common fields similar to the pasturelands are managed and used collectively by the community.

Finally, despite the severe degradation of the local CPRs (forests and grazing lands), the villagers do still rely significantly on common pool resources for various economic purposes. The economic contribution of the local resources are at two levels: firstly, the important role they play in supporting household livelihoods and, secondly, at community level in augmenting village development efforts. Households, for instance, appropriate local CPRs (pasturelands and common fields) to generate agricultural output (crops and livestock). Likewise, local community, being *'authorised users'* of the local afforested watershed enclosure, also benefit by selling matured trees and grasses, and use the cash for various village developmental activities.

7.2.5. A brief overview over local common pool resources management regimes

The management regimes of local common pool resources in Tsehaflam can be grouped into three categories: common property rights; state-based property rights and private property rights. They are discussed in turn below:

The common property rights regime *(Village commons)*

The customary system of common property rights in natural resources management have existed for a long time in the village. Within this property rights regime, three types of CPRs are discussed: communal grazing lands, common fields as grazing lands, and forest/woodlands and their respective descriptions follow:

Communal grazing land (Hiza'eti Sa'eri)

Communal grazing land constitutes an important source of livestock feed in the village. In terms of existing land use, they include the non-arable lands, including the hillsides and the seasonal wetlands.

As the name signifies, the communal grazing lands are collectively managed by the villagers under the common property right management system. It is exercised in the form of establishing temporary grazing enclosures (*Hisa'eti sa'eri*) with a set of rules for its implementation. Farmers indicated that the system is an old traditional practice that was developed for the purpose of wise utilisation of the grazing resources by regulating its use.

The grazing lands are seasonally closed and remain off limits to livestock and human access for two to five months annually, to allow for the natural regeneration of grasses, and is aimed at reserving grazing for the dry season. The *Shimagle hiza'eti* (committee for grazing land) is responsible for regulating and overseeing the operational rules for managing the grazing lands.

According to information received from the village elders and field guards (*Halewti meriet*), Tsehaflam has several small parcels of grazing land dispersed across the village area: *La'elai Addi* (*enda-abune-aregawi*), *Tokor tahitai* and *Sheka* (seasonal wetland). The village elders pointed out that these grazing lands are not sufficient to support their livestock. It is for this reason that common fields (crop residues after harvest) and fallow lands are used as grazing lands. In explaining the tradition of yearly enclosure of grazing land, the interviewees indicated that all livestock usually leave the village by the 3rd week of July and return towards the end of August. However, each household is permitted to keep a single donkey during this temporary leave, as donkeys are crucially important for the households in their day-to-day activities for transporting goods, including farmyard manure from the homesteads to the fields and for fetching water.

Grazing in enclosures is done on a rotational basis, i.e. a particular grazing land is made accessible to the livestock for grazing while other sites remain closed. All of the grazing sites are accessible for all types of livestock during the designated grazing period of the year, except the *Sheka* (the seasonal wetland grazing site), which is exclusively reserved for oxen. The farmers explained that, as oxen are the sole draught power for working the soil and an integral part of the crop enterprise in the area, special care was necessary to secure a better/adequate feed supply for them. The interviewee farmers also pointed out that no 'cut-and-carry' practice is allowed in any part of the village, whether in the regular grazing lands or the common fields.

A discussion with *Shimagle meriet* indicated that monitoring of all types of the local commons is done either through a rotational guarding scheme in which it is mandatory for each household to take part, or by hiring permanent guards from among the villagers whose remuneration is paid in the form of a specified amount of grain contributed by each

household. The contract runs for a year and the remuneration is paid following the harvest of the crops for the year. The preference of most of the villagers is to assign hired field guards as the mandatory rotational guarding entails a high opportunity cost for many of the households, especially for those who are involved in off-farm activities. During the field study, hired guards were on duty.

Common fields (as grazing lands)

Common fields are farming lands but they are also used as grazing lands after crops are removed from these fields or when they are left fallow. Common fields, in terms of their role as grazing lands, constitute one form of common property right resource management, and yet, when the individual cultivators' right to till their individual farm plots is considered, it represents a private usufruct right arrangement. Thus, this management of resource blends private and communal activities and results in a complex pattern of decision-making and interaction.

The oscillation from and to private usage rights to till the land, to communal rights to graze after harvest, places a premium on the collective management of the resources. For this reason, the Common fields in the village are regulated by the same rules that govern regular grazing lands discussed earlier. The common fields, whether under cropping, or ready for grazing, are monitored by the same guards who monitor regular grazing lands.

An interview with elders indicated that the village of Tsehaflam has five farmland zones (common fields), namely: *Foza, Tokor La'elai, Grat-che'a, Denkebkoba*, and *Ghedena*. In addition to being used for post harvest stubble, all but the *Ghedena* are left to lie fallow collectively on a rotational basis every four years (one farming zone per year) and it is mandatory, pursuant to the local bylaws. According to the interviewed farmers, the need to adopt compulsory collective fallowing was primarily to respond to the severe shortage of grazing land in the area. They also acknowledged the contribution of such an arrangement in rehabilitating the fertility of the farmlands.

With regard to the *Ghedana*, the interviewees outlined two reasons for the exemption of this farming zone from fallowing arrangements. Firstly: as this zone is situated immediately

surrounding the village, it is relatively fertile as it gets more manure compared to the far-off farmlands. Secondly, it serves both as a free grazing area when other fields are closed and as a buffer zone to prevent livestock encroachment into the fields beyond it.

Forest/Woodlands/ (historical account)

As discussed in *Section 7.2.4*, decades of unsustainable use of the natural forest left the area devoid of naturally grown indigenous forests. What is now a conspicuously visible forest stand in the area is the afforested watershed (this will be discussed immediately after this section). For the time being, the focus of discussion will be on the historical account of the natural forest based on the recollections of the local farmers.

When asked about their own experiences and/or oral history received from their fathers regarding the natural forest endowment of the area, the group of elderly interviewees said that the area had a considerable forest cover about a century ago. According to these farmers, the forest resource started to diminish rapidly and the area was virtually devoid of any type of forest around the 1950s. As the researcher had witnessed during the fieldwork, there is practically no real natural forest in the area and only a few remnants of the natural indigenous tree species occur here and there.

The interviewees were of the opinion that the main causes for the destruction of the natural forest cover of the area included cutting trees for construction of traditional houses *(Hidmo*), which needed an excessive quantity of timber, fuel wood, and farm implements, and clearing forests to extend agricultural land. What the interviewee farmers outlined as the main causes for the destruction of the forests are in fact proxy and not the underlying causes. When the researcher probed to figure out the underlying causes (institutional failure) that might have led to the destruction of the natural forests, the farmers pointed out that during that time cutting of trees was only partially regulated. Though outsiders were excluded, there were no rules to limit the rate of use by village members. In addition, the retraction of the management rights of the local community over their local forests by the colonial governments (Italians and British and, later, Ethiopian rule) might also have contributed to the rapid exhaustion of the natural forests by turning the local community from legal users into poachers.

The state-based property rights management regime *(afforested watershed enclosure)*

Land degradation and deforestation are considered as major national issues in Eritrea. In line with this concern, the Government of Eritrea, ever since independence, has been actively involved in the large-scale afforestation of degraded catchments in the Highlands of the country in an effort to halt and reverse the process of degradation. The existing afforested watershed enclosure in Tsehaflam is part of this national initiative.

As pointed out earlier, the watershed afforestation programme, as elsewhere in the Highlands, was initiated and financed by the government, and its management has been under state control. From the government's management point of view, afforested watersheds are primarily seen as suppliers of a wider range of environmental services such as watershed/upland protection, soil protection, habitat protection, and protection of biodiversity and species and aesthetic value. The secondary role of forests is as a source of consumable goods such as fuel wood, timber and fodder for the local community, when obtained in a manner that does not compromise the primary objectives. A discussion with a group of farmers from the village, however, revealed that the primary objectives or demands of the local people are concerned with the consumable value of the forests, hinting at the classical divergence of local and national objectives in environmental conservation endeavours.

In the Highlands of Eritrea, deforestation is one of the major causes of upland degradation and the downstream impact of siltation of dams/reservoirs and irrigation facilities, impaired water quality, and water shortage for downstream use. Thus, unsustainable use of the uplands/watersheds could result in on-site and off-site negative externalities.

The Tsehaflam watershed drains into the seasonal Tokor River on which the Tokor water supply dam is built, downstream of its confluence. The water supply dam is meant to support the ever-increasing water needs of Asmara, the capital city of Eritrea, and has been operational since 2001. This situation, therefore, gives an additional dimension to the importance of the Tsehaflam watershed in terms of contributing to the protection of the upstream of Tokor River, thereby contributing to reducing siltation and improving the water quality of the dam.

In line with the secondary objectives of the afforested watershed, which are aimed at supporting the local community in terms of use of consumable forest products, the government has, for the last number of years, allowed the local community to harvest mature eucalyptus trees and grasses from the watershed enclosure. The utilisation, however, occurs in a controlled manner in order to ensure sustainability of the resource. Thus, the decision on when and how to use the said resource depends on an external decision maker, the MOA.

Tree species other than eucalyptus are exclusively meant for biodiversity, non-extractable uses such as bee fodder and other environmental services, and because of these reasons they are not to be harvested physically.

The private property rights regime *(private woodlots/homestead trees)*

The case study village has small-scale private woodlots along a small segment of the seasonal stream dividing the village from the neighbouring village of Afdeyu. These woodlots are owned by several dozens of households and (based on the researcher's estimation) consist of anything between 450 and 500 trees, all of them eucalyptus. An interview with key informants suggested that the trees are more than 10 to 15 years old and are mostly owned by senior households, as the available land is already occupied and newly-established households have not been able to get planting space.

Besides these far-off woodlots, many farmers own a few eucalyptus trees planted within their private hay enclosures and around their homesteads. According to interviewed farmers, about 50% of the households in the village own homestead eucalyptus trees, each of them owning five to ten trees. Private trees from both woodlots and homesteads may be cut at will by the private owner.

7.2.6. An overview of land tenure systems in the Highlands and at Tsehaflam

In 1994, the government issued a Proclamation (Land proclamation No. 58/1994), aimed at reforming the old land tenure systems and replacing them with a nationwide system. According to this proclamation, all land came under the state property rights regime, which would grant limited usufruct land rights to all eligible Eritreans and provide land leases for domestic and foreign investors.

Although some progress has been made towards the implementation of the provisions of the new Land Proclamation Act, particularly with regard to urban and semi-urban land uses primarily for housing development, no usufruct rights over agricultural land has yet been allocated under it. Thus, as far as rural lands, including farmlands, are concerned, the customary system of land tenure mainly continues to operate, as also in the case study village, Tsehaflam.

The traditional land tenure systems in Eritrea are predominately of three types: *diesa* – village-based ownership, *risti* – kinship ownership,[20] and *domaniale*–state ownership[21] tenure patterns (FAO 2000; & Kiflemariam 2001). The dominant form of land tenure ownership in the Highlands and the sole type of land tenure system in Tsehaflam is village-based *diesa*, which grants households individual usufruct rights over farming lands, while grazing lands and woodlands/forest are commonly owned and used by the villagers as a whole. As the existing tenure system in the case study area is *diesa,* a further discussion on this is presented in the subsequent subsection.

Customary land tenure systems

Diesa literally means equality (FAO, 2000). Under this system, the land surrounding a village is commonly owned by the village community. Gebremedhin (1996) notes that ownership rights over land by tradition reside with the village, and farmers have only the rights of access to and use of land. This land-tenure system is the predominant form of land tenure in the highlands of Eritrea and has been common practice since time immemorial (Gebremedhin, 1996; Tesfai, 1996).

