INFORMATION TO USERS

This manuscript has been reproduced from the microfilm master. UMI films the text directly from the original or copy submitted. Thus, some thesis and dissertation copies are in typewriter face, while others may be from any type of computer printer.

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleedthrough, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send UMI a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

Oversize materials (e.g., maps, drawings, charts) are reproduced by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps. Each original is also photographed in one exposure and is included in reduced form at the back of the book.

Photographs included in the original manuscript have been reproduced xerographically in this copy. Higher quality 6" x 9" black and white photographic prints are available for any photographs or illustrations appearing in this copy for an additional charge. Contact UMI directly to order.
Irrigation and state formation in Hunza: The cultural ecology of a hydraulic kingdom

Sidky, M. Homayun, Ph.D.

The Ohio State University, 1994
IRRIGATION AND STATE FORMATION IN HUNZA:  
THE CULTURAL ECOLOGY OF A HYDRAULIC KINGDOM 

DISSERTATION 

Presented in Partial Fulfillment of the Requirements for 
the Degree of Doctor of Philosophy in the Graduate 
School of The Ohio State University 

By 

M. Homayun Sidky, B.A., M.A. 

The Ohio State University 

1994 

Dissertation Committee: 

A. R. Walker 
E. E. Borguignon 
J. C. Messenger 
R. H. Moore 

Approved by 

Advisor 

Department of Anthropology
Copyright by
M. Homayun Sidky
1994
ACKNOWLEDGMENTS

I am grateful to The Ohio State University for awarding me a Presidential Scholarship that enabled me to conduct the research for this dissertation. I wish to thank Dr. Anthony R. Walker for his tolerant and patient supervision of this dissertation, for his constant support and encouragement beyond the call of duty, and for his suggestions and constructive criticisms. I would also like to thank the members of my dissertation committee for their insights, helpful suggestions, and support. I wish to express my gratitude for the support given to me during my course of study at The Ohio State University by Dr. C. M. Chen, Chairman of the Department of Anthropology. Finally, I wish to express my thanks to my Hunzakut friends who opened their hearts and homes to me during my brief stay in their country.
VITA

November 11, 1956 .............. Born - New York, New York

1978 ............................ B.A., Rocky Mountain College, Billing, Montana

1985 ............................. M.A. Department of Sociology, University of Miami, Miami, Florida

PUBLICATIONS


FIELDS OF STUDY

Major Field: Anthropology

Studies in Cultural Ecology, Anthropology of Religion, Central Asia
TABLE OF CONTENTS

ACKNOWLEDGMENTS ........................................ ii
VITA ................................................... iii
LIST OF TABLES ........................................ vi
LIST OF FIGURES ........................................ vi
LIST OF PLATES ......................................... vii
PREFACE ................................................ ix

CHAPTER PAGE

I. INTRODUCTION: HUNZA AND THE STUDY
OF STATE FORMATION ............................. 1
   Introduction ........................................ 1
   Hunza: Geographical and Historical
   Background ........................................ 2
   The People and their
   Ethnolinguistic Affiliations ................... 9
   Hunza and the Coming of Islam ................ 18
   Subsistence, Economy, and Social
   Organization ....................................... 19
   The Hunza State ................................... 26
   The Anthropological Study of Irrigation .... 32
   Focus of the Present Study .................... 43

II. HUNZA: THE ECOLOGICAL SETTING .............. 44
   The Physical Environment,
   Climate, and the Growing Season ............ 44
   Land and Water: Hydraulic Ecology and
   Mountain Oasis Environments ................ 53
   Soils, Soil Management, and Land-Use
   Patterns .......................................... 68

III. THE DEVELOPMENT OF HUNZA'S HYDRAULIC WORKS
   AND RISE OF THE HUNZA STATE ............... 74

IV. HYDRAULIC AGRICULTURE AND STATE
   AGRO-MANAGERIAL CONTROLS .................... 121
   The Agricultural Cycle and State Regulation
   of Crop Production ............................. 121
**LIST OF TABLES**

<table>
<thead>
<tr>
<th>TABLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Estimates of present-day population size and size of arable lands in villages in the Hunza Valley</td>
<td>149</td>
</tr>
<tr>
<td>2. Area under cereal production and estimated outputs of grain and straw on a 2 ha farm</td>
<td>197</td>
</tr>
<tr>
<td>3. Estimated nitrogen requirements of the various crops on a 2 ha farm</td>
<td>198</td>
</tr>
<tr>
<td>4. Estimated outputs from various fodder sources</td>
<td>201</td>
</tr>
<tr>
<td>5. Estimated manure production capacity of Hunzakut ruminants (DM) and total outputs from livestock on a 2 ha farm</td>
<td>205</td>
</tr>
<tr>
<td>6. Estimated nitrogen obtained from all sources on a 2 ha farm</td>
<td>207</td>
</tr>
</tbody>
</table>
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>FIGURES</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Map 1. Hunza's location between Central and South Asian.</td>
<td>3</td>
</tr>
<tr>
<td>2. Map 2. Village settlements along the Hunza Valley</td>
<td>11</td>
</tr>
<tr>
<td>3. Map 3. Central Hunza's major hydraulic works</td>
<td>82</td>
</tr>
<tr>
<td>5. Map 5. Territorial expansion of the Hunza state during the reign of Silim Khan III</td>
<td>106</td>
</tr>
<tr>
<td>6. The Hunzakut agricultural and ritual cycle</td>
<td>132</td>
</tr>
<tr>
<td>7. The Hunzakut pastoral cycle</td>
<td>172</td>
</tr>
<tr>
<td>9. The flow of nutrients and materials in a Hunzakut farm</td>
<td>208</td>
</tr>
</tbody>
</table>
# LIST OF PLATES

