The Limits to Common Resource Management: The Bypassed Commons or Commons without Tragedy

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The Limits to Common Resource Management

Abstract

Land, labor, indigenous knowledge and institutional resources of producers in the Central Highlands of Ethiopia are investigated. Frequency distribution and comparative statistical analysis of the two regions with respect to these and other parameters suggest that in a situation where all producers are subjected to a common source of risk (e.g. rainfall): i) the institutional resources become less effective, and ii) combination of land, labor, knowledge and other complementary resources form the basis for adjustment mechanisms, sequential or strategic decisions, and that these decisions are directed towards maintaining the nuclear family. On the other hand, when essential resources such as land are government owned and household decisions are shared by the state, local institutions or social networks become an effective means to maintain reproduction of the farm and the producer through providing access to or sharing of resources.

The Limit to Common Resource Management

1. Introduction

Resource and property that are central concepts to this paper have been defined differently by several studies (Tietenberg, 1988; Stevenson, 1991). Most of these studies emphasize on entities which are characterized by their physical attributes. The present study departs from these studies because it relies on a comprehensive working definition adapted from the Webster's dictionary. A resource is defined as:

> " a source of *supply*, wealth, *information or expertise*, and ability to meet and handle a situation." and

Property is defined as:

> "a quality or trait belonging and especially peculiar to an individual or thing (*member of a household or a household representative in a social group*), something owned or possessed (*privately or publicly*), an exclusive right to posses, enjoy and dispose off a thing, and something to which a person has a legal title." (***italics added***)

According to these definitions, resources and property refer not only to objects with physical but also non-physical attributes. Examples of entities with non-physical properties include skill, information, knowledge and institutions. This study focuses on resources with non-physical attributes.

Most resources entail private and/or public ownership and user rights (Andelson, 1991). Exclusion and inclusion of user and ownership rights to resource differ by village, region, social groupings or political systems. The means (e.g. physical and skill resources) and relations of production (e.g. institutions) are the necessary and sufficient conditions to determine whether a resource is privately or communally owned. Stevenson (1991) defines common property as:

> " a form of resource management in which a well -delineated group of competing users participates in extraction or use of a jointly held, fugitive resource according to explicitly or implicitly understood rules about who may take how much of the resource (Stevenson, 1991, pp. 46).

In reference to this definition, a distinction can be made between two forms of common property. A household in LDCs may be composed of a nuclear or extended family. Most resources owned by a household can be seen as common property since members with divergent interests are entitled to use them. Households that belong to a parish or a village may use a common grazing land. Each household competes for the use of the common pasture as long as the benefits are greater than costs. The present study considers these two forms of common property.

2. The Problem

Knowledge is an essential input to crop and livestock production. Indigenous knowledge is experience, location, gender and age specific, thus norms of scarcity apply when any of these situations change. Food production is possible through "rational" combination of knowledge, physical, institutional and environmental factors. The processes of combining these factors

determine the chances of reproduction of the farming unit and producers. Intervention strategies and changes in the physical environment alter the modalities within which production processes take place thus marginalizing the value of indigenous knowledge (WCED, 1987). Furthermore, while misuse of physical resources is identified as the major cause of environmental degradation and catastrophe, the importance of knowledge and other non-physical resources to create stability of the eco-system is not investigated (Warren, et al., 1988, pp.107).

Losses of resources are examined based on an assessment of their carrying capacity, i.e. its capacity to enable reproduction and stability of the ecosystem. Carrying capacity has been illustrated with examples from grazing lands, parks, fishing zones and forests (Stevenson, 1991; Hardin, et al., 1977; Andelson, 1991). Over-exploitation of resources reduces their ability to support the fauna and flora of the eco-system. Ironically, however, rarely have these studies made explicit recognition of knowledge in the utilization of resources.

The carrying capacity of the eco-system declines with losses of not only physical but also non-physical resources (e.g. institutions). When people are moved to a different location, exposed to different production, marketing and consumption techniques, the capacity of knowledge and institutions to enable food production may decline.

Organization of production, consumption and marketing requires institutional inputs that provide the infrastructure for access and sharing of labor, skill, seed and risk. These institutions are as important as physical resources and determine the survival of peasants. Similar to other resources, losses in carrying capacity of institutions disrupts the processes of production and reproduction of the ecosystem. To attain sustainable development, investments should give equal emphasis to both physical (e.g. land) and non-physical resources (e.g. institutions) (Berry, 1986).