Under the *diesa* tenure system, the community, as the ultimate owner of the village land, determines the land-use of its area, allocates it by classifying the territory into farming, communal grazing, communal woodlands, and residential zones, and distributes the arable lands to its eligible members equitably. According to the *diesa* tenure system, farmlands are

[20] *'Risti'* – extended family (lineage) landownership is another communal land ownership, which is now prevalent in very limited areas of the highlands. The reason given by Tesfai (1996) is that this land-tenure system has either evolved into or, on the main part, been changed by legislation into the *diesa* system.
[21] *'Diesa'* – Village-based ownership land tenure system

reallocated every five to seven years among the heads of the households by a system of drawing lots (Gebremedhin, 1996). To ensure a degree of fairness, *diesa* land is divided into different categories according to its fertility and land of each quality is distributed among village members periodically.

Each male adult individual in the village who has established a separate household is entitled to a share of land (FAO, 2000; & Kiflemariam, 2001). Those who have left the village permanently with all family members are denied the right of access to all forms of the village land but retain the right to own a piece of land (*'tiesa')* for housing in the village of their origin.

The principal virtue of the *diesa* system is ensuring equity through guaranteeing each family an equal share of land in terms of area and fertility and thereby preventing landlessness. The disadvantage of this system, on the other hand, is the periodic redistribution of land every five to seven years. Moreover, the system leads to fragmentation of land and provides insufficient security to induce farmers to make long-term land improvements by investing in yield-increasing technologies (FAO, 2000).

The *diesa* tenure system can also be called common field agriculture (see discussion on common fields in *Section 7.2.5.*). In this tenure system, so long as the land is cropped, other members are excluded from exercising their right of concurrent use. However, all members of the community retain the right to graze livestock on the stubble on fallow and previously unclaimed land, and to use other commonly owned resources–pasturage, and woodlands.

In line with the principle of equity in local natural resource use that prevails in the area, all communal grazing lands, common fields (open fields) and woodlands/forestlands within the village territory are commonly owned and are used collectively according to the institutional arrangements adopted by the villagers in their *Megabaya* meetings.

New land law

The new land law (Land Proclamation No. 58/1994) proclaims that government has sovereignty over all land within the country and all rights accruing to land must be

recognised and specifically permitted by the government. While the Proclamation reserves ownership rights for the State, it gives usage rights to farmers by stating, "Every Eritrea citizen shall have a usufruct right to land". According to this Proclamation, lifetime usufruct to land is granted to all Eritreans.

The main objective of the land law as stipulated in the Proclamation is to reform the old tenure systems by eliminating periodic redistribution, increase the duration of the land rights (lifetime usage right) and enhance exclusivity and transferability rights. These measures are meant to provide land cultivators with more secure land rights, which would ultimately contribute in boosting long-tem investment and development. Nevertheless, the new land law has been stalled in a transitional phase and the traditional systems of land tenure largely continue to function.

In addition to the usufruct rights to farming lands, the Proclamation states that a village would continue to control its own communal grazing area, woodlands and water resources collectively according to their customary bylaws. Nevertheless, it also states that all these rights are subject to government review or intervention if the need arises.

7.3. Common pool resources situation analysis

7.3.1. Physical and technical attributes of the local CPRs (grazing land and forests)

As suggested by Oakerson (1986; 1990), problems of common pool resource appropriation and provision are rooted in the physical attributes of the resource or the technology employed for its harvest. These physical and technical constraints can be analysed using three economic concepts: (1) *jointness* of consumption or supply, (2) *exclusion*, and (3) *indivisibility*. For definitions and full discussions on these concepts, see *Sect. 3.5.*

The nature of interaction among resource users is highly influenced by the attributes of the resource system and available technology. Analysis of these characteristics provides critical information on the actions taken by appropriators and rules that they have devised to maintain joint beneficial use of the commons. Conversely, the lack of congruence between

the resource attributes and the rules for their appropriation and provision potentially creates a negative incentive structure leading individuals into counterproductive patterns of interaction that generate undesirable outcomes.

The local CPRs of the case study village, which is the focus of this thesis, will be analysed using the three economic concepts outlined earlier under two headings: (1) grazing lands and (2) forests/woodlands.

Grazing land resources

The grazing lands in the case study village include: all non-arable lands, including hillsides, and seasonal wetlands and common fields (post harvest stubbles)

Jointness

Jointness, according to Oakerson (1986), means, "… that no single beneficiary of some good subtracts from the ability of others to derive benefits". To determine the limits within which this jointness of a resource can be maintained, one has to specify the limiting conditions established in the nature of the resource or technology employed for its harvest. The relevant conditions, for example, include grazing limits in a common pasture. According to Artz *et al.* (1986), exceeding this grazing limit over a significant period by the cumulative herds of the joint resource users essentially results in disjointness of the common grazing land. It is also suggested that resource appropriation limits (such as grazing limits) provide essential information for devising rules to maximise the joint beneficial use of the commons.

Grazing limits for a certain ecological zone or area may be expressed in terms of 'X'–the number of a certain type of grazing animal/ha. In situations where such a quotient is not available, however, one has to resort to exploring surrogate indicators of exceeding grazing limits. According to Maganga (1997), some of the indicators (effects) of exceeding grazing capacity (limits) are overgrazing and over browsing resulting in a decline in the general health of animals because of insufficient feed to maintain them, occurrence of soil erosion, and changes in the floristic and vegetation composition.

As no sort of quotient of grazing limit that could be used to determine the jointness of the local grazing land resource was available for the study area, the evaluation was performed through exploring the effects (indicators) of exceeding the grazing limits of the local common grazing land. This assessment, as will be revealed in the discussion that follows, shows that the grazing limit of the local grazing area has been exceeded, and this has been the case for some decades.

Grazing land in the village, as pointed out earlier, includes all non-arable lands and common fields (post harvest stubble) and is said to be very limited. Key informants who were interviewed indicated that, to respond to this severe shortage, the local community was forced to implement mandatory collective fallowing for grazing purpose. This is practiced on a rotational basis, so that each of the farming zones, except the *ghedena*, lies fallow every three years. This fallowing practice, however, is not a recent phenomenon; it has been the case for many decades. Another practice that indicates the short supply of animal feed and the ruling thereof is that no cut-and-carry is allowed from any corner of the territory, including own farmland, at any time of the year. One of the grazing land zones called *sheka* is exclusively reserved for oxen and cows only. The limited resource system and resource flows indicate the disjointness of the common grazing lands.

Jointness of the grazing resource of the area has also been further diminished by the decision of the village *Megabaya* to sell grasses from the watershed to outside wholesale buyers instead of using it by means of cut-and-carry practices. This decision was based on equity issues and the matter is discussed in the ensuing subsections.

According to the judgment of field staff and regional experts, the biomass productivity per unit area is very low, in addition to grass being poor in composition, with very poor nutritive value. They suggested that this was because of the overgrazing that has been going on in the area for decades. As yet, however, no improved grass species have been introduced to counteract this trend. Given the prevailing degradation levels, mere seasonal enclosure practices would be insufficient; instead, in addition to appropriate rules, a technological change in terms of seeding the resource system with improved grass species would be

necessary. This measure would contribute towards reducing the current disjointness of the common grazing resources in the area.

Moreover, despite the fact that the grazing commons in the area, as pointed out earlier, is already in a state of disjointness, no coercion is being exercised by the village management/ *Megabaya* to compel individual households to 'stint' to reduce externalities resulting from large animal holdings. The decision about how many livestock to own and graze is up to the individual households.

Exclusion

No natural barriers separate the case study village territory from surrounding villages, but the boundaries are fairly well known by the villagers and by the inhabitants of adjoining villages. Moreover, all villagers from within and adjoining villages know that it is punishable (the punisher is the side on which is encroached) to trespass into other village's commons. Therefore exclusion of ineligible potential users from the village's local CPRs (grazing lands, common fields and woodlands) is primarily effected through recognition. In addition to this recognition, field guards who patrol the CPRs of the village are also appointed. Therefore, it is generally possible to exclude encroachment of the local commons through recognition and monitoring.

There is no possibility of excluding ineligible users by means of manmade physical barriers such as fencing, as farming in the case study area comprises subsistence economy. The cost would undoubtedly exceed its benefits. Instead, the villagers involved in the case study have substitute rules by which they can punish violators for physical barriers.

Despite efforts at exclusion through recognition and the appointment of field guards, however, the *shimagle meriet* and field guards reported that encroachment by neighbouring and insider livestock into the grazing lands is frequent.

Indivisibility

In this part of the discussion, the divisibility or indivisibility of the commonly-owned grazing resource system of the village will be explored in terms of equity (as there is heterogeneity in resource flows from the resource system) and the cost of doing so.

Heterogeneity in resource flows: Tsehaflame, inclusive of the plantation site, is characterised by undulating topography, diverse soil types and variable precipitation, both in space and time. These attributes essentially gave rise to heterogeneous pasture and stubble flow units from the grazing system. Due to these characteristics, forage production in the area is not sufficiently uniform to allow division of the commons into individual parcels. This is possibly one of the reasons why the local community adopted '*diesa'* resource tenure arrangements. Through such arrangements, the community has been able to solve assignment problems and, in effect, curb the conflicts that may arise over access to good grazing patches.

High transaction costs: Grazing lands, including common fields, are potentially divisible but economic considerations make this infeasible. The relative economic advantages of common grazing arrangements may be expressed in terms of, firstly, eliminating the need for fencing and, thereby, its cost and, secondly, low transaction costs (lower levels of conflict and litigation with neighbours). Thirdly, there is reduced labour commitment for guarding activities, especially given the fact that each landowner in the case study village has holdings that are divided into a number of scattered plots (the *diesa* farmland tenure system).

Common ownership arrangements therefore allow economies of scale in monitoring and save on transaction costs. Nevertheless, as pointed out by a group of interviewed farmers, free-riding by individuals both from within and outside the village has become increasingly problematic for the management of the commons in the case study.

Forest resources

When state or common property rights management regimes are judged to perform inadequately in terms of securing exclusivity of the forest resources, the conventional policy prescription to reduce the externalities resulting from this failure is privatisation—i.e.

breaking the resource system into individual holdings. The Interim Forestry and Wildlife Resources Regulations issued by the MOA in 2004 is a case in point *(see 6.9.1).*

While there is a strong belief that privatisation can usually promote efficient resource allocation in the case of strictly private goods, it fails to do so in the case of common pool resources such as forests, especially when they are managed not only for products that can be removed, but also for their environmental value. This is primarily linked to the physical attributes of the resources or the technology employed for their harvest. These attributes include: *jointness of consumption or supply*, (low) *exclusion*, and *indivisibility*. In this section, each of these variables will be discussed in relation to the forest resources in the case study area.

Jointness

Currently, there is virtually no real natural forest stand in the case study village; only a few pockets of natural indigenous tree species remain. Therefore, indigenous forest resources in the area are a thing of the past. Owing to this undesirable situation, the local farmers are faced with lack of forest products for agricultural purposes and, more crucially, the severe shortage of fuel wood has largely rendered the local people dependent on animal dung for fuel that could otherwise have been used for fertilizing the farmlands.

Discussions with elders from the village indicated that forest access and usage rules were very loose and deficient in the past. Because of this, the jointness of use of the natural resources was declining progressively while the degradation of forest resources continued. Conservation or jointness of forests can only be maintained as long as appropriation pressure is matched with the ability of the forest resource system to be sustained. In other words, the appropriation effort should not exceed the maximum sustainable yield of the forest resource. In the historical natural forests, however, excessive appropriation seems to have been pursued beyond the ability of the resource system it could support, resulting in the situation prevailing in the area.

As indicated, unsustainable use of the natural forest left the area devoid of natural indigenous forests. The present conspicuously visible forest stand in the area is the watershed enclosure.

Despite the establishment of the watershed and authorisation of usage rights for the local community over some of the removable resources (eucalyptus trees and grasses), the disjointness of the forest resource use in the area has continued. Firstly, though the local people have been benefiting from the sale of matured woody and grass biomass, their fuel wood and other forest resource needs have not been met yet. Secondly, there is disparity between the point of view of the local people and the national government regarding forest resources.