<table>
<thead>
<tr>
<th>PLATES</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Old road to Hunza</td>
<td>4</td>
</tr>
<tr>
<td>II. Central Hunza Valley</td>
<td>12</td>
</tr>
<tr>
<td>III. Ethnic groups in Hunza</td>
<td>13</td>
</tr>
<tr>
<td>IV. Hunzakut Children</td>
<td>17</td>
</tr>
<tr>
<td>V. Around a Hunzakut Village</td>
<td>24</td>
</tr>
<tr>
<td>VI. Royal Hunza</td>
<td>27</td>
</tr>
<tr>
<td>VII. Hunza's terrain</td>
<td>45</td>
</tr>
<tr>
<td>VIII. Topographical shading</td>
<td>52</td>
</tr>
<tr>
<td>IX. Hunzakut farmlands</td>
<td>55</td>
</tr>
<tr>
<td>X. Ultar glacier</td>
<td>57</td>
</tr>
<tr>
<td>XI. Bulolo snowbed</td>
<td>58</td>
</tr>
<tr>
<td>XII. Irrigation channels</td>
<td>59</td>
</tr>
<tr>
<td>XIII. Field irrigation</td>
<td>61</td>
</tr>
<tr>
<td>XIV. Supervising water distribution</td>
<td>64</td>
</tr>
<tr>
<td>XV. Irrigation channels clinging to precipitous cliffs above Ultar side-valley</td>
<td>86</td>
</tr>
<tr>
<td>XVI. Hunzakut villager transporting boulder for irrigation channel wall</td>
<td>87</td>
</tr>
<tr>
<td>XVII. Activities during public festivals</td>
<td>133</td>
</tr>
<tr>
<td>XVIII. Hunzakut livestock</td>
<td>164</td>
</tr>
<tr>
<td>XIX. Sheep and Goats Grazing</td>
<td>176</td>
</tr>
</tbody>
</table>
XX    Summer Pastures ................................. 183
XXI   Dairy production ............................ 189
XXII. Fodder collection and production .......... 200
PREFACE

The present study is based on ethnographic, ethnohistorical, and ecological data gathered between November 1990 and August 1991 in Hunza, a remote high-mountain region of the Western Karakorams straddling Central and South Asia. The study focuses on the process of state formation in Hunza during the late-eighteenth and early-nineteenth centuries. Hunza offers an extraordinary opportunity for the study of state formation, both from historical and ethnographic perspectives. This is because Hunzakut oral tradition is replete with detailed accounts of the events leading to the rise of the state in this high-mountain society. Moreover, many of the environmental and ecological conditions under which the Hunza state emerged remain unchanged and are still accessible to ethnographic field investigation.

This study is the culmination of nearly five years of work. It had its beginnings as part of a general survey of Central Asiatic peoples and cultures. The first stage was to prepare a library research report, The Hunzakut: A Mountain People in Northern Pakistan (Sidky 1987), in order to provide a synthesis of the available ethnographic data on Hunza and its people. My interest in Hunza and its people developed rapidly, at first mainly because of the cultural ties between
Hunza and Afghanistan, my ancestral homeland. Originally I had intended to study pastoral nomads in Afghanistan, but was compelled to abandon this plan due to the Soviet occupation of that country in 1979. My interest in Hunza developed further as I came to realize that this would be an ideal field site for the study of human ecological adaptations to a resource scarce environment.

My preliminary library research led to the formulation of several research questions concerning the interconnections between ecological conditions, subsistence strategies, and social organization. With this ecological orientation I began my fieldwork, focusing on agro-pastoral production in the villages of Central Hunza.

During the initial stages of the field research my interest was directed more or less exclusively on Hunzakut subsistence strategies. As time went on, however, I found myself increasingly intrigued by Hunza's hydraulic works, a network of channels and conduits constructed during the late-18th and early-19th centuries, which has made it possible for human communities to thrive in what is otherwise a barren and desiccated landscape. The detailed information that I was able to obtain about these magnificent waterworks, their history, how they were constructed and maintained, and which communities relied on them for irrigation, made it evident that the hydraulic enterprise in Hunza was of particular significance to the rise of the Hunza state. Thereafter, the
connections between irrigation and the evolution of sociopolitical complexity became my primary research focus.

The ecological data for this study come from my own field research and from the technical reports of agronomists who have also worked in Hunza. My data on agro-pastoral production were gathered both by actual field measurements and by in-depth interviews of informants. I visited village farms to investigate irrigation practices, labor allocation, and cropping and land use patterns. I recorded data on the yields farmers obtained from the cereal, vegetable, fruit, and fodder components of a typical Hunzakut agricultural enterprise. On the farms I also collected information on the size and composition of livestock herds and how much manure the animals produced. Besides visiting Hunzakut farms, I also climbed up into the alpine pastures (3,200 meters a.s.l.), where I gathered data on the numbers and types of animals under the care of the shepherds and details regarding dairy production and herding practices. (I conducted interviews either in Persian [taught in the local schools until 1947] or in English, which is now part of Hunzakut school curriculum; sometimes I also used English-speaking Hunzakut translators.)