Most household studies tend to by-pass the critical role that indigenous knowledge and institutions play in a peasant economy. A resource is defined not only by its physical attributes but also by the relationship between people, plants, animals and other components of the ecosystem that are embodied in it. This study argues that households can not survive, among other things, without ownership and user rights to indigenous knowledge and institutions. These resources have features of both private and communal property.

Knowledge can be acquired from specific and specialized sources, thus it becomes private property. It can also be a common property if part of the specialized knowledge is laterally transferred to friends and relatives. Indigenous knowledge can be seen as an unmanaged common because there are no specific rules governing the contribution to and extraction of the commons. Tragedy follows when members have open access to unmanaged commons. Similar to other resources, however, access to common knowledge is governed by institutions. Institutions can be viewed as private property if they serve the interest of politically or economically powerful individuals. In many cases, however, institutions provide services to members (i.e. common resource or property).

Increases in human and livestock population, and technological progress are believed to be the major causes for over-exploitation of resources. The trend in the utilization of resources is that households utilize the commons before switching to private resources. Often, switching in the pattern of resource utilization may indicate an irreversible damage to the eco-system. Furthermore, this process of resource utilization has always been seen with respect to physical resources. The importance of non-physical resources such as knowledge and institutions are not

investigated. As a result, solutions to minimize losses of carrying capacity of resources are not self-sustaining. Appropriate remedies should include an assessment of the carrying capacity of resources and designing an early warning system before reaching a point-of-no-return. It is essential to know the limits of what households contribute to and extract from the commons, and visible patterns of resources utilization when the carrying capacity of the eco-system begins to decline. Information need to be gathered on ways in which households compensate for the losses of benefits from common resources to facilitate the design of conservation strategies.

The carrying capacity of indigenous knowledge and institutions tend to decline when households are exposed to common sources of risk, and when ownership and user rights to essential resources are controlled by the state. The present research defines the term "limit" by a situation where households switch from the use of public to only private resources, and where households resort to common resources to ensure subsistence food requirements. In this study, the implication of limits to common resource management is studied among Ethiopian farmers. This study is expected to provide evidence on the importance of non-physical resources, possibilities of implementing an early warnings system based on patterns of resources utilization rather than relying on global climatic changes and the need to treat socio-cultural environment similar to the physical environment in designing strategies that help minimize the tragedy of the unmanaged commons and enhance sustainable development.

The farming system and village organization of the study sites are discussed. This is followed by examination of the importance of indigenous knowledge and institutions. The role of indigenous knowledge and institutions under situation of crop failure and predatory state are investigated. Finally, conclusions are provided.

3. The Ethiopian highland and the study sites

3.1. The Farming system

Mixed farming is the dominant system of production in the Ethiopian highlands where intensive multiple crop production is integrated with livestock production. This type of farming system is dominant at an altitude of more than 1500 meters above sea level. The system employs multiple cropping and crop rotation (cereals alternating with legumes) as a means of maintaining soil fertility. There is little use of inorganic fertilizer, manure and fallowing are used to combat losses in soil fertility.

The highlands of Ethiopia are inhabited by 88% of the total human population. Ninety five percent of the crop land, 70% of the livestock production and 90 % of the economic activities are concentrated in the highlands (Constable, 1983; Gryseels, 1988; Jahnke, et al., 1984). Over exploitation of the land and vegetation in these highlands necessitated relocation of people and preservation of the land for at least fifty years before the ecosystem re-gains its ability to support the flora and fauna (Constable, 1983).

The study took place in the Selale and Ada districts of the Central Highlands of Ethiopia. The study sites have similar farming systems and belong to the high potential cereal livestock zone. Selale is representative of the high altitude zone (more than 2000 meters a.s.l.) of the country. Ada represents the country's large middle-altitude cropping zone (1500 to 2000 meters). The major crops grown in the area include oat, teff, barley, wheat, chickpeas, horse beans and field peas. The average farm size is 2.9 and 2 hectares for Selale and Ada regions respectively (Finnida, 1989). Most households in the Selale region belong to the Oromo ethnic group, while that of Ada farmers to the Amhara and Oromo ethnic groups (Gryseels, et al., 1983; Belay,

1977). Farmers in the Selale region specialize in livestock production while Ada farmers concentrate in crop production.

3.2. The Village Organization

Until 1986, farmers lived in small villages organized in peasant associations and cooperatives. In 1986, villages dispersed through out the highlands were converted into "pseudo-city" type residential units. The consequences of this type of villagization program to household organization and economy were significant (Kebede, 1993). Peasants who used to live over an area of 800 hectares were forced to live in one, two or three villages and closer to roads accessible to vehicles.