As the field study and consultation of secondary data on national forest/watershed objectives revealed, there is substantial disparity between local and national objectives for forest resources. From the local users' point of view, the forest, including grasses growing in between trees, is mainly there for consumable uses such as collecting fuel wood, timber, and fodder. In the view of the national government, the forest is a supplier of a wider range of goods grouped into two broad objective categories. The primary aim is generation of non-consumable or environmental services such as land and water protection, protection of downstream irrigation and reduction of siltation in water supply dams, biological diversity, and for its aesthetic value. The secondary objective for the forest includes the consumable uses which ought to be appropriated in a manner that does not jeopardise the supply of the environmental services.

The disjointness of forest resource use thus is the prevailing situation in the area. This disjointness, as pointed out earlier, is manifested in terms of the divergence of meanings ascribed to the forest from the viewpoint of the local and national stakeholders. It was moreover pointed out that the definition of forest, in turn, is a function of the context of the lives, needs, and wants of the various stakeholders. Unless this divergence of objectives is recognised, and an appropriate management arrangement is devised, misunderstanding between the local people and national stakeholders will persist, and the situation will remain potentially detrimental to the sustainability of the forest resource system.

Exclusion

Exclusion from the remnant of scattered indigenous tree species by means of fencing is not feasible. Nevertheless, exclusion by recognition is working fairly well as the local people

seem to have special respect for these remnants of indigenous forest. The field guards (*halewti meriet/ekli*), whose primary task is the protection of field crops and grazing lands, are also involved in protecting these trees. Finally, the felling of live trees is prohibited and is punishable by the MOA.

Exclusion from the afforested watershed area by means of fencing also remains impossible, because it would be extremely expensive and doing so would undoubtedly outweigh the benefits. The MOA—the managing body for the site—relies on guarding it and one watchman currently is posted at the site. When the researcher asked the guard about encroachment into the afforested enclosure, he said that it was too big to be effectively patrolled by one person and pointed out that there have been a number of incursions by local villagers and outsiders.

Indivisibility

Under this heading, attempt will be made to answer some questions that have a decisive impact on the issue of privatisation, i.e. dividing the resource into small individual holdings. This inquiry will attempt to answer the following questions: Is the resource system divisible without disturbing its ecosystem? Is the resource system homogenous, so that it could be divided equitably among potential eligible appropriators? Can potential ineligible appropriators be excluded at relatively low cost from benefiting from the resource? These questions are discussed below.

Ecosystem viability: In the opinion of Head Office and Regional MOA experts, the case study forest (watershed) area serves a number of important societal functions that transcend individual concerns. These functions, in addition to the supply of removable goods such as fuel wood, timber, etc., include soil conservation, protection of the water catchment, reducing damage to downstream irrigation and water supply dam facilities (e.g. Tokor dam), climate amelioration, preservation of biodiversity and aesthetic value. Moreover, the non-removable or non-consumptive environmental functions constitute the primary objectives of forests or watershed systems adopted by the MOA.

Mr. Fekreyesus Ghile and Mrs. Eden Solomon, forestry and wildlife experts from Headquarters and *Zoba* Ma'ekel MOA respectively were asked for their opinions on the issue of breaking up watersheds among individual households. Basing their response on their work experience, they suggested that doing so would be detrimental to the resource systems. They argued that individual owners of small adjacent patches of a watershed were likely to make uncoordinated decisions about harvesting the resource and this, in turn, would be likely to cause adverse on-site and off-site effects. They suggested that the continuity of the environmental services of watersheds (forests) could only be ensured if these systems were managed as intact systems.

Heterogeneity in resource flows: The topography of the plantation site (watershed enclosure) is undulating, which results in micro-environmental variation in terms of soil and moisture endowment across the site. These variations, in turn, have resulted in considerable heterogeneity in the performance of trees and grasses in different parts of the site. Generally, trees and grasses located at the foot of the hill and the valley form good stands (reflecting relatively good silt deposition and better moisture retention) compared to those found in the upper parts of the watershed area. Given this heterogeneity of the commons, it would be extremely difficult to equitably subdivide the resource system among the eligible users. According to Oakerson (1986), inequity has the potential to lead to costly conflict, culminating in a situation where all parties lose. Experts from the MOA also suggested that dividing the forest system into small parcels would lead to differences in economic benefit among resource users as the site is characterised by a diversity of resource flows. Economic inequity, in turn, may lead to conflict between local resource users—the *assignment problem*.

Transaction cost: The above discussions have indicated that ecological viability and heterogeneity are not compatible with the division of the forest resource system. Further to these, investigation will be made to see how economic considerations also work against subdivision of the resource system.

As indicated, the MOA has already granted the local community with rights to extract mature trees and grass. According to MOA guidelines, harvested trees are meant for collective developmental activities, whereas, with regard to grass, the decision is left to the village

Megabaya, either to use it individually through the cut-and-carry system to feed own livestock or sell it to bidding wholesale buyers and use the cash from sales for collective developmental activities. The local people adopted the latter option. The reason, according to the local farmers, is the transaction cost consideration coupled with equity issues. The discussion conducted with some of the farmers is presented below.

When a group of farmers plus members of *Shimagle Lim'at* were asked about the aforementioned decision, they said that partitioning the watershed grasses into individual patches would undoubtedly make it extremely difficult to check individual behaviour and free riding could consequently become rampant, potentially leading to conflict among resource users. Moreover, households would have to closely monitor/patrol their individual holdings to try to prevent free riding, which might result in substantial labour costs.

With regard to equity, the interviewees felt that "… partitioning would benefit the powerful while disadvantaging the weak". The powerful, according to them are households with adequate labour supply and aggressive free rider behaviour; while the weak are those households who are short of labour resources. The latter category includes households such as female-headed households; aged people, poor people with no livestock. Further, they pointed out that the *diesa (equality)* principle that the community subscribes to is a major force that dictates many of their collective decisions.

7.3.2. Decision-making arrangements

Decision-making/institutional arrangements comprise those rules that shape the choices made by both the individual members and the group in using the CPR as conditioned by the physical and technical attributes of the resource. Rules can apply at different levels of decision-making arrangements. In this paper Oakerson's breakdown of these arrangements, were employed which he categorised them into three levels: *operational rules*, *collective choice*, and *external arrangements* *(see Sect. 3.5).*

External institutional arrangements

This higher level of institutional arrangement denotes those rules that originate from the decision structures external to the immediate user community of the common pool resources

that impinge on how these resources are managed. As Oakerson (1986) suggests, though these external decision-making arrangements are relevant in most cases, the scope and impact of the various external rules varies. In line with this argument, he pointed out that some of the arrangements are chiefly constitutional and aimed at creating an enabling environment for the user community to engage in local collective choice. At the other end of the continuum of such decision-making arrangements, however, the management of the local common pool resources could substantially depend on the external body's legislation and enforcement of operational rules; in effect converting the common property rights regime into a state controlled (external) body.

External institutional arrangements, as they are applied in the Highlands and the rest of the country, are important in the case study village. The external rules that are relevant to the subject at hand include those decision-making arrangements related to governance of forest resource systems, eligibility qualifications for participating in local decision-making processes, and access to local common pool resources such as farming lands, grazing areas and woodlands. These arrangements are discussed briefly in the ensuing paragraphs.

Problems of natural and environmental degradation in Eritrea are regarded as national concerns. Based on this, the main Ministry of Agriculture policy is spearheaded towards conservation and protection of the environmental/natural resources and establishing systems for their sustainable use. The Ministry, apart from formulating such policies and regulating them, has also been proactively involved in large-scale afforestation of degraded catchments in the Highlands of the country, aiming at halting and reversing the severe environmental degradation.

Because of the policy orientation of the Ministry of Agriculture and because of its hands-on involvement in terms of substantial investment and technical support, the most important method of forest management in the Highlands has been state-based or under 'state auspices'. The remaining indigenous tree species and the afforested watershed in Tsehaflam are, for instance, under the control of the MOA. Nevertheless, the central government (MOA), while retaining the state control management regime, has granted the local people 'authorized use right' over the afforested watershed since the late 1990s. This arrangement still renders the

local people substantially dependent on an external decision maker (the MOA) for legislating and enforcing operational rules, including the monitoring of the resource system, implying that the local community has no management right over the afforested watershed.

The second type of external institutional arrangements, which are mainly constitutional, are the set of rules which specify who is eligible to participate in the local decision-making process. The Proclamation for the Establishment of Regional Administrations no 86/1996 decrees that all citizens who have attained the age of 18 and above, without regard to sex and marital status, are entitled to participate in any of his/her village or area related decisions through the local *Megabayas*—collective choice decision making. In the customary system, only married men or landholders, no women, were allowed to participate in such sessions.

The third institutional arrangement that stems from the decision-making structure external to the immediate resource users is related to access right to land. In 1994, the government adopted the Land Proclamation, which initiated a nationwide land reform programme vesting ownership of all land in the government, while granting limited usufructuary rights to Eritreans and providing land leases for domestic and foreign investors.

As pointed out in *Section 7.2.6* where it was discussed the issue of land tenure systems, the new land law has not been implemented yet. So far, no usufruct rights over agricultural land have been allocated according to this new land tenure system. Nevertheless, some of its provisions which specify who is entitled to land have already been adopted. According to this new law, usufructuary rights to land are granted to every Eritrean upon the attainment of the age 18 or above, without regard to sex, religion, or marital status. Under the old land tenure ruling (*diesa*) only male adults who established a separate household were entitled to land. This customary ruling also used to allow single widows with children, orphans, and widowers a one-half share of the normal land allotment.

In the customary land tenure ruling (*diesa*), the ownership rights over land used to reside with the village, and farmers had the right of access to and use of land. According to the new land law, however, the village has no collective claim to its former farming area, as the government owns such land. Moreover, the new land law, though it entitles villages with the

right to continue to manage their communal pastures and woodlands, revokes their collective ownership as it does with the farmlands. Furthermore, it states that the right of managing communal pasture and woodlands is subject to government review or intervention, should the need arise.

Collective choice rules

This decision-making level is where operational rules about how the resource should be managed are formulated and enforced. Issues that fall under the realm of this decision-making arrangement include formulation and modification or change of existing operational rules, settlement of conflicts, monitoring, and sanctioning against transgressing. Furthermore, it spells out eligibility criteria in the local decision-making process and states what proportion of the eligible appropriators must agree before a rule may be adopted.

Having briefly described the institutional arrangements at this level of decision making, the formulation and enforcement process of these rules in the case study village will be examined by dividing their application into two: pure common property rights and 'authorized use rights' of the local community over the local common pool resources.

Pure common property rights of local CPRs

The villagers, through their village assembly (*Megabaya adi*), formulate operational rules aimed at regulating the use of the grazing lands, common fields post harvest stubbles and collective fallowing. The rules are mainly based on the customary bylaws. The authority of the local community to formulate operational rules (access and withdrawal rights) represents the possession of *management rights* over the aforementioned local resources.

The community also possesses the right to craft exclusion rules, which define the qualifications that potential appropriators must fulfil in order to access and extract resource flows from a designated area of grazing land and common fields post harvest stubble. Parallel to the exclusion rules, the community also formulates and enforces monitoring and sanctioning of rules. The legislation and enforcement of exclusion rules with regard to indigenous remnant tree species are, however, largely dependent on an external agent (the MOA).

The bylaws of the Area and village *Megabaya* state that all residents who are 18 and above are qualified to participate in any of the various committees, including the committee for land and pasturage management. Each eligible individual is granted full participation rights and everyone is equal in having one vote. The bylaws further state that, before a rule may be adopted, more than half of the participants must agree. Through this collective choice decision-making arrangement, villagers can modify existing operational rules, or create and adopt new ones.

Nevertheless, according to some interviewed farmers and the area administrator and his executive secretary, the number of individuals participating in *megabaya* meetings nowadays is low. According to the administrator and the executive secretary, the total number of participants in such meetings more often than not is around 100 to 120 persons. The full number of members is estimated at between 275 and 300. They pointed that, despite the low rate of participation, *Megabaya* meetings normally go ahead. Moreover, these officials indicated that when they deem it necessary, they circulate the resolution of the meetings to the absentees by assigning an *ad hoc* messenger (*Quadere*) who makes house-to-house or at least block-to-block visits across the settlement area.