I have used these data to interpret the ethnohistorical information given to me by my Hunzakut informants. Some of this they presented in the form of supposed factual statements about the past, some as tales of the exploits of well-known
historical figures, and yet others as myths and anecdotes. My collection of Hunzakut oral history relating to the sociopolitical developments that took place in Hunza during the late 18th and early 19th centuries constitutes a vital component of the present study, explicating the complex developmental sequence that led to the rise of the Hunza state. Whenever possible, I cross-checked an informant's account by eliciting a second or third version from others. In cases where I encountered inconsistencies in chronology, individual or place names, or the sequence of events, I sought input from still other informants, finally settling on those versions of particular narratives for which there seemed to be greatest consensus. My purpose was not to reconstruct historical truth (probably unrecoverable in many instances), but to establish the fullest and most acceptable version of any remembered past event.

As part of my study I have also compared the ethnohistorical materials that I gathered for myself in Hunza with data contained in the large corpus of Burushaski texts and ethnographic writings assembled by the Lorimers. David L. Lorimer (1935, 1979) was the British Political Agent in Gilgit from 1920 to 1924, during which time he amassed a large body of Burushaski texts, a number of which deal specifically with Hunza's political history. Lorimer and his wife, Emily, returned to Hunza in 1934-1935 to conduct 14 months of additional ethnographic and linguistic field research. Aside
from consulting the Lorimers' published works, I was particularly fortunate to be able to study their original fieldnotes and diaries, now held at the School of Oriental and African Studies Library in London.

* * *

There is a considerable volume of anthropological writing on irrigation and its impact on society. The theoretical premises of my own study are, in large part, conceived against the background of this body of literature. However, it is the ideas of the Sinologist and historian, Karl Wittfogel, that seem to me to best explicate the particular ecological and historical circumstances that constituted the background to the rise of the Hunza state.

In his major study Oriental Despotism (1957), Wittfogel describes a form of political organization, the "Asiatic state," in which political power derives from control over the country's economically-vital hydraulic works. This political system is characterized by an asymmetrical concentration of power in the hands of governmental officials (who manage and control the state's waterworks and are in effect the "ruling class") and a supreme despot, who is the embodiment of the state and who wields absolute authority over his subjects. During this study, Wittfogel details his famous "hydraulic hypothesis," which posits causal connections between the development of a distinctive pattern of political authority,
an arid natural environment, and a hydraulic mode of production.

Wittfogel's end concern, of course, is to explain the evolution of "oriental despotism" and the socioeconomic ramifications of this form of government. The objectives of my own study, however, are more general. Following Wittfogel's insights concerning the relationships between irrigation and the development of political centralization, I shall examine linkages between specific ecological conditions, hydraulic agriculture, and the particular pattern of socioeconomic and political organization that emerged in Hunza during the late 18th and early 19th centuries consequent upon the construction of a large-scale hydraulic system by a local ruler.

My materialist approach, focusing on the determinative influence of etic phenomena on sociocultural processes, should not, however, be interpreted as one that seeks to reduce social forms to "mere epiphenomena of technologies and environments," as so many critics of this research strategy have charged. Throughout this study my aim is to emphasize the interplay between ecological, technological, economic, sociopolitical, and historical circumstances, as they relate to the evolution of the Hunza state.
CHAPTER I
INTRODUCTION: HUNZA AND THE STUDY OF STATE FORMATION

Introduction
In this study I examine the process of state formation in Hunza, a remote high-mountain kingdom in the western Karakoram mountains. The rise of the Hunza state, I shall argue, can be linked directly to the construction of Hunza's large-scale irrigation works during the late 18th- and early-19th centuries. Hunza represents a particular ethnographic instance, where the hydraulic potential of the natural environment, a degree of organizational power at the disposal of a ruling authority, and the decision to construct and operate a large-scale irrigation system led to increased political centralization and state formation.

My intentions in this opening chapter are threefold: first, to provide a brief introduction to Hunzakut society, the ethnolinguistic affiliations of its peoples, and its religious, economic, and sociopolitical organization; second, to outline certain basic theoretical issues in the anthropological study of irrigation; third, to delineate the specific objectives of the present study.
Hunza: Geographical and Historical Background

The former princely state of Hunza (36° N, 74° E) is located in the northernmost area of Pakistan, encompassing the northwestern Karakoram mountains (Map 1). Here the Hindu Kush, Karakoram, and Himalayan ranges converge to produce a vast network of glaciers, peaks, and isolated valleys. This is the most massive concentration of mountains to be found anywhere in the world. The area also contains the largest glacier system outside the earth's Polar regions (Goudie et al. 1984:359-361). Hunza's territory is roughly 7,900 km², bordering Afghanistan, Russia, and China to the northwest, north, and northeast, Baltistan and Kashmir to the east and southeast, and the valleys of Gilgit, Yasin, and Ishkoman to the south and southwest.