The villagization program resulted in strengthening of cooperation among non-blood related households. However, relationships became impersonal and traditional value systems became weaker. Farmers spent a lot of time traveling from pseudo-cities to their crop fields resulting in a loss of effective working hours. Farmers were contacted more frequently by extension agents, government officials and development agents. The result of unbounded government intervention in the social and economic organization of households farther disrupted the value systems and the functioning of the social-net works, thus contributing to the decline of food production.

4. Indigenous Knowledge

Households in the Ethiopian highlands make use of physical resources, indigenous knowledge and institutions to survive from environmental catastrophe since the 50's. However, governments and international agencies focus on the human beings, land, animals, vegetation,

soil and rainfall as their targets. Indigenous knowledge and institutions are ignored . Sections four and five of this study provide a synopsis of the importance of these aspects of the eco-system.

Local knowledge is a repertoire of various kinds of information and action oriented experience (Belay, 1977; Bell, 1972; Rogers, 1983). Indigenous knowledge refers to skills and experience gained through oral tradition and practice over many generations. To be indigenous, the knowledge must be functional within a given socio-economic and spatial boundaries of a society. It must be an active part of the culture of the population concerned, preserved, communicated and used by its members to some purpose in relation to a productive activity within the society (Bell, 1972). Variations in knowledge are observed by sex, age, ethnic group and degree of contact with the outside world (Warren, et al., 1988). To examine variations in knowledge, problem solving tests were administered to fifty households. The test relates to production and marketing problems as these are the most important decisions that determine the survival of households. The results are presented below.

4.1. Problem Solving Tests

Prior knowledge can be obtained from social experience, and schooling. To establish a bench mark for comparing answers given by households, the questions were presented to a group of farmers whose age ranges between 18 and 65. A score of 1 to 10 was prepared. Answers given by each farmer was rated relative to those given by the group. Farmers were grouped into two: those who were closely affiliated with government institutions (politicians and extension agents) and those who were not. The result of frequency distribution of production and marketing

knowledge are presented in Table 1. The results indicate that farmers who were closely affiliated with government institutions (group 1) received higher scores in production and marketing problems than farmers who were not (group 2).

Table 1. Differences in Knowledge Because of Access to Government Institutions

Type of Knowledge	Ada		Selale	
	Group 1	Group 2	Group 1	Group 2
Knowledge (score/10)				
Crop Production	8	7	7	7
Livestock Prod.	7	6	8	7
Marketing	9	8	7	6
Sample Size	14	36	24	26

Household studies in LDCs have found a strong relationship between experience (age) and knowledge (Warren, et al., 1988). To examine the relevance of this conclusion in the study sites of Ada and Selale regions, 42 farmers with different periods of experience were selected. A score, as indicated earlier, was prepared (see Table 2).

Table 2. Scores of Problems Solving Tests By Region

Experience (years)	Selale Region			Ada Region			N
	Crop Prod.	Livest. Prod.	Market	Crop Prod.	Livest. Prod.	Market	
5	5	6	7	6	4	7.5	4
10	5.5	6	7	7.5	5.2	7.9	5
15	6.2	7	6.5	8	5.3	8.1	4
20	6.8	7.1	7.2	9.1	5.5	8.4	12
25	8.1	8.2	8	9.4	5.8	8.9	2
30	8.5	8.5	8.4	9.5	6.4	9.1	5
35	8.7	8.8	8.5	9.7	6.5	9.4	7
40	9	8.9	8.8	9.78	6.6	9.5	4
45	9.1	9.0	8.9	9.81	6.8	9.61	3

Production knowledge increases at a faster rate until the number of years of farming experience reaches 25 (Table 2). The young generation (18 to 30 years of age) visit cities and markets frequently and interact with people who have attended secular schools. Consequently, farmers in this age group attained higher scores on marketing questions compared to older farmers. The results also indicate location-specificity of knowledge. That is, crop production knowledge is not only high but also increases at a faster rate among Ada farmers while this pattern holds true for livestock production knowledge among Selale farmers. Furthermore, marketing knowledge is relatively high among farmers living closer to big cities (e.g. Ada).

5. Access to Resources and Institutions

Household decision making in the Ethiopian highlands is influenced by institutions that operate at village, regional and national levels. Institutions at a village level can be referred as "inter-household and micro-macro interface" institutions, while those originating from outside the village can be categorized as "macro-integrating forces or institutions" (see Kebede, 1993). The micro-macro interface institutions or social net-works provide insurance and access to resources such as labor. Other forms of institutions include those established by the government (e.g. service cooperatives).