Contextual changes against which the rural community is operating are said to be the primary factors behind the declining rate of participation. Discussion on these contextual changes is presented in the next section.

Another important aspect of collective choice rules is whether the local villagers have access to rapid, low-cost, local mediation to settle conflicts that may arise among resource users. In this regard, the village of Tsehaflam has a customary dispute resolution mechanism characterised by consensus and mediation. For the past two years, this conflict resolution mechanism has been supplemented with a semi formal resolution mechanism called *adawi bietferdi* (community court).

With regard to minimal recognition of rights to organise, it is important to look at the institutional arrangements that are in place. As noted in *Section 7.2.3*, the institutional arrangements that regulate local commons appropriation and provision in the case study

village are embedded in the broader institutional arrangements that govern the socio-economic life of the village as a whole. Thus, the rules for the local commons of the case study area are village-based. The area or village administrative set-up, in turn, is created by merging the official institutional arrangement with that of the customary rules. In this arrangement, the local community are granted the right to devise their own rules concerning the local commons, as long as these rules do not contradict higher administration guidelines and government policies. Therefore, the local villagers' freedom to organise and devise their own institutions is subject to scrutiny, implying that the right of the resource users to organise is partially challenged by external governmental authorities.

Watershed: 'authorised usage rights'

Regarding the afforested watershed enclosure, the local people are '*authorised users'*. This institutional arrangement empowers the local resource users with rights of access and withdrawal. And these rights are defined by the external authority, the MOA, who holds collective choice rights of management and exclusion over the said resource system.

Operational Rules

The most relevant operational-level rights are "access" and "withdrawal" rights. They are defined as the right to enter a defined physical property and the right to obtain the "products" of a resource respectively.

The operational rules regarding the management of communal grazing lands and common fields post harvest stubbles are crafted and instituted locally. These rules originate from the customary laws of the area. The prerogative of overseeing these commons therefore belongs to the local community, whereas the operational rules related to the use of the state-based afforested watershed and over which the local people have authorised usage rights originate from both the state and the local customary laws.

Resource boundary and member rules

The commons of the Tsehaflam has well-delineated users and defined boundaries. This is to say that the local commons has identifiable community members or co-owners who have

rights to withdraw resource units from these resources and the boundaries of the common pool resource system itself are clearly defined and their access is closed to outsiders.

The watershed, which is within the village territory and under state control, is also well delineated with identifiable authorised users and boundaries. The authorised users are the village community members and no outsiders may access and withdraw from this resource system.

Access and withdrawal rules

The access and withdrawal rights to the commons are granted to all persons whose origin is in the village, who reside in the village permanently, and engage in farming activities. Absentees are denied these rights, though they are lawfully entitled to own a piece of land (‘*tiesa’*) for housing.

A set of rules linked to the access and withdrawal rights specify the temporal and spatial limits of appropriation by the resource users. Some of the main ones are discussed below.

Because of grass resource seasonality in the area, all the grazing areas (both non-arable lands and fallow lands) are closed for a two- to five-month period to allow for grass regeneration. During this time of closure, all livestock leave the village, except for donkeys in the case of which each household is allowed to keep one but not more. When the area is open, collective grazing is scheduled on a rotational basis by which a certain grazing zone is open for use while others remain closed. The *shimagile Meriet* are responsible for overseeing the operation of these activities.

Users enter the open zone for use and graze as many livestock as the household has freely, i.e. there is no limit to the number of animals that a household may own and graze on the commonly owned grazing pasture. On the other hand, no cut-and-carry system is permitted to prevent competition for grass accumulation; only weeds from a user’s own crop field may be carried home.

All of the grazing zones are accessible for all types of livestock, except for a grazing zone called *Sheka* (seasonal wetland). This particular area is reserved exclusively for oxen and

cows and herders pay up to Nfa 20/ox or cow to access this commons. This exclusive reserve for these animals is in recognition of their importance in the local farming system.[22]

Free riding by outsiders in the form of a temporary stay of livestock in the village is not tolerated. Insiders themselves are not allowed to free ride on the commons by keeping cattle for commercial purposes. Nevertheless, villagers may keep livestock for commercial purposes as long as they keep them within their own premises and feed them from other (purchased) sources.

With regard to the authorised use of the watershed resources, access and withdrawal by individuals is prohibited. Harvest of the common pool resource units from this resource system is for collective use. This is realised through the sale of resource flows and using the cash income to support village development projects.

Monitoring rules

The operational rules not only grant the eligible user households rights of access to and withdrawal of resource units from the commons, but also shoulder them with the responsibility of partaking in the endeavour of monitoring the commons. This obligation is effected through either of the following alternatives. The first option, which is the preferred one of the villagers, is to recruit full-time field guards from among the villagers for the duration of a year. According to this arrangement, every household, without exception, is obliged to contribute four *rbi'et* (approximately 10 kg) of barley or wheat grain at harvest time. The second alternative, which is implemented when there are no applicants for the full-time field guard job, is rotational guarding whereby all eligible males serve as field guards in turn. The *Megabaya* selects 12 men for a year; guarding responsibility changes hand every two months (i.e. 2 watchmen/2months). The remuneration (grain) for the individuals who serve in this rotational guarding scheme is similar to that of the full-time field guards.

According to some interviewed farmers, the main reasons why the majority of the people prefer to be relieved from serving as field guards are two-fold: first, the job of guarding is

[22] Nfa is an abbreviation for Nakfa, the name for Eritrean currency. The current official exchange rate is: 1USD=15Nfa

very problematic for it involves frequent conflict with rule violators from within and outside the village. Second, the opportunity cost of rotational guarding is very high for many individuals. Moreover, it is ever-increasing, as more off-farm opportunities are becoming available.

The field guards are in charge of patrolling the commons on a daily basis to prevent encroachment and punish rule violators, both from the village itself and from neighbouring villages, thereby to enforce exclusion rules. The guards retain the whole or a share of the fine, as the case may be.

In addition to the full-time or part-time rotating field guards, the village *Megabaya* also assigns two guard supervisors, locally known as *Abo-guassa,* whose main task is to closely monitor the behaviour and attendance of the assigned field guards. These overseers are elected and serve for a year, but receive no remuneration for their service. Whenever they are involved in apprehending rule violators, however, they may share the cash claimed as punishment with the field guards.

Other community members are also encouraged/solicited to report observed rule violations to field guards or guard supervisors (*Abo guassa*), or council officials. Nevertheless, the interviewed field guards, guard supervisors, and some farmers, suggested that most of the individuals who observe violation of the rules nowadays maintain silence. In the opinion of these interviewees, this turning of a blind eye to free riders stems largely from the strategy of maximising self-interest in that they themselves may benefit from the same act in the future—receiving reciprocation for not revealing each other's violation of the commons rules. In contrast to what happens nowadays, the farmers recalled that some four to five decades ago, the villagers had a tradition of observing the principle of "all is a guardian", i.e. anyone, not merely assigned field guards, used to report rule violations. One of the elderly interviewees said, "A rule violator of that time, when caught breaking any of the rules, was extremely ashamed of his/her wrong doing for that he/she transgressed brothers' law". And added, "Nowadays, on the other hand, a rule breaker walks stubbornly, declaring nothing will happen to him/her but a cash punishment".

Thus far, the discussion has focused on the operational rules related to the pure common property rights regime for the management of the local commons. Now the discussion will turn on the monitoring activities regarding the afforested watershed enclosure. This plantation site, as indicated in the previous discussions, is under the control of the state, while the local community has an authorised usage right.

This afforested watershed is managed by the government (MOA) and patrolled by a forest guard with the aim of enforcing the exclusion rules of the Ministry. The job of this forest guard is to apprehend trespassers and hand them over to the local MOA office for punishment. When asked for his opinion about the adequacy of the monitoring activity, the stationed forest guard said that one person was not sufficient for the monitoring of the 64-hectare afforested site, as there was frequent animal encroachment from various directions of the site and illegal tree felling at night.

Despite the fact that the local people are authorised users at present, the task of enforcing exclusion rules for the site seems to have been left to the MOA and the guard. As was revealed during the discussion conducted with the Area Administrator, the involvement of the local administration and the people is limited and occasional. The frequent violation of the rules testified to by the forest guard, MOA staff at different levels and local farmers reinforces the judgment that the involvement of the people in the protection of the watershed resource system is very weak.

Graduated sanctioning

If rules are to generate their intended objectives, they have to be enforced. Therefore, monitoring without effective sanctions inevitably triggers the occurrence of rampant free-riding behaviour in the resource systems.

In the village under study, the operational rules encompass graduated sanctions stipulating specific punishment for specific violations. Fines are levied in the event of rule violations depending on the seriousness and context of the offence. For instance, the punishment for night grazing or deliberate grazing at any time in a closure area (*Hiza'eti sa'eri*) or crop fields (*Hiza'eti Ekli*) is set much higher in an effort to deter such actions.

The graded cash punishments reflecting the various types of rule violation are set by the village *Megabaya*. Penalties are imposed in the following manner: for grazing that takes place accidentally (by strayed animals) the charge is Nfa five/herd, whereas, for deliberate grazing *(Hassiya)* that occurs during daytime or at night, the offenders are fined Nfa 30/herd. The action of cut-and-carry with regard to grass is prohibited in the village and individuals apprehended breaking this rule are punishable with Nfa 30/action. Individuals caught while breaking any of the monitoring rules and who disobey the rule enforcement by the field guards or *Abo-guassa* are punishable with Nfa 30.

The villagers, however, do not have an escalating scale of penalties that begins with smaller fines and proceeds gradually to larger cash fines for given types of rule violation. An escalating scheme of penalties is believed to be essential in deterring repeat rule violators.

Historical indigenous forests and operating rules

The account concerning the historical indigenous forest resource of the area, as obtained from the interviewees, hinted that the regulations, which were being practised by the people, were partial. This is to say that there were rules regulating access to these resources by non-members so as to prevent open access situations from arising, but no rules regulating usage rate by the eligible resource users. This partial regulation did not help the local community to deal with conservation issues and the ultimate outcome was decimation of the natural forest resource system.

7.3.3. Patterns of interaction

Given the physical attributes of the common pool resource and the institutional arrangements in place, resource users make choices from a set of different possible strategies in relation to the common pool resource and to one another. These choices of strategies have given rise to the emergence of some patterns of interaction among resource users and between resource users and external agents. These interactions, in turn, determine the ultimate outcome of the resource base.

Patterns of interaction resulting from the strategies adopted by the resource users may happen to be either cooperative or free-riding/conflict-oriented behaviours. In the latter scenario, the

source of this problem lies in a lack of congruence between the physical attributes of the commons and the decision-making arrangements used to govern its use.

The discussion on institutional arrangements for the management of the local common pool resources of the village under study presented in *Sect. 7.3.2* showed that there are two types of patterns of interaction in the area: those *among local resource users*, and those *between the people and the government (the external agent)*. Discussions on each of these two main categories and subcategories are presented below:

Patterns of interaction among resource users in the common property rights regimes

This interaction refers to the patterns of interaction among resource users using and managing the local common pool resources (grazing lands, fallow lands, and common fields) held under pure common property rights.

The discussions and analyses presented in *Section 7.3.1* and *Section 7.3.2*, showed that the patterns of interaction are more representative of free riding and consumption/distribution and less of cooperative and conservation behaviours. These may be illustrated by the following points abstracted from the various preceding sections of this case study:

- Villagers in the past used to respect their village institutions and contribute to the upkeep of the common property arrangements. Obedience to the rules was largely based on an appreciation of their value and peer pressure, and not merely on compliance to avoid penalties. As opposed to the past, rules nowadays are less adhered to and enforcement is said to be weak; the enforcement organisation does not act promptly and adequately;
- Free riding by individuals both from within and outside of the village has become increasingly rampant and problematic with regard to the management of the case study village commons. Maintaining their silence when individuals observe rule violation has become a commonplace in the hope that these individuals themselves will benefit from the same act in the future—through reciprocation for not revealing another's violation of the commons rules. Moreover, reporting and following up on the matter may entail transaction costs which many are not ready to incur;

- Low rate of participation in the collective decision-making process (*Megabaya* meetings) as the opportunity cost of time is becoming too high for many households;
- No tradition/rules that limit number of animals a household may keep and graze in the commons;
- No collective provision rules for enhancement/maintenance of grazing/forest lands;
- The regulation related to the appropriation of indigenous forest resources was incomplete in the sense that, though there were rules that deny access to these resources to non-members, which prevents the open access situation, there were no rules regulating the extraction rate of resource by community members.