In the past, the region's formidable geographic barriers made access to Hunza extremely difficult. Visitors from China and Afghanistan to the north and northwest had to traverse the high and extremely dangerous mountain passes of Irshad, Kilik, Mintaka, and Khunjerab, negotiable only during the summer months and blocked by snow for the rest of the year. Travellers from Shinkari, Kohistan, and Kashmir to the south and southeast did not have to worry about snow, but still had to face a treacherous trail that zigzagged across steep and precipitous gorges (Pl.I). Incessant rock slides made journeys to Hunza from any direction both arduous and dangerous, as accounts written by travellers
Figure 1. Map 1. Hunza's location between Central and South Asia
Plate I. Old road to Hunza, cut into the sheer cliffs above the Hunza River (Photo M. Sidky)

The history of Hunza before the 18th century is vague and poorly documented (Crane et al. 1956:442). The earliest references to Hunza and its people, according to some scholars, are to be found in Tibetan annals and accounts written by Buddhist pilgrims during the seventh century (Bacot et al. 1940:150; Poucha 1960; Stein 1972:35; Ali 1982:18). Such findings, however, are of dubious value; they provide few clues to Hunza's ancient past. What little is known about the history of Hunza comes from oral tradition. We know, for example, that for centuries Hunza was an independent principality headed by a hereditary ruler, the Mir, who claimed legitimacy through a heavenly mandate\(^1\) and his special relationship with mountain spirits (Biddulph 1880:30; Knight 1893:330; Lorimer 1979:295). In addition, oral accounts tell us something about the ethnogenesis of the Hunzakut people (see below), and also provide a general picture of the events leading to the evolution of the Hunza state during the late-18th and early 19th-centuries (see Chapter III).

\(^1\) According to oral tradition, when the Hunzakut were asked by their enemies to reveal the identity of their ruler (the founder of Hunza's dynastic family), they replied "He is Ayasho, he has descended from Heaven."
The earliest written records containing detailed information about Hunza date to the latter part of the 18th century. These comprise mostly letters and official communiques written by the Chinese Governors of East Turkestan, who were at that time seeking to extend their sphere of influence over outlying territories to the south and west. These documents describe the existence of what may be portrayed as a "tributary" relationship between Hunza and China, established following the conquest of East Turkestan, in 1759, by the Chinese Emperor Qianlong (Müller-Stellrecht 1978:8-21, 136-139; 1984a:129).

The precise nature of the ties between Hunza and China is unclear, but appears to have involved little more than an annual exchange of gifts (Leitner 1889: Appendix 1:9; Macdonald 1899). Saj, a small bag of gold dust, was sent from Hunza to the Khaqan\(^2\) of China; in return horses, rolls of silk and cotton cloth, bricks of black and green tea, and ceramic bowls, dishes, and teapots were sent from Yarkand to the "Khan of Kunjut"\(^3\) (Qudratullah Beg 1980:149). Aside from their nominal subservience to the Chinese, the rulers of Hunza appear to have enjoyed complete political autonomy.

---

\(^2\) Turkish for Great Khan, the title used by the Hunzakut to refer to the Emperor of China.

\(^3\) This was another name for Hunza, literally, "land of mines." According to my informants, the term was coined by the people of Turkestan, who had heard rumors about the existence of countless gold, ruby, garnet, and lapis lazuli mines in Hunza. Nineteenth-century British sources also used the term "Kunjut" to refer to Hunza (e.g., Knight 1895; Leitner 1889; Durand 1899).
By the early part of the 19th century, when this area of the South Asian subcontinent came under the purview of the British Indian Political Department, Hunza had evolved into a powerful state-level polity (Barth 1956:79-86; Staley 1969: 229; Sidky 1993a). The rulers of the Hunza state had brought under their control a territory extending from the village of Maiyon, to the south, to the Kilik Pass, along the Chinese border, to the north (Map 1).

Towards the end of the 19th century, events occurring outside Hunza drastically altered the political fortunes of this isolated high-mountain kingdom. The British, apprehensive over the Russian push into Central Asia,\(^4\) and afraid of a possible invasion of India by Russian troops "descending from the Pamirs," embarked on a systematic program to consolidate India's northern frontier. News of a visit to Hunza by a company of Cossacks in 1889, and alarm over possible intriguing between the Dogra Maharajah of Kashmir, Patrab Singh, and the Russians (Hamid 1992:14-17; Müller-Stellrecht 1984a:129) further fostered British fears of an impending invasion.\(^5\)

In 1891, as part of an overall strategy to forestall a possible Russian onslaught on India, the British invaded Hunza

\(^4\) See Wheeler (1964, Chapters 6 and 7) for an account of the Tsarist invasion of Central Asia.

\(^5\) Younghusband (1896) and Durand (1899) provide first hand accounts of these events, which are referred to as "the Great Game." For a summary see Huttenback (1975). More detailed accounts are to be found in Keay (1979) and Alder (1963).
and, after a brief but dramatic military engagement (Knight 1893:330-337), made it part of the Gilgit Agency within Jammu and Kashmir State (Biddulph 1880:20). The British deposed the reigning Mir, Safdar Ali Khan (1886-1891), and installed in his place his half-brother, Nazim Khan (1892-1938), a person more amenable to Imperial interests.