The small and dispersed farmers of the Ethiopian highlands were organized into private peasant associations, service and producers cooperatives between 1974-1990. Cooperatives were

given large subsidies and benefit packages compared to private farmers (Kebede, 1993).[1] Cooperatives act as an independent institution in the marketing channel and receive more information on(about) production and marketing of crop and livestock products. Thus, their knowledge of marketing is better than individual farmers (Table 3). Members of cooperatives show less interest to form insurance related networks since they receive support from the government. Members of cooperatives tend to engage more in distributive type of social networks than in credit or insurance. Despite obtaining large farm size and coverage from risks, cooperatives accomplish less than private farmers in protecting crop lands from erosion and overgrazing of pasture (Belete, 1989).

Table 3. The Effect of Belonging to Private and Cooperative Farms on Access to Land, Labor and Knowledge

Parameter	Peasant Association		Cooperatives	
	Selale	Ada	Selale	Ada
	Average values per household			
Land (hectare)	2.9	2	3.1	2.5
Labor for farming (man days)	168	194	130	149
Production Knowledge	7.1	7.5	6.2	6.9
Marketing Knowledge	7.2	8.1	7.5	8.4
Labor for social group:				
Distributive	105	73	167	140
Credit	93	98	68	76

Sections four and five described the importance of knowledge and institutions in the Ada and Selale regions. Sections six and seven discuss these resources with respect to households

[1] Cooperatives were formed to attain the objective of transforming peasants into a working class. However, advocates of the commons argue that managed commons (e.g. cooperatives) are needed to internalize risks or rents of misuse of resources and avoid tragedy (Andelson, 1991).

goals and in situations where households face uncertainty in securing adequate food supply.

6. Household Goals, Indigenous Knowledge and Adjustment Mechanisms

The guiding principle of resource allocation varies within a household and between households. These may include risk spreading, risk minimization, disaster avoidance and opportunistic (Eisemon, et al., 1988). Households evaluate benefits accruing from access to privately and communally owned resources in ranking goals and strategies. The primary goal of households in the study sites is reducing the risk of falling below subsistence food requirements.

Decisions made by households reflect failures of the eco-system to provide access to resources. For instance, if crop farming fails the mechanisms through which farmers plan to provide subsistence requirements depend on what households own rather than what they obtain from the commons or government (Table 4). This pattern of resource management also depends on possibilities open to each region. Regions where access to common grazing areas are relatively better, thus offering greater carrying capacity, have more livestock thus enable households to make use of livestock during periods crises. Farmers living in regions closer to big cities have good marketing knowledge and institutional linkages in the marketing system. Thus, they make use of their specialized knowledge of trade as a means of reducing the effect of crop failures (Table 4).

Table 4. Goals and Strategic Decision Making

Items		Selale	Ada
If crop fails :	sell livestock	55	29
	engage in trade	12	23
	trade/wage labor	32	46
	Request gov't assistance	1	2

Failures of common knowledge and physical resources to provide subsistence requirements force households to make use of specialized or private knowledge.[2] For example, all producers plant more than one crop on different plots with different soil characteristics. Moreover, households raise different classes of livestock. The success of these strategies, however, depends on the extent to which private knowledge differs from knowledge required for day-to-day operations (common knowledge) (see Table 5). These strategies require specific knowledge about the requirements of crops and livestock, suitability of environment, family considerations and other technical factors.

Failure to secure subsistence food requirements is manifested by switch to specialized knowledge involving strategic or sequential decision making. Among farmers of Selale and Ada regions, this pattern starts with reducing expenses, selling livestock, search for off-farm work such as trade and wage labor, reduce consumption and selling of household valuables (Table 5). The last two strategies, however, signify a point-of-no-return.

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[2] This pattern of resource utilization under situation of scarcity is the reason for the use of labels such as "efficient" or "rational" peasants. What has not been seen is that efficiency is an outcome of losses in carrying capacity of resources rather than the goal of peasants when resources are abundant.