The above points, drawn from the preceding discussions and analyses, are some of the examples that suggest the fragility of the existing common property rights institutional arrangements of the local CPRs of the case study village. The source of this fragility is twofold: 'inherent' deficiency of the local commons institutional arrangement itself and the contextual changes that were/ are increasingly eroding this local institutional arrangement. Further discussion on each of these is presented below.

'Inherent' imperfection of the institutional arrangement

Apart from the contextual changes (these factors are discussed later on) that further and aggressively eroded the local institutional arrangements, the management regime itself seems initially to have been imperfect. This may be explained in terms of the operational grazing rules' failure to solve *appropriation externalities* because they do not regulate or limit the number of animals that a household may keep; they fail to respond to *demand-side provision* by limiting the total number of grazing animals to match the grazing limits. Moreover, they are also deficient in solving *supply-side provision problems* for there is hitherto no technological change in the form of seeding the grazing land with improved grass seeds, despite the area being overgrazed.

Moreover, the institutional arrangements did not include rules aimed at addressing the *demand-side provision problem* in the appropriation of indigenous forest resources. As indicated by key informants from the village, trees were largely considered as 'free goods'

and were managed 'passively'. Though outsiders were excluded from accessing the resources and open access was prevented thereby, there were no meaningful rules that limited the usage rate of the insiders (eligible users). This deficiency in the operational rules, *inter alia*, is believed to have contributed significantly to the virtual destruction of the historical indigenous forest stands.

Contextual changes

The set of contextual factors which were/are eroding the common property rights institutional arrangements of the local commons of the case study area can be classified into: *state intervention*, *market integration*, *population pressure* and *migration*. These factors have had the adverse effect of weakening collective choice arrangements in coping with appropriation, and provision problems. They are discussed briefly, below.

State intervention

The collective systems that controlled the local commons in the case study village, as they have in the country as a whole, have faced significant administrative interventions launched by successive governments. As hinted in the historical account of the case study village administration, efforts by these governments to establish control over rural organisations have resulted in partial displacement of customary laws with official institutional arrangements. This process is believed to have affected the indigenous arrangements negatively and have increasingly weakened villagers' power with regard to independent decision-making activities.

Market integration/modernisation

Many households in the village are increasingly shifting their time and labour resources away from agriculture and investing them in various off-farm economic activities. The younger generation, especially, are increasingly taking up year-round off-farm employment. This access to the labour market is creating "exit" options and thereby increasing the opportunity cost of labour, which in turn is undermining individuals' incentive to participate in collective action. In other words, as market integration offers more labour opportunities, the opportunity cost of time also increases—in effect diminishing time available for collective

action. The low rate of participation in local *Megabayas*, *inter alia*, is substantially caused by this situation.

As suggested by key informants and a group of elders, market access for labour and economic integration in general has been loosening individuals' ties with their traditional institutional arrangements. With economic integration resulting in high geographical mobility, the frequency of the interaction of individuals with other rights holders over local level resources has been diminishing, resulting in lower involvement in community affairs.

Moreover, farmers have indicated that expansion of modern education is strongly influencing the younger generations to opt for other non-agricultural fields of work and shun agriculture. Nowadays very few children participate in livestock herding and other agricultural activities. The reason is twofold: they lack the time for other activities and, more importantly, they are considerably less interested in agriculture. One of the elderly interviewee farmers said, "Agriculture shall hardly be inherited by the young generation. It seems the profession is to pass away together with us".

Population pressure/increase

The local common pool resources and the institutional arrangements for their management have been facing increasing pressure from growing populations. Common pool resources are subject to certain limits for accommodating additional units of effort or pressure. As the population grows, the pressure on resources increases, and the resource will seriously, perhaps rapidly, decline beyond a certain threshold level. Supply-side provision towards land improvement in terms of improved grass seed, fertilizing farmland and planting trees has been extremely low in this case study area.

Population pressure, apart from its direct impact on the resource through a higher rate of exploitation, also reduces the observability of individual behaviours, which is crucial in curbing free riding and safeguarding collective action. In the opinion of some interviewees, information flow was easy in the past because the population was low; everyone knew everyone else and information was easily communicated from one another. Current visibility of individuals and their behaviour in connection with resource access and use is more

difficult than it was in the past. A general observation on the participatory approach is that sustainable participation is easier to achieve if the group of participants is not too large. As population increases, the possibility of 'assurance solution' to collective action problems is likely to decrease.

Migration

The uncertain environment (in terms of agricultural livelihood support) of the area and the increasing integration of the local economy into the market are increasingly forcing or inviting individuals to out-migrate, either for a longer term or seasonally. This out-migration for the purpose of off-farm employment or with the intention to leave the village for various purposes is increasingly reducing individual incentive for collective commitment. In game theory terms, the assurance game, i.e. the repeated game with no predefined end point, which the villagers used to play, is gradually turning into a series of restricted N-person PD games. The increasing free riding attests to this. Only individuals motivated by the expectation of long-term future benefits would engage in irrecoverable costly investments in building and maintaining institutions needed for formal regulation.

To sum up, it may be suggested that, over time, combinations of these contextual factors—state administrative interventions, market/economic integration, population pressure and migration—have severely weakened the common property rights under which the local common pool resources of the area was controlled and managed historically.

Patterns of interaction between the external agent and the local people

Discussions presented in the various preceding sections of this thesis have revealed that the collective decision-making arrangement of the local people with regard to the management of forest resources has been diminished to an insignificant level. The main reasons include: First, local natural forests have been virtually decimated, for various reasons. Second, live trees in the country primarily fall within government jurisdiction for use and conservation. Third, recent afforestation schemes essentially have been state-based initiatives. Owing to these factors, the dominant set of interactions with regard to these resources does not take place among the local resource users but between these users and the state (MOA).

As the natural forest in the case study area is negligible, it will be ignored here and the discussion will focus on the patterns of interaction that have come into play following the establishment of the state-controlled afforestation watershed.[23]

Following the establishment of the state-controlled watershed enclosure:
According to key informants, the establishment of the afforestation watershed followed a top-down approach. It was pointed out that, though the idea was brought to the attention of the people in a *Megabaya* meeting, it was essentially presented as part of a national environmental programme that had to be implemented. Many of the villagers expressed their discontent with the scheme for the reason that grazing was to be prohibited in the watershed enclosure and replaced by a cut-and-carry system. Moreover, many feared that the land would be altogether lost to use by the villagers.

Because of the divergent considerations regarding natural resources usage and conservation objectives of the local people and the central government (MOA) and the scepticism that has surfaced among local resource users in connection with access rights to future benefits, the patterns of interaction that emerged following the establishment of the watershed were not cooperative. Instead, free riding in terms of livestock encroachment on the commons has become frequent and maintaining silence about violators of the rule commonplace.

Following the 'authorized use right' to the state-controlled watershed resource flows:
In order to enhance or create local community participation and thereby ensure better management of the afforested watershed, the MOA has allowed 'authorized use rights' to this resource system to the local people since 1995 (Ghebremussie, 1997). This move constitutes an important legitimate use of the local forest resources by the local people and it involves harvesting of mature eucalyptus trees and grasses from the afforested watersheds by the local community.

This 'authorized use right' to the watershed in terms of harvesting mature trees and grasses has somehow convinced the local people who were initially suspicious of the intentions of

[23] The remnants of scattered indigenous tree species in the case study area is maintained for environmental purposes exclusively and not for removable resource flows. The exclusion is fairly well maintained both by recognition from the local people and monitoring by the local foresters.

the scheme. Nevertheless, the uncertainty is still there and cooperation by the community hitherto is low. The underlying cause is that there is no formal agreement defining the duties and rights of both parties—the authorised users and the government (MOA). The members of the local community feel that the benefit they obtain from the watersheds is totally under the authority and judgment of the MOA.

Patterns of interaction among resource users in using removable watershed products

Because of the 'authorized use right', the local community has been benefiting from the watershed through the selling of timber and grasses on wholesale basis to outside commercial enterprises and the proceeds are used for collective village development. Before such an arrangement was reached, however, the issue of grass from the watershed had raised a hot debate among the local users. Most of the farmers who own livestock had proposed that the grass should be used by households in the form of the cut-and-carry system instead of selling it. However, households that did not own livestock and/or did not have adequate labour for the cut-and-carry system opposed this proposal.

Since the overriding principle of local commons distribution in the village involved ensuring equity and that the benefits from the watershed should not be skewed towards a certain section of the community, the village *Megabaya* opted for the grass, as is the case with timber products, to be sold and the proceeds to be used for collective benefits.

As pointed out, the rationale for selling grass is the issue of equity as the community subscribes to the *diesa system*. The community also is not homogenous in terms of livestock and household labour endowment. For these reasons it would have been unfair, from the community's point of view, to practise the cut-and-carry system, which would only benefit those who have from a few to many livestock and adequate labour power. Nevertheless, this exportation of grass is also a great loss to the local farming system. It was explained that the area is suffering from severe feed shortage. Export of fodder exacerbates the current disjointness of the grazing resource of the area. Thus, it would be beneficial for the community as a whole to design a system by which the grass would be retained in the village to benefit livestock owners and the losers from such arrangements be compensated by the gainers.

Another area of concern and which potentially creates conflicting patterns of interaction among resource users is the issue of the management of the money raised from the sale of timber and grass. As members of the development committee (*shimagle lim'at)* themselves have revealed, the local people appear to have no adequate information on the sale and use of the fund. They said, "Some people suspect us of misusing the fund", and added, "this claim was mainly due to our poor information supply to the people on how we manage the fund and what exactly becomes of the money".

Though there are no reports on misuse, the prevailing deficient flow of information between the village council and the community members about what has become of the fund has given rise to suspicion among some community members. This situation may, in turn, contribute to reduced reciprocity among users in terms of safeguarding and utilising the afforested watersheds.

7.3.4. Outcome (application of the design principles)

The first part of the research question was answered by identifying, describing and analysing the physical attributes *(Sect. 7.3.1)* of the local CPRs; by exploring the institutional arrangements in place for the governance of these resources *(Sect. 7.3.2)*; and through examining the patterns of interaction that result from individual users' strategies in appropriating the local resources *(Sect. 7.3.3)*. Now, using these descriptions and analyses, and with the underpinning of the theoretical discourse espoused in the chapters dealing with the theoretical framework, it is possible to answer the second part of the research question. This part of the research question constitutes the crux of the research project and it is stated as '*How robust (sustainable) or fragile is the common property right regime for the governance of local common pool resources in the case study area?'*

The centre of gravity of the whole argument advanced in the paper was that a common pool resources dilemma occurs when institutional arrangements for the governance of these resources fail; a situation arises in which individuals make independent choices in an interdependent situation. This non-cooperative relationship between individual agents leads to inefficient/excess appropriation of common pool resources, which in turn causes

deterioration and ultimate collapse of these resource systems. The question of how to deal with the problem of the commons is, therefore, primarily an issue of the existence of effective institutions.

As noted, successful institutions are crucially important for the sustainability of resources and this sustainability is strongly related to the capacity of the stakeholders to design and share institutions that are enforced and continuously adapted in the face of evolving conditions. An important tool for evaluating the status of institutions is Ostrom's *design principles* *(see also Sect. 3.5)*. These *design principles* form a core of the necessary conditions for achieving institutional robustness in CPR settings. In this study, the first seven of Ostrom's design principles will be applied as a template against which the robustness (sustainability) or fragility of the common property rights management regime that govern local commons in the case study area will be determined.