The British invasion brought to an end a developmental sequence that began in the late-18th century, gave rise to the Hunza state during the early-19th century, and set Hunza on a course towards increasing political power and economic prosperity. Thereafter Hunza's political and socioeconomic status remained relatively unchanged until the British withdrawal from India in 1947.

Shortly after the partition of the subcontinent into India and Pakistan, and the subsequent dispute over Kashmir, the Mir of Hunza proclaimed allegiance to Pakistan Ali 1981:224). For the first two-and-a-half decades of Pakistani rule (from 1947 to 1974), the Mir retained full internal administrative powers. This autonomy, however, was abrogated in 1974, when the Bhutto regime in Pakistan abolished the privileges of the princely states. Hunza was now brought under the direct administration of Islamabad, becoming a subdivision of the Northern Areas District (Ali 1982:20).

Hunza's isolation from the rest of Pakistan, however, was not significantly breached until 1978. In that year, the 1,284 km Karakoram Highway was completed (A.S. Akbar 1988:193-194).
A joint Sino-Pakistani venture, the highway links, via the Hunza Valley, the ancient Silk Road oasis of Kashgar in Xinjiang with the twin cities of Islamabad-Rawalpindi in Pakistan. Since the mid-1980s the pace of change has escalated significantly, particularly because of the arrival of Punjabi truckers and the influx of European mountaineers and tourists.

The growth of tourism, opportunities for wage labor in the job markets of Pakistan, the decline of subsistence agriculture, a growing cash economy, and as the spread of lowland Pakistani tastes in architecture, dress, and music, have been major forces impinging on Hunzakut society. The new circumstances have already begun to alter, radically and permanently, the traditional Hunzakut way of life (Sidky 1993d).

The People and their Ethnolinquistic Affiliations

The inhabitants of Hunza live primarily along the main valley of the Hunza River (Map 2). This valley, bisected lengthwise by the Hunza River, was previously divided into two political entities: the former Hunza state, on the north bank, and the principality of Nagar, on the south (Pl. II).

Four ethnolinquistic groups are represented here (Pl. III). The first group are the Shin, or Shen (cf. Lorimer

---

1980), who inhabit the lower part of the valley, roughly from the village of Nomal to the village of Hini (Map 2). Their language, Shina, belongs to the so-called Dardic group of Indo-Aryan languages, and is spoken throughout the Gilgit region (Jettmar 1961:81).

The second group are the Hunzakut, "the people of Hunza." (They are also called Burusko, or Burusho, an ethnonym I avoid here because it refers also to the dominant population of the neighboring former principality of Nagar.) These Hunzakut live in the central portion of the Hunza Valley, from Murtazabad to Nazimabad (Map 2), and were the dominant ethnic group in the former Hunza state. The Hunzakut language, Burushaski, appears not to be related to the Indo-European languages spoken in India, Pakistan and Afghanistan, nor to those of the Sino-Tibetan family found in Ladakh and northeastern Xinjian (Berger 1985:37; Morgenstierne 1935:vii-xxx; Lorimer 1935:xxi-lxiii).8

---

7 The term "Dard," which appears in the works of colonial officers, as well as other writers from that period, is highly problematic. It has been used loosely and inconsistently to describe heterologous ethnolinguistic groups, including the Shin, Hunzakut, and the other inhabitants of the former Gilgit Agency, thus generating considerable confusion in the literature. For a discussion see G. Clark (1977:343-345).

8 On the other hand, Burushaski vocabulary has been influenced by neighboring tongues, particularly by Urdu (the national language of Pakistan), through contacts with the Pakistan army, school system, and administration, and with the Gilgit market. To a lesser extent, Burushaski, has been affected by the Sino-Tibetan (Tibeto-Burman branch) languages of the peoples of Baltistan (cf. Parkin 1987:159).
Figure 2. Map 2. Village settlements along the Hunza Valley
Plate II. Central Hunza Valley: Hunza (left), Nagar (right); the two formerly independent political entities divided by mountain ridge (center) (Photo M. Sidky)
Plates III. Ethnic Groups of Hunza: clockwise from top left, Shen, Bericho, Wakhi, Hunzakut (Photos M. Sidky)
Then there are the Guwicho, or Wakhi, immigrants from Afghanistan, and former vassals of the Mir of Hunza. They occupy an area stretching from Gulmit (Herber) to Passu. Their language, known as Gojali, or Wakhi, belongs to the East-Iranian Pamir languages and is spoken in upper Hunza and the Pamir area of Afghanistan (Buddruss 1985:27-29; Shahrani 1979:55-86).

During the 19th century, three Mirs of Hunza: Shah Silim Khan (1790-1824), Ghazanfar Khan (1824-1865), and Ghazan Khan (1865-1886), compelled the Hunzakut to colonize both the upper and lower altitude areas to the north and south. Consequently, Hunzakut villages are to be found in all three of the above-mentioned areas.