Table 5. Responses to Questions Related to Goals of Resource Allocation Strategies

Items	Selale	Ada
1. When Rainfall is uncertain		
a. Reduce expense and increase saving	51	46
b. Sell ruminants/cattle	29	15
c. Reduce consumption	12	12
d. Sell household valuables	8	26
2. Future livestock feed is less, thus:		
-reduce livestock	37	79
-use hay, straw & reduce arable land	55	11
-Purchase feed	8	10
3. > one crop		
pest problems, market value, rainfall, family	83	97
Others	17	3
4. > 1 livestock class traction and milk	37	58
traction, milk, meat & transport	55	37
Others	9	5

Resource depletion and rainfall variability force producers to foresee what may happen to their crop and livestock enterprises, and take appropriate remedies. For example, producers anticipate that prospects for adequate supply of livestock feed in the Selale and Ada regions are bleak. When environmental degradation threatens survival, households receive very little help from social networks. Access to government assistance to reduce stress on the land through the provision of fertilizer, improved seed and cross-bred cows is limited. Households, therefore, prefer to improve management of traditional resources to cope with problems of environmental degradation. To reduce stress on the land caused by the large number of livestock, households use straw, hay, reduce crop area and livestock numbers (Table 5).

Prior to villagization farmers had access to private and common grazing lands. Farmers use common grazing lands before they resort to private pasture. Since villagization, however,

farmers have limited access to plots that are manured and capable of producing adequate supply of hay. Therefore, the major source of feed for livestock is the common grazing land. Thus, overgrazing of the unmanaged commons has increased since household start living in pseudo-cities. In post- villagization period not only the area of crop land but also the number of months a cropped land is grazed (stubble feeding) have increased compared with pre-villagization period (Table 6).

Table 6. Access and Utilization of Livestock Feed

	Pre-villagization		**Post-villagization**	
	Selale	**Ada**	**Selale**	**Ada**
Stubble feeding (ha)	1.01	1.2	1.3	1.7
No. of Months	3	5	4	6
Grazing Lands				
Common grazing/PA (ha)	60	20	45	11
Private grazing (ha)	1.5	.41	1.2	.35

Scarcity of the common grazing lands and excessive use of stubble accelerated depletion of fertility. Consequently, households are forced to search for alternative sources of feed such as atela (by product of brewing), salt, hay and growing feed on the farm. This compensation for losses of benefits from common grazing lands requires strategic resource allocation to ensure adequate supply of livestock feed (Table 7). These alternatives tend to be practiced frequently in a region that faces acute shortage of feed (e.g. Ada) (Table 7).

Table 7. Alternative Sources of Livestock Feed

Parameters	Ada	Selale
Livestock (heads)	9	13
Grazing Area (hectare)	3898	12246
Capacity (months)	3	7
Stubble Grazing area	17424	13651
Capacity (months)	5	3
Atela per year (frequency)	32	19
Salt per year (frequency)	24	40
Forage or Hay Area (hectare)	1887	3452

Other forms of decision making or switching from common to private knowledge involve the implementation of adjustment techniques (Jodha, et al., 1983). This is accomplished through re-arrangement of resources, management style and making use of social-networks as a last resort. The choice of adjustment mechanisms are influenced by the expectation of rainfall and stock of resources. Based on their expectation, adjustments are made with respect to size, number and location of plots (Table 8). In general, when rainfall is uncertain, few plots are planted on low moisture retaining plots (low-land), most crops are planted on high moisture retaining plots (upland), green or immature crops are harvested for livestock feed from a large number of plots, weeds are collected from many plots to reduce moisture competition and several weeding and re-plantings are performed to secure subsistence (Table 8).

Table 8. Strategic Management or Adjustment Techniques

Adjustment Technique	Ada Expectation of Rainfall		Selale Expectation of Rainfall	
	Depend.	Uncertain	Depend.	Uncertain
1. low lying plots	5	3	3	2
2. high lying plots	3	6	3	3
3. Harvested green	3	5	3	2
4. No. of plots from which weed are collected	3	6	4	3
5. Plots from which mature crops are harvested	6	3	4	3
6. Plots weeded >1	3	5	2	3
7. Plots planted >1	3	3	3	2

7. Institutions as a Resource and Switch Board

Benefits and carrying capacity of common resources such as crop and grazing lands, indigenous knowledge and institutions ensure securing subsistence food requirements when rainfall is adequate or normal. The carrying capacity of these resources decline when their misuse results in crop failures. when crops fail, households utilize various alternatives to receive support and design ways of sharing resources. The result from Table 9 indicates that in situations where crops fail, the commons (e.g. institutions) become less effective because all households are equally affected and the commons lack the capacity to provide members with adequate food supply.