Based on considerable research on common pool resources, Ostrom (1990) suggested that robust or long-term (sustainable) institutions are characterised by most of the design principles. Fragile institutions tend to be characterised by only some of these design principles. Failed institutions are characterised by very few of these principles. The following presents an evaluation of the local commons institutional arrangement in the case study area in terms of the application of the design principles.

Design principle one: **Clearly defined boundaries and resource users**

The territory of the studied village is well defined, has the recognition of all adjoining villages, as are the commons that fall within this area. An alternative way of expressing this situation is to say that the commons of the case study area are not open access resources; instead they are characterised by identifiable community members or co-owners who have rights to withdraw resource flows from these resources and to exclude non-members from harvesting the resource. Thus, the boundaries of the resource systems and the individuals or households with rights to harvest resource products are clearly defined; outsiders are denied access.

Nevertheless, these definitions of resource system boundaries and eligible users are only capable of preventing open access by excluding outsiders. Sustainable use of a common pool resource does not require devising institutional arrangements that exclude non-members only, but also requires setting limits on usage rate in specifying time and spacing of harvest, and maintenance of this commonly owned resource system, by the eligible users of the resources. So how efficient are the rules of the case study area in this regard? This crucially important factor is discussed under design principle two.

Summary evaluation: --robust: *Individuals or households with rights to withdraw resource units from common pool resources and the boundaries of the common pool resource system itself are clearly defined.*

Design principle two: **Congruence between appropriation and provision rules**

One of the most critical elements of the design principles, which constitute a necessary condition for achieving institutional robustness in CPR settings, is the state of congruence between rules governing appropriation and provision or how well the existing institutional arrangements solve appropriation and provision problems.

The community of Tsehaflam has operational rules that attempt to govern and regulate appropriation and provision of the local common pool resources. These rules attempt to keep the balance between the benefits derived from appropriation rules and those costs imposed by provision rules. Now the question is how robust are the local institutional arrangements in addressing appropriation and provision problems in order to ensure sustainability of the resource systems in the case study area? The present task will be to tackle this issue. For this purpose, the design principle under consideration will be broken down into: 1) *appropriation rights and provision duties* and 2) *match between restrictions on harvest and regeneration/carrying capacity* (e.g. grazing limits, sustainable forest harvest level, etc.).

Appropriation rights and provision duties

Appropriation rules:

- Access and withdrawal rights to the local CPRs are granted to all households whose origin is in the village, who reside in the village permanently and engage in farming;
- Grazing areas are closed for a few months each year to allow grass to regenerate. During this period of closure, all livestock except one donkey per household have to migrate out of the village. When the area is reopened for use, collective grazing is scheduled on a rotational basis;
- All of the grazing zones are accessible for all types of livestock, with the exception of a grazing zone called *Sheka* (seasonal wetland). This particular area is exclusively reserved for oxen, in recognition of the importance of these animals in the local farming system;
- There is no rule coercing individual households to limit the number of animals that may be kept to graze in the commons. Users enter the open grazing zone for use and freely graze as many livestock as they may possess. The decision about how many livestock to own and graze is up to the individual households;
- Historical accounts of the case study area indicate that the regulations for appropriating the indigenous forest were partial, i.e. that there were rules to exclude outsiders but no rules regulating the usage rate of the community members;
- Timber and grass from the afforested watershed, pursuant to *'authorized use rights',* are harvested and sold for collective use and there is no access and withdrawal on an individual basis;

Provision rules:

- Collectively implementing and observing seasonal grazing enclosure rules carries costs;
- Refraining from individually beneficial behaviour, i.e. not free riding by violating grazing enclosures carries a cost in the form of foregone benefits;
- But there are no rules requiring the community to supply physical inputs/implement technological changes to rehabilitate the overgrazed pasturelands in the form of planting improved grass seeds;

- Rotational guarding where each household serves as a guard in turn or contributes grain as remuneration for permanently assigned/recruited guards carries an opportunity costs;
- Mandatory collective fallowing, largely for grazing purpose has an opportunity cost in the form of foregone benefits;
- No cut-and-carry practice is permitted in the commons, which is meant to prevent competition for grass accumulation and conflict that may arise therefrom, as grazing resources in the village are limited.

Match between restrictions on harvest and regeneration (efficiency of constraints on use)

Grazing lands

- The lack of rules that limit the herd size of a household has resulted in *appropriation externalities*. The decision about how many animals to own and graze is left to each individual. Consequently, some farmers own relatively large herds while many (the poor) keep small or no herds. The expansion or increase in appropriation activity of putting more animals in the limited grazing lands by some groups of users reduces the amount of grass available for other livestock owners.

  The *appropriation externality,* by creating overuse incentive structures, gives rise to *demand-side provision problems*. Specifically, the latter problem is a situation whereby increased grazing beyond some critical level will reduce grass stock to the extent that the productivity of the grazing resource system is reduced. It is strongly believed that the appropriation externality that has persisted in the area might have contributed greatly to overuse and, in turn, led to the prevailing overgrazing of the local resource.

- The lack of physical input in terms of improved grass seeding, despite the fact that the area has been characterised by overgrazing, constitutes the *supply side provision problem*. This externality is associated with the physical attributes of the resource system (grazing land), which is prone to free riding. The solution to this supply-side externality is to institute robust rules to ensure that everyone contributes to the enhancement and maintenance of the resource system.

- Exportation of grass obtained from the afforested watershed is believed to exacerbate the grazing resource system disjointness, although the arrangement is contributing financial resources for other village development activities.

It may therefore be judged that the operational grazing rules have been deficient in solving *appropriation externalities*, *demand side provision problems* and *supply side provision problems*. However, the grazing management system addresses the *assignment problem* as it secures equity in terms of access rights for all households to all types grazing land, where fodder is a very good and where it is not.

The indigenous forest resource (*historical account*)

- The rules that were being used for the appropriation of the indigenous forests only prevented the open access regime by excluding non-members while hardly regulating the use rate of eligible members. This partial regulation resulted in *demand-side provision problems,* which, *inter alia*, led to virtual decimation of the natural forest resource system. Efficient resource management prerequisites, not only for excluding non-authorised potential beneficiaries from appropriating the resource but also for regulating use rates and maintenance of the commonly owned resource by members of the local community are needed.
- Moreover, in addition to regulating use rate, sustainable resource management may also be enhanced by addressing the *supply side provision problem*. The case study area has no tradition of such measures and no community-initiated reforestation efforts on the commons have been tried yet.

To sum up: The significant presence of *appropriation externalities*, *demand side* and *supply side externalities* implies the incongruence between appropriation and provision rules. It is also true that the existence of these externalities strongly hints at the incongruence between the physical attributes of the local common pool resources and the institutional arrangements in place for their management.

The incongruence between appropriation rules and provision rules constitutes the major source of weakness of the existing common property rights in the area. The collective

behaviour of the local community with regard to the local CPRs seems to be skewed towards consumption and equitable distribution rather than conservation.

Summary evaluation: --fragile: *there is significant incongruence between appropriation and provision rules. This is manifested in terms of appropriation externalities and demand side and supply side provision externalities, and signifies the mismatch between the physical attributes of the local CPRs and the rules for their appropriation and provision*

Design principle three: **Collective choice arrangements**

As pointed out in *collective choice rules* under subsection 7.3.2, all villagers who are 18 and above are eligible for Megabaya membership, through which all village issues are debated and resolved. Nevertheless, although all of the eligible individuals who are affected by operational rules have the right to participate in making and modifying operational rules for their commons, there is no broad participation in this decision-making process at present. Members do not attend the Megabaya meetings consistently. The current situation has a few members making decisions for everyone. The ever-shrinking participation in making and modifying the collective choice rules is ascribed to the contextual changes that increasingly alter the socio-economic situation of the area. Evaluation in this regard therefore states that there is no broad participation in the modification of operational rules by individuals affected by these rules.

Summary evaluation: --weakened: *Although all eligible individuals affected by operational rules have the right to participate in making and modifying operational rules, there is no broad participation by individuals in the decision-making process at present.*

Design principle four: **Monitoring**

The operational rules that are in use grant appropriation rights to eligible resource users and also place an obligation of provision towards safeguarding the commons on these individuals. One form of this provision concerns taking part in the endeavour of monitoring the commons. Each eligible household participates in this activity, either in the form of rotational guarding or by contributing grain as remuneration for permanently assigned

guards. These monitors, who patrol common pool resource conditions and users' behaviour, are accountable to the users and are users themselves.

Nevertheless, there is a general feeling among the resource users that monitoring of the local commons is weakening. According to the villagers, the causes for this weakening are twofold: firstly, guarding as a job or assignment is becoming increasingly problematic because obedience to rules is eroding and enforcement is becoming difficult and conflict-laden. Secondly, the opportunity cost of rotational guarding is becoming too high for many individuals, with more off-farm opportunities becoming available.

Moreover, despite the fact that other community members are also solicited to report observed rule violations, it has been suggested that most individuals who observe rule violation nowadays maintain their silence. This turning of a blind eye to free riders stems largely from the strategy of maximising self-interest in the expectation that they themselves may benefit from the same act in the future. In addition, reporting and following up on the matter may entail significant transaction costs, which many are not ready to expend. All of this implies that free riding is on the rise and monitoring is weakening.

Summary evaluation: --weakened: *there is a monitoring mechanism; and the monitors, who audit the local common pool resource conditions and users' behaviour, are accountable to the users and are users themselves. Nevertheless, it is judged as weak, as it fails increasingly to curb free riding.*

Design principle five: Graduated sanctioning

Rules produce useful outcomes only when they are enforced. Rule breaching in the use of resources and management ought to be monitored and punished. Effective monitoring and adequate sanctioning are capable of guiding individuals' behaviour by keeping the balance between legitimate resource use by individuals and safeguarding collective interest.

The operational rules in the case study area include graduated sanctions, which stipulate specific punishments for specific violations. Fines are levied in the event of violations,

depending on the seriousness and context of the offence. The operational rules, however, do not include an escalating scale of penalties that begin with smaller fines and gradually proceed to a larger sum of cash fines for a given type of rule violation. An escalating scheme of penalties is believed to be essential in deterring repeat rule violators and this shortcoming constitutes a deficiency in the current sanctioning rule.

Summary evaluation: --deficient: *There is application of graduated sanctions to violators of operational rules, depending on the seriousness and context of the offence, but no escalating scale of penalties, which is essential to deter repeated rule violation.*

Design principle six: **Conflict resolution mechanism**

Another element of the design principles is whether the local villagers have access to rapid, low-cost local mediation to settle conflicts that may arise among users of resources. The village of Tsehaflam has a long history of dispute resolution characterised by consensus and mediation. This tradition originates from the centuries old customary law (*Higgi endaba*) that prevails in this area and in the Highlands. Over the past two years, this conflict resolution mechanism has been supplemented with a semi-formal resolution mechanism called *adawi bietferdi* (community court). In view of these, it may be said that users and their officials have rapid access to low-cost local mediation to resolve conflict among users or between users and officials. It is worthwhile, however, to mention that the traditional conflict mechanism is also increasingly falling under the destabilising effect of contextual changes and is increasingly ceding its role to semi-formal and formal conflict resolution mechanisms. This gradual shifting is accompanied by increasing transaction costs in conflict resolution.

Summary evaluation: --increasing transaction cost: *There was/is access to rapid, low-cost, local mediation to resolve conflict among users or between users and officials, but as the contextual changes also increasingly affect this institutional arrangement, there is a continued shift towards semi-formal and formal conflict resolution mechanisms, resulting in increased conflict resolution transaction costs*

Design principle seven: **Minimal recognition of rights to organise**

The current institutional arrangements that regulate local common pool resources appropriation and provision in the case study village are embedded in the broader institutional arrangements that govern village life as a whole. These institutional arrangements in turn are amalgams of official institutional rules and customary bylaws.