Finally, the Bericho, or Dom, a small endogamous, caste-like community of blacksmiths (dak-etash-Bericho) and musicians (egherasho-Bericho), are Hunza's least numerous ethnic group. They live mostly in their own segregated village of Berishal (now called Mominabad) in Central Hunza, but a few scattered Bericho households are also to be found in some of the Hunzakut villages. According to local tradition, these artisans were allowed to settle in Hunza as patrons of the Mir (cf. Sidky 1993b). The Bericho language, Beritski, or Dumaki, is thought to be related to the Indo-Aryan languages spoken in Kashmir (Lorimer 1939:1-19).

The total population of Hunza in the early- to mid-1980s was 32,300, distributed among 52 villages (Charles 1985:19-26;
The Hunzakut, who constitute the largest segment of the population, roughly 58%, are distributed over 2,606 households (out of a total of 4,441). The origins of the Hunzakut are lost in antiquity. A persistent, though improbable, Hunzakut local tradition claims their forbears to have been five soldiers of the army of Iskandar Azimo, Alexander the Great, who brought his military forces across the Pamirs and the Hindu Kush in 330 B.C.E, reaching Taxila, the capital of Gandahara in 326 B.C.E. (Fox 1980:319-321). These five men, according to Hunzakut tradition, were accompanied by their Persian wives and settled in Central Hunza. Here, it is said, they established the fort-villages of Baltit, Altit, and Ganesh (Map 2).

Another local tradition traces the ancestry of the Hunzakut to five warriors from a horde of "Huns, Mongols, and several other tribes," fleeing a great rebellion in their homeland of Taklamakan, to the north. While passing through the Hunza Valley, it is said, the leader of this migrating group, a man named Mughul Titam, was kicked by a horse and seriously injured. Mughul Titam's followers, realizing that their leader was too ill to be moved, left him behind under the care of four of his most loyal men. Mughul Titam eventually recovered and, along with his four companions, settled down in the Hunza Valley, where he founded the fort-
villages of Kaye (now called Baltit), Altit, and Ganesh. Today, some 30 generations later, Hunzakut say, the descendants of Mughul Titam and his comrades are still to be found in the three villages they established.

Unspoiled and beautiful beyond description, in the United States and Europe, Hunza has enjoyed an almost mythical reputation as a Shangri-la, a paradise on earth (Crane 1986:400; Müller-Stellrecht 1984b:123). No less extravagant than the almost fairytale-land image of Hunza is the extraordinary reputation of its people. Phenotypically, many have Caucasoid features and fair skins; a few even have blond hair and blue eyes (Pl. IV). Accounts written by 20th-century Western travellers have often made exaggerated claims about the extraordinary health and longevity of the Hunzakut, whom they assert live well past a hundred years (Banik and Taylor 1960; Tobe 1960; Rodale 1949). Such claims, however, are not easy to reconcile with observations by medical practitioners and researchers (Giles 1984:351; J. Clark 1963; Harada and Miyoshi 1963) that the Hunzakut suffer from a host

---

9 According to another version of this narrative, Altit territory was already inhabited by a "tribe of Huns," and was referred to as Hunukhushal, "place of the Huns." The name of the Hunza valley itself, some of my Hunzakut informants maintained, is derived from its original inhabitants, the "Huns."

10 The basis of this myth is a report (now in the India Office in London) by Robert McCarrison (1921), a British medical officer who visited Hunza briefly in 1920 and was greatly impressed by the health and longevity of the people he met (Imanishi 1963:i). The myth was perpetuated by the writings of E. O. Lorimer (cf. Staley 1982:272-273), who accompanied her husband David Lorimer during field research in Hunza in 1934-1935.
Plate IV. Hunzakut children; hair, skin, & eye colors sometimes resemble European characteristics (Photos M. Sidky)
of diseases, such as rheumatism, intestinal worms, cataracts, goiter, trachoma, pneumonia, tuberculosis, dysentery, appendicitis, and heart disease.

Hunza and the Coming of Islam

Today, the inhabitants of Hunza are Muslims. However, the past physical isolation of the Hunzakut has been instrumental in allowing them to preserve elements of their pre-Islamic shamanistic religious beliefs. Centered on practitioners known as bitan, this indigenous religious tradition has certain characteristics, such as the shaman inhaling juniper smoke and drinking the blood from a freshly-severed goat's head, which appear to be unique among South and Central Asian peoples (cf. Sidky 1994; 1993a; 1990:274-277).

Islam spread to Hunza from various directions and at different times. Written and orally transmitted sources, however, are contradictory. According to local tradition, Islam (of the Shia variety) came to Hunza during the early-16th century, after Ayasho II, thum (Mir) of Hunza, married the daughter of Abda Khan, the King of Baltistan. Tradition tells of Shia divines, called akhund, coming from Baltistan to Hunza to disseminate the Asnahashari (Shia) religion. Other sources suggest that Shia Islam reached the Hunzakut a hundred years later, with the arrival of missionaries from Baltistan or Kashmir during the late-16th and 17th centuries (cf. Staley 1969:230).
Much later, the Hunzakut were converted to the Agha Khan's Ismailia sect\textsuperscript{11} of Shia Islam (Lorimer 1979:213-214). This was brought to them, at the invitation of the Mir of Hunza himself, by proselytizers from Badakhshan, in northern Afghanistan (Map 1). All Hunzakut, except for the people of the village of Ganesh, who refused to convert, adopted Ismailia doctrines. According to some local sources, the Hunzakut accepted the Ismailia faith during "the 15th year of the rule of Mir Ghazanfar Khan" (1824-1865). Other informants maintain, however, that Ismailism came to them earlier, during the time of Mir Silim Khan (1790-1824). Local people with whom I have conversed still recall the names and genealogies of the Ismailia teachers who visited their country to spread the doctrines of the new sect.