The primary mechanism that households utilize to ensure subsistence is own adjustment mechanism involving specialized skill and physical resources. Furthermore, when rainfall is inadequate or excess, institutions, relatives and friends are exposed to the vagaries of crop failures. Therefore, the burden of securing adequate food supply lies on the household and the government. However, households expect little assistance from predatory government when the

causes of crop failures are environmental (e.g. rainfall) (Table 9). Therefore, the severity of tragedy from using resources inappropriately depends on what households can do with their skills and physical resources.

Table 9. Forms of adjustment Mechanisms and Dependencies when Households are exposed to Common Sources of Risk

Categories	Selale Normal Crop	Selale Crop Failures	Ada Normal Crop	Ada Crop Failures
	Percentage of farmers, N=60			
Sharing of labor & other resources from:				
friends	3	2	4	1
relatives	5	6	3	2
social networks	18	7	17	6
own family	74	85	76	91
Expectation of Assistance from:				
Government	5	15	12	21
networks	15	5	10	1
relatives	10	6	6	2
friends	5	1	3	1
own	55	73	71	75

Common resources serve as an insurance when decisions critical to the survival of households are shared by the state. This is particularly true of the Ethiopian marketing agency which was functional between 1978 and 1990. The results from Table 10 suggest that in situations where selling output is controlled by the state, households make use of their own resources (esp. knowledge) and social networks in sharing or exchanging resources. With respect to expectations of assistance, however, households make use of social networks more

than their own resources. The relative importance of social networks is high in a region were social relationship are stronger (e.g. Selale) (Table 10).

Table 10. Forms of adjustment Mechanisms and Dependencies when marketing decisions are shared by government

Categories	Selale		Ada	
	When selling of output is			
	controlled	free	controlled	Free
	Percentage of farmers, N=60			
Sharing of labor & other resources from:				
friends	5	6	2	1
relatives	15	12	3	2
social networks	25	10	15	5
own family	55	72	77	92
Expectation of Assistance from:				
Government	1	10	25	14
networks	60	18	52	10
relatives	10	5	7	3
friends	5	2	2	1
own	24	65	14	72

Ownership rights to land are the major source of uncertainty in peasant agriculture. Households have access to land use rights. Similar to any public good, therefore, household care little to the consequences of over-exploitation or losses of fertility as long as they secure subsistence requirements. Similar to Tables 9 and 10 , social networks and own resources play significant role in sharing of resources and expectation of assistance when land is state owned than when it is private (Table 11).

Table 11. Forms of adjustment Mechanisms and Dependencies when land is fixed or state owned

Categories	Selale		Ada	
	When land is owned by the			
	State	private	State	private
	Percentage of farmers, N=60			
Sharing of labor & other resources from:				
friends	6	5	2	4
relatives	12	10	8	7
social networks	35	15	22	10
own family	47	70	68	79
Expectation of Assistance from:				
Government	1	9	2	15
networks	34	15	21	5
relatives	8	5	3	2
friends	2	1	2	1
own	55	70	72	77

What are the implications of results of Tables 9, 10 and 11? Households switch to exclusive use of specialized knowledge when the only means to secure subsistence requirements is own resource. This switch is reflected by strategic or sequential decisions and a search for alternative sources of food and feed. When environmental degradation affects the livelihood of members of a society, households make use of their skill and intra-household institutions or the government state. However, when important physical resources are owned by the state and decisions that are critical to the survival of households are shared by the state, households switch to social networks and own resources to ensure subsistence food requirements. In so doing, they attempt to reduce the severity of poverty and hence losses of human resources.

8. Conclusions

Common resource management is investigated with respect to land, labor, indigenous knowledge and institutions among producers in the Central Highlands of Ethiopia. Conventional studies regarding the tragedy of the commons have ignored the importance of resources with non-physical attributes. This study has demonstrated that strategies that don't take into account indigenous knowledge and institutions in the design of development strategies are doomed to failure.

The results of this study indicate that in a situation where all producers are subjected to a common source of risk (e.g. rainfall): i) the institutional resources become less effective, and ii) combination of land, labor, knowledge and other complementary resources form the basis for adjustment mechanisms, and that these decisions are intended to provide subsistence food requirements for the household. When essential resources such as land are government owned and household decisions are shared by the state (e.g. marketing of grain), local institutions become an effective means to maintain reproduction of the farm and the producer through providing access to or sharing of resources. Losses of resources are the result of mismanagement. That is, they are the outcome of knowledge-directed actions of decision makers and the infrastructure that permits these actions (i.e. institutions). Thus, successful development strategies that are intended not only to revitalize the ecosystem should incorporate indigenous knowledge and institutions as major components.

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