Within the said decision-making administrative structure, the government has granted rights to devise their own rules related to local commons to the local community, as long as these rules do not contradict higher administration guidelines and government policies. Nevertheless, there seems to be some kind of constraint that stems primarily from the new land law provisions. The land law, despite the fact that it allows local communities to continue to manage their own communal grazing area, woodlands and water resources collectively according to their customary bylaws, states that all these rights are subject to government review or intervention, should the need arise. Thus, there seems to be some kind of subtle limitation, which the local people are faced with, and which negatively affects the local people's initiative to organise around issues related to the local commons.

Therefore, though the rights of the local people to organise and devise their own rules related to the local commons is not challenged, the fact that the control of the commons is subject to state review or intervention constitutes a significant constraint on the local people to exercise their rights in a meaningful way.

Summary evaluation: --deficient: *though the right to devise their own institution and organise is not explicitly challenged, the fact that the local commons are subject to state review and intervention creates a negative incentive structure for the local people to exercise their rights adequately.*

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8. Conclusions and recommendations

8.1.Introduction

Eritrea has suffered grave natural and environmental resources degradation. There are also indications that the degradation of these resources has continued unabated despite considerable technical interventions by the Government to try to counteract this undesirable trend.[24]

The Highlands ecological zone, where the case study was carried out, is the worst affected part of the country. This zone is characterised by widespread forest and soil degradation and rampant over grazing. Moreover, wildlife is under great pressure and some species are facing the threat of disappearance. Continuing deforestation in this part of the country is resulting in the deterioration of the terrestrial ecosystem and loss of gene resources. It is also adversely affecting the hydrological regime, leading to reduction in the water holding capacity of the watersheds, and increased silt loads in rivers, resulting in rapid siltation of dams.

Why is this widespread deterioration of the commons occurring and why is not being halted and/or reversed? The bottom line of this research comprised trying to give plausible answers to these questions.

The seminal article of Garrett Hardin, "*The tragedy of the commons",* (Hardin, 1968) has been widely used to explain the degradation of various resources such as forests, fisheries, and overgrazing, air and water pollution, extinction of species, ground water depletion, and other environmental problems. Hardin's model suggests that all resources held in common (commons) will inevitably suffer overexploitation and degradation.

According to Hardin's model, each appropriator of a resource, by rationally seeking their own self-interest, inadvertently contributes to the overexploitation of the commonly used

[24] Technical interventions refer to the ongoing biophysical measures aimed at rehabilitating and developing the environment. These interventions include: construction of terraces, micro-basins and check-dams and planting trees, implementing temporary and permanent natural regeneration enclosures.

resource beyond its regenerative capacity. The *"tragedy"* of resource degradation results from each person's incentive to free ride, regardless of the expected actions of others. Thus, the central proposition of Hardin's model is that the human behaviour of self-centred utility maximisation inexorably leads to the deterioration and ultimately to the decimation of the commons.

When the tragedy of the commons is formalised into a Prisoner's Dilemma game, it illustrates that individuals driven by self-interested rationality are locked into collective irrationality—implying rational agents using a commons will not cooperate so as to achieve collective benefits. In other words, the model posits that individuals appropriating from the commons are trapped in a commons dilemma—a situation in which individuals make independent decisions in an interdependent situation.

There are situations where this paradigm of the source of the commons problem holds true. Nevertheless, this hypothesis does not adequately answer why is it that communities are able to manage the commons successfully in some situations and not in others, if this form of management is inherently deficient. This shows, contrary to the deterministic prediction of Hardin's model, that the commons regimes are not inherently or consistently deficient. Therefore, it is implausible that every commons situation must result in 'tragedy'. As Vink (1986:90) put it, "Even if a tragedy of the commons were logically possible, it would not be inevitable."

Hence, if Hardin's deterministic prediction does not necessarily hold true and if commons degradation does not inexorably arise from the strict dominance of free rider strategy or the pervasive self-centred benefit maximisation strategy of individual resource appropriators, then where is the fundamental root of the problem? Why do communities govern the commons successfully in some circumstances and not in others? What are the fundamental forces of environmental degradation?

The new institutional economics, in explaining the "tragedy of the commons", gives less weight to the short-sightedness of the individual resource appropriators, which arises from their self-centred utility maximisation strategy, and more to deficiencies in the social

institutions dealing with this individual rationality. According to this theory, the underlying source of the 'tragedy' is the inability of interdependent individuals to coordinate and enforce actions in situations of strategic interdependence. Conversely speaking, efficient institutions are able to achieve social synergism by harnessing individual rationality into collective benefits.

It is argued that Hardin's "tragedy of the commons" is applicable only to open access resources where no property rights are assigned, and not to commons.[25] In the latter type of institutional arrangement, the resource are assigned to an identified community of interdependent users who have the right to exclude non-members from harvesting the resource while regulating usage rates and maintenance of the communally owned resource by members of the local community.

Moreover, it is suggested that the 'tragedy' is not due to inherent flaws in the common property rights management regimes, but because of institutional failure to control access to resources, and to make and enforce internal decisions for collective use. Based on this line of argument, it is further suggested that, if there is a defined set of resource users and yet the commons dilemma situation exists, then the underlying problem is the degeneration of the existing common property rights resource management regimes into open-access-like regimes—a condition that can trigger "the tragedy of the commons". The question of how to deal with the problem of the commons is, therefore, primarily an issue of the existence of efficient institutions.

The prevailing severe and unabated degradation of the natural and environmental resources in the Highlands thus calls into question the efficacy /robustness of the common property rights regimes that are in place for the governance of these resources. Based on this

[25] *Open access* is a situation of non-property where no one owns or regulates a resource, and it is free and open to everyone and no one has the legal right to exclude anyone from using a resource (Bryan E. Burke 2001). As suggested by Jean-Marie Baland and Jean-Philippe Platteau (1996), when a given resource is free for all, under open access, the agents' decision whether or not to 'enter' and start exploiting the resource is based on the comparison between the price of entry, which they have to bear, and the expected income they will get. Hence, as long as the net expected benefit is positive, they decide to enter and exploit the resource. Because of this skewed cost-benefit ratio, resources will be overexploited and potentially destroyed.

observation, the study commences from the hypothesis that existing local institutions for the governance of the local CPRs in this part of the country are imperfect.

To assess the study premise empirically and thereby to try to explain the reason why the commons continues to decline, a case study was carried out in a village located in the Highlands of the country. The types of local CPRs on which this research focused include forests/woodland and grazing land resources.

The main research questions formulated towards the aforementioned research objective were:

(1) What are the institutional arrangements for the management of local common pool resources (forests and pasturages) under the common property rights regime in the Highlands of Eritrea in general and in the case study area in particular and (2) how robust/sustainable or fragile is this common property rights regime?

To answer the first part of the research question Oakerson's framework was employed to identify, describe and analyse the physical attributes of the local CPRs, the institutional arrangements in place for managing these resources, and to explore the patterns of interaction that result from the individual users' strategy in appropriating the local resources.

As to answering the second part of the research question, which constitutes the crux of the issue, Ostrom's design principles were adopted. Sustainable commons are strongly related to the capacity of the stakeholders to design and share institutions that are enforced and continuously adapted in the face of evolving conditions. Important tools for evaluating the robustness/sustainability of common property institutions are Ostrom's design principles. In this study, the first seven design principles were used as criteria to determine the robustness or fragility of the institutions that govern the forest and grazing lands (watershed) in the case study area. Robust or long-term (sustainable) institutions are characterised by most of the design principles. Fragile institutions tend to be characterised by only some of these design principles. Failed institutions are characterised by very few of these principles.

8.2.Conclusions

The field findings from the case study village demonstrate that:

Design principle one*—individuals or households with rights to withdraw resource units from common pool resources and the boundaries of the common pool resource system itself are clearly defined.*

Design principle two*—there is a significant incongruence between appropriation and provision rules. This is manifested in terms of appropriation externalities as well as demand-side, and supply-side provision externalities, and signifies the mismatch between the physical attributes of the local CPRs and the rules for their appropriation and provision.*

Design principle three*—although all eligible individuals affected by operational rules have rights to participate in making and modifying operational rules, currently there is no broad participation of individuals in the decision-making process.*

Design principle four*—there is a monitoring mechanism; and the monitors, who audit the local common pool resource conditions and users' behaviour, are accountable to the users and are users themselves. Nevertheless, it is judged to be weak, as it is increasingly failing to curb free riding.*

Design principle five*—there is application of graduated sanctions to operational rules violators, depending on the seriousness and context of the offence, but no escalating scale of penalties, which are essential to deter repeated violation of rules.*

Design principle six*—there was/is access to rapid, low-cost, local mediation arenas to resolve conflict among users or between users and officials; but as contextual changes are also increasingly affecting this institutional arrangement, there is a continued shift towards semi-formal and formal conflict resolution mechanisms, resulting in increased conflict resolution transaction costs*

Design principle seven*—though the right to devise their own institution and to organise is not explicitly challenged, the fact that the local commons is subject to state review and*

intervention creates a negative incentive structure for the local people to exercise their rights adequately.

Hence, as the institutional arrangement that was researched tends to be characterised by only some of the design principles, it is strongly suggested that the common property rights regimes for the management of the local common pool resources of the case study area are fragile. This means that existing local institutional arrangements are not sufficiently robust to solve common pool resource appropriation and provision externalities.

The field findings from the case study are consistent with the argument that institutional failure triggers negative externalities and, ultimately, environmental degradation. The prevailing grave natural resources degradation in the case study area and the deficient institutional arrangements in place strongly suggest that a "tragedy of the commons" is occurring in this case study area.

The underlying factors identified as responsible for the deterioration of the common property rights regime include. 1) *Imperfect institutional design*: the institutional arrangements seem to have been imperfect in their initial design, i.e. the community was not sufficiently conservation oriented; instead they seem to be inclined towards equity in benefit distributions, and 2) the *contextual changes* that were/are eroding the common property rights regimes *(see Section 7.3.3)*.

Finally, though generalisation cannot be made beyond the case that was studied, the empirical findings are relevant to cases in the Highlands of the country, which exhibit similar characteristics to this case study. Moreover, there are several lessons that may be drawn from this field analysis, which may have valid implications for the natural resources management challenges and opportunities of the entire Highlands ecological zone.

8.3.Recommendations

In view of the current status of the local institutions of the case study area that were researched, it is strongly recommended that the Government and the community of Tsehaflam consider the following points and institutional changes to try to halt the

undesirable prevailing natural resources degradation and to develop these resources in a sustainable way:

- Existing local institutional arrangements (common property rights) were judged as *weak/fragile*.

  This means that the existing local institutional arrangements are not efficient enough to solve common pool resources appropriation and provision externalities. Nor is it possible to revive them completely so that the local community alone would be able to mange the local CPRs (particularly forest resources). This is mainly because most of the objective circumstances associated with them in the past have changed too completely to permit their revival and ensure their effectiveness in the present setting. The contextual changes make village-level resource regulation more difficult than it was before. Instead, the focus should be on searching for functional substitutes of the existing institutional arrangements, which can fit in with the present day circumstances (this alternative is presented towards the end of this discussion).

- State-based ownership is seldom associated with successful common pool resources management in developing countries. This has been demonstrated theoretically and by presenting some experiential evidence from around the world. Moreover, there is strong evidence that this property right is performing deficiently in Eritrea, too, as it was revealed in the discussion around the country context.

  The prime factors causing imperfection in state control in the context of developing countries is ascribed to pervasive informational asymmetry between the state and users with regard to the resources, lack of adequate financial means and trained personnel, the moral hazard, corruption, coercive implementation of the *de jure* rights, and deficient monitoring capability for sizable and scattered state-controlled natural resources.

- Private property rights (markets), in theory, efficiently allocate resources that are strictly private goods, where the cost of exclusion is relatively low and one person's consumption is subtractable from what is available to another. Nevertheless, private property regimes (breaking the common pool resource system into many household

ownership sections) are severely deficient in solving commons dilemmas, for markets cannot capture the full value of common pool resources and thereby create perverse incentives for owners. The underlying cause of market failure is linked to the pervasive externalities arising from the use of common pool resources.