\textbf{Subsistence, Economy, and Social Organization}

Irrigation agriculture constitutes the main economic activity in Hunza, and arable land the principal source of wealth. Traditionally, food production entailed the expenditure of enormous amounts of human energy and effort. According to David L. Lorimer (1979:28), the British Political Agent in Gilgit (1920-1924), who conducted ethnographic research in Hunza in 1934-1935:

\begin{quote}
\textsuperscript{11} The Hunzakut make up a small portion of the approximately 250,000 Ismailia now living in Pakistan. The Ismailia consider the Agha Khan as their spiritual leader (Weeks 1978:52). For a discussion of the spread of Ismailism in the subcontinent see Nanji (1978). For background to the rise of the sect itself see Madelung (1987).
\end{quote}
... almost all their ordinary activities are directly motivated by economic considerations. Creating food is the constant preoccupation of all. It has to be won from the soil and in Hunza you cannot lie back and leave nature to go on with it. Nature there is occupied with the destructive processes, mountain-breaking and denudation, and simply will not function in the creating of vegetable life except under compulsion. ... every family owns or occupies land on the produce of which it lives. The service of the land requires the cooperation of all able-bodied members of the family. The principal means of livelihood is agriculture, which provides the bulk of the food supplies.

Despite careful planning and considerable effort, Lorimer (1979:28) records, Hunzakut households often experienced critical food shortages during late-winter and spring. Today, although much has changed, agricultural production is still as laborious, time consuming, and precarious for many farmers as it was in the past.

Hunzakut farmers operate a subsistence economy that combines the cultivation of cereal crops, vegetables, and fruit and nut trees, with animal husbandry, and transhumant pastoralism. Hunzakut food crop production is intricately adjusted to ecological conditions through the use of cultigens suited to specific microenvironmental zones and complementing one another in tolerance, maturation rates, and yields. Animal husbandry is similarly adapted to ecological circumstances, through the management of size and composition of the herds, as well as through the natural ability of the various ruminant species (goats, sheep, cattle) to utilize different ecological niches. Traditionally all phases of agro-pastoral production
were coordinated by state-sponsored rituals that punctuated the agricultural year (Sidky 1993d and Chapters IV and V below). Hunzakut households constitute the principal productive units. Households are made up of patrilineally-extended families, comprising parents, unmarried sons and daughters, and married sons, their wives, and children. The typical household has an average of seven members, although in the past it was not uncommon for a few households to have up to 20 members. Household members share the same grain stores, cook and eat their meals together, sleep in one room, utilize the same tools and agricultural implements, and depend upon the same set of resources to meet their subsistence needs (Ali 1982:218).

Traditionally, authority over the family rested with its senior male. He decided such matters as the acquisition of new land, exchange of grain and livestock, and anything else pertaining to property rights. All foodstuffs not used for immediate consumption, such as grain, butter, and dried fruits in storage, strictly belonged to the male head of the household. Any money, cloth (once an imported luxury item), weapons, along with the family's farming implements, were also the property of the senior male.

The patrifocality and patriarchal nature of the Hunzakut family should not, however, be read as indicative of female insignificance. The senior female of the household was in charge of the family's valuable metal utensils. She was also
responsible for managing the household's limited food supply, so that the males received more than females and adults more than children. All this she had to do, while still making sure that everyone had sufficient to eat, despite the inevitable dwindling of food supplies as the winter months wore on. Her crucial role as manager and distributor of food cannot be underestimated, since any error on her part could have resulted in family starvation. According to Lorimer (1979:156), females who mismanaged the household food supplies were sent back to their fathers' homes. The female household head also exercised complete authority over all other women and girls in the family. It was well understood, not least by the menfolk, that her managerial abilities were what determined the family's happiness, well-being, and harmony.

The typical household owned between one to two hectares of land (1 ha = 2.47 acres), divided into locationally-separate fields, orchards, and irrigated pastures. Such a dispersed land-holding pattern was the result of Hunza's traditional land-tenure system (see Chapter III).

The optimal utilization of these small, privately-held parcels of land has traditionally been achieved primarily through the household's own labor input. The household divides its labor according to sex and age. Men prepare the fields, irrigate the soil before and after sowing, plant the crops, prune and plant trees, procure fodder, tend and milk sheep and goats, repair terrace walls, and clean and maintain the
irrigation channels. Women weed and thin the crops, haul and spread manure, grow vegetables, collect fodder, gather and process fruit, and (along with children), tend and milk the household cows. All able-bodied members of the household jointly reap, winnow and thresh the crops, and carry home the harvested grain and foodstuffs.