Privatisation of the local CPRs (forest and grazing lands) of the case study area will not be feasible, as it is likely to worsen the problems of externalities. As evidenced by the empirical study, the local CPRs are characterised by the following attributes, which do not allow the realisation of efficient privatisation.

- Low exclusion—high vulnerability to free riding behaviours, high transaction costs of exclusion when parcelled out;
- High disjointness—divergence between objectives of individual and national interest, various users with diverse usage objectives that may be contradictory;
- Low divisibility—ecological damage if divided among individual households; entails high transaction costs when parcelled out, equity issue (*diesa* tradition).

Recommendation

In view of the empirical evidence that has illustrated the weakened state of the existing institutional arrangements, and taking into account the limitations of the state-based and private property rights regimes discussed above, it is strongly recommended that the government (Ministry of Agriculture) and the local community (of Tsehaflam) work jointly towards implementing co-management of the local common pool resources. Before venturing into implementing this institutional arrangement, however, political and economic circumstances will have to be assessed first, if they would allow the proper implementation.

Co-management presupposes that communities and state have different capacities and comparative advantages in overcoming the many externalities that may emanate from using common pool resources. Thus, co-management is oriented towards harnessing these complementarities. However, to create a viable environment for successful co-management, *inter alia,* the existing local institutional arrangements need to be upgraded.

Annexure

Interim Forestry and Wildlife Resources Regulations

(This is an excerpt from the full content of the Interim Regulations pertinent to the Forestry and Pasturages part only)

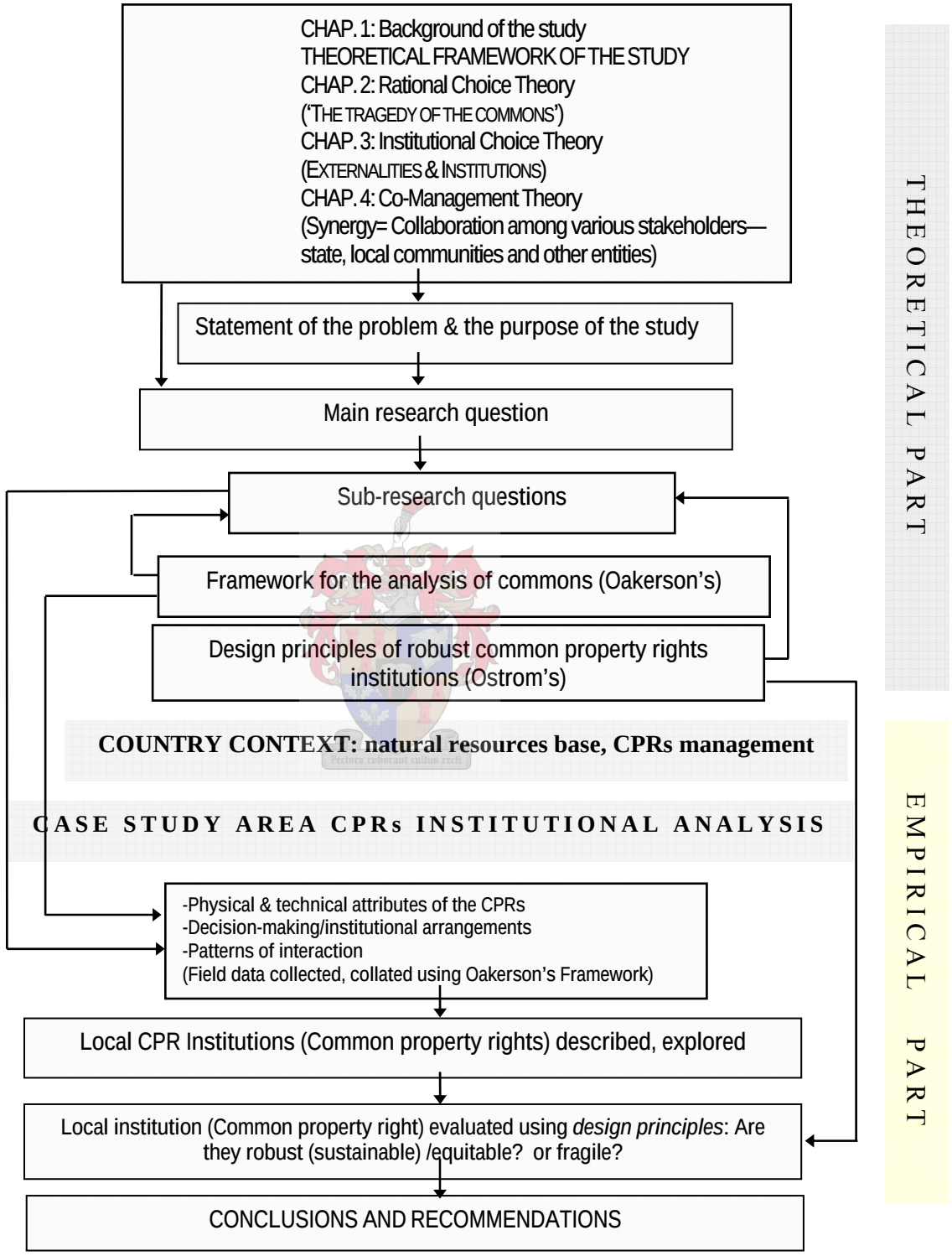
The following are the *main tenets of the Regulations* (IFWRR/MOA, 2004) on transferring state-based afforested watersheds and natural regeneration enclosures to local communities or breaking up of these resource systems among individual households:

- Hillside afforested enclosures (watersheds) developed through Food-for-Work or Cash-for-Work and/or campaigns shall be handed over to respective villages;
- Watersheds (hillside afforested enclosures) that have been handed over to villages, pursuant to this regulation, may be subdivided among individual farming households;
- However, until such time that the common pool resources (watersheds) are parcelled out among individual households, they should stay under the collective management of the village by setting up a committee that would manage these resources. The committee is accountable to the village administration (*mimhidar adi*);
    - Monitoring of the site shall be ensured by hiring guards whose salary shall be covered by the resource user villagers;
    - Grass flows from the watersheds may be harvested collectively and the cash incomes from the sale of these resource units may be used for collective developmental activities of the village;
    - Villagers (collectively) may also harvest mature trees from the plantation sites following authorization from their local MOA office. The cash incomes from the sale of these resources may be used for collective developmental activities of their village;
    - Withdrawals of resource flows (woody and grass biomass units) are exclusively the rights of the local villages and their eligible resource users; no other potential appropriator (entity) is allowed to access and withdraw any resource flows;
    - Villages have an obligation, pursuant to this regulation, to plant five seedlings for every mature tree they may harvest;

- Temporary enclosures shall be fully under the management of a users' committee whose accountability will be to the village administration (*mimihidar adi*); guards should be hired by the resource users to monitor unauthorized access and withdrawal;
    - Grasses from the temporary closures may be harvested and used collectively. As far as natural forests (woody biomass) found within the temporary enclosures are concerned, however, since these resources are currently in a highly degraded form, require an extended period for their full recovery/regenerations. Therefore, there shall be no harvesting of these resources until judged they have sufficiently recovered. Nevertheless, in the meantime, local appropriators may practice restricted harvesting of natural forests found within the temporary enclosures in the form of 'tree-stand improvement practices' through proper thinning. This may be done only under close supervision of foresters from MOA.
- Each village has an obligation to establish at least one temporary woodland enclosure, and this should be monitored by guards hired by the villagers.
- Any poaching activity is prosecutable and punishable by the law.

Appendices

Schematic illustration of the approach followed in the research work



Source: constructed by the researcher for the purpose of a systematic approach to the research

List of persons met/interviewed

National Level

Ministry of Agriculture (Head Office)

Mr. Estifanos Bein	Director, Department of Regulatory Service, Environment Quality Division
Mr. Fikreysus Ghile	Senior expert, Land Resources and Crop Production Department

Ministry of Land Water & Environment (Head Office)

Mr. Abrara Hasen	Director, Land Use and Cartography Division
Mr. Mullugetta Asmelash	Senior expert, Land Use
Mr. Bereket Hailizghi	Senior expert, Land Use
Mr. Awet Berhe	Senior expert, Land Use

Cultural Assets Rehabilitation Project - Eritrea (CARP-E)

Mr. Naigzy Gebremedhin	Co-coordinator, Cultural Heritage Project

Natural Resources Consulting Engineers NRCE, Inc

Mr. Yohannes Debretsion	Engineer, Water Resources

Zoba Level Ministry of Agriculture—Zoba Ma'ekel Branch Office

Mr. Haileab G/egzabiher	Unit Head, Land Resources and Crop Production
Mrs. Eden Solomon	Expert, Forestry & Wildlife Unit
Mrs. Mieraf Solomon	Expert, Forestry & Wildlife Unit

Sub-zoba Level Ministry of Agriculture Branch Offices

Mr. Tesfay Taye	Forester, *Sub-zoba*-Gallnefhi, Forestry Unit
Mr. Ghebrai Tekleab	Soil & water conservation expert, *Sub-zoba*-Gallnefhi
Mr. Hailemichael	Head, *Sub-zoba*-Gallnefhi, Branch Office
Mr. Rusom Alem	Head, *Sub-Zoba* Serejeka, Branch Office
Mrs. Kibra Asmelash	Extension agent, *Sub-Zoba* Serejeka
Mrs. Mihret Tewolde	Extension agent, *Sub-Zoba* Serejeka
Mrs. Eden Kaisai	Home economics agent, *Sub-Zoba* Serejeka,

Local Area & Village Administration Level

(Serejeka-Tsehaflam-Afdeyu Local area administration)

Mr. Ghirmay Sahle	Tsehaflam-Afdeyu local admin; Executive Secretary (current)

Mr. Kahisai Woldehariat	Tsehaflam-Afdeyu local admin; Administrator (previous)
Mr. Worede Berhe	Tsehaflam-Afdeyu local admin; Administrator (current)
Mrs. Asmera Tekle	Tsehaflam village; dev. committee members
Mrs. Adanesh Tesfalase	Tsehaflam village; dev. committee members
Mr. Tesfahiwot Tella	Tsehaflam village; dev. committee members
Mr. Rusom Haile	Tsehaflam village; dev. committee members
Mr. Merhawi Kelati	Tsehaflam village; dev. committee members
Mr. Kidane Gherezghiher	Tsehaflam village; dev. committee member
Mr. Abraham Embaye	Tsehaflam village; farmer
Mr. Asmerom Gherezghiher	Tsehaflam village; social affairs committee member
Mr. Bereketeab Semere	Tsehaflam village; farmer
Mr. Daniel Bairu	Tsehaflam village; *Halaw-meriet* /field guard
Mr. Estifanos Tekie	Tsehaflam village; *Halaw-meriet/* field guard
Mr. Fikre Tekleab	Tsehaflam village; *Abo-guassa/* guard-supervisor
Mr. Ghebrai Tedlla	Tsehaflam village; farmer
Mr. Ghebremedhin Mesel	Tsehaflam village; farmer
Mr. Gherrensa'e Solomon	Tsehaflam village; farmer
Mr. Habteab Semere	Tsehaflam village; farmer
Mr. Kefla Ghebrehiwot	Tsehaflam village; farmer
Mr. Teklesenbet Andenki'el	Tsehaflam afforested watershed forest guard
Mrs. Fekadu Kbrom	Tsehaflam village; farmer
Mrs. Ketem Keshi Tekeste	Tsehaflam village; farmer
Mrs. Mil'ete Mebrahtu	Tsehaflam village; farmer
Mrs. Okubamariam Teki'e	Tsehaflam village; farmer
Mrs. Saba Okuba-michael	Tsehaflam village; farmer
Mrs. Tserha Woldekidane	Tsehaflam village; farmer
Mrs. Wsesenet Tekeste	Tsehaflam village; farmer

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