Households constitute the principal units of production, while villages -- the hubs of communal life -- are formed by agglomerations of households (Pl. V). Members of various households in a village may belong to one of several exogamous patrilineal clans (there are 15 in Central Hunza). The clan represents the most inclusive descent category, beyond which no appeals are made to common lineal ancestry (cf. Ali 1982:90). Each clan has distinct origins and possesses a separate genealogical charter; but otherwise all clans are politically and socially isonomous. Clan membership regulates marriage (and one clan, the Diramitting, as we shall see below, had certain ritual prerogatives), but otherwise these kinship categories played little part in the traditional organization of most Hunzakut village communities (see Chapter III).

Neighboring households in the villages frequently help each other with demanding tasks, such as preparing fields, and harvesting crops. Such inter-household aid at critical times during the agricultural cycle not only alleviates the labor shortages of particular productive units,
Plates V. Around a Hunzakut village: clockwise from top left, windowless houses with characteristic smoke holes; street running underneath mosque; narrow street, family inside home (Photos M. Sidky)
it also reinforces household interdependencies and village solidarity.

Circumstances associated with everyday life in traditional Hunzakut villages serve to override genealogical boundaries and foster wider village ties. People living in the same village are subject to similar ecological conditions and environmental perturbations; they depend upon the same section of the irrigation system for their water, and they are jointly responsible for the operation and upkeep of their branch of the hydraulic network. Cooperation and mutual assistance are therefore in the interests of a village's inhabitants.

In the past, villagers also had to cooperate closely with one another in order to be able to synchronize their agro-pastoral activities with respect to the water-disbursement timetable and ritual calendar imposed by the state (see below, Chapters II and III). Moreover, joint cooperative action was required (as it still is) for the upkeep of the village's agricultural infrastructure: paths, terrace-walls, conduits, reservoir-tanks, and de-silting ponds. These practical economic relationships, cutting across kinship categories, served to unite individuals and households and helped to create a sense of "community."

Villages, in turn, were involved in broader cooperative exchange networks that were necessary to maintain the agricultural infrastructure (terraced slopes and the hydraulic network) upon which Hunza's agriculture depended, as it still
does. Thus, although Hunzakut households represented the primary units of production, the total agricultural enterprise depended (as it still does to some extent) upon group collaboration and mutual assistance among neighbors and between villages.

The Hunza State

By the start of the 19th century, Hunzakut society had attained a degree of political centralization and social stratification to warrant classification as a state-level polity. At the apex of the traditional state hierarchy of the Hunza was the Thum, or Mir (Pl. VI). Thum was his Burushaski title, Mir its Persian equivalent. The Mir, commanding supreme political authority, was deemed also to be the source of fertility, able to control the melting of glaciers, produce snow and rain, and quell storms (Qudratullah

---

12 Defined here as an autonomous political body, controlling a defined territory incorporating many communities, possessing a centralized government and administrative bureaucracy, with powers to issue and enforce legislation, extract taxes, conscript labor, and draft men for military service. State level polities are also characterized by a degree of social stratification and differential access on the part of higher and lower social strata to the necessary means of production. Some writers argue that states also differ from other types of political entities in terms of "scale," having populations numbering "at least in the hundreds of thousands" (e.g., D. H. Thomas 1989:357). However, states can be small (as in the case of Hunza), although they may have the potential for encompassing large numbers of people (Rosman and Rubel 1989:150). See Cohen and Service (1978) and Bodley (1994:160-162) for other definitions.

13 Since Burushaski had no written form, Persian was the official language of the Hunza court. (Burushaski was not written in the Arabic-based Persian script because this, according to Lorimer (1935:xlviii), does not have the facility to correctly express all the sounds of the Burushaski language.) Thus, communications between the British Government in India and the Mirs of Hunza were written in Persian. This language was taught in the local schools until 1947, when it was supplanted by Urdu. Many elderly Hunzakut remain fluent Persian speakers.
Plate VI. Royal Hunza: clockwise from top left, Baltit the royal capital, with Mir's palace at center of picture; Mir's palace; Mir's fort at Altit with statue of sacred ibex atop tower; royal cemetery at Baltit (Photos M. Sidky)
Beg 1980:95, 219). All land in Hunza was considered the personal property of the Mir, who granted usufruct rights to his subjects in return for payments in kind and in corvée labor.

The Mirs of Hunza belonged to a dynastic family, the Ayashkutz, that traced its bloodline to legendary rulers of centuries past (cf. Qudratullah Beg 1980:66-81). It was a cadet lineage of the Tarkhany rulers of Gilgit. The royal family of Hunza maintained extensive marital ties (through bride exchange) with both the Tarkhany of Gilgit, and the ruling families of neighboring Muslim principalities (e.g., Nagar, Punyal, Yasin, Ishkuman, Chitral, Ladakh, Baltistan, Wakhan, Badakhshan).

Only a member of the Ayashkutz family could claim the throne of Hunza. There were, however, no precise rules of succession. When the Mir died, his sons and brothers (if there were any) entered into a bloody power struggle that ended only when one claimant succeeded either in murdering or forcing his rivals into exile.

The Mir was supported by an administrative hierarchy comprising officials who held hereditary posts and estates (cf. Lorimer 1979:127-128). The Mir also had a large staff of attendants and court functionaries, such as the farrash (steward), yasawal (royal attendants), yilchi (diplomatic envoys), and ilbanchi (collectors of taxes from the Wakhi, as well as from the Kirghiz nomads in Upper Hunza), and bodigar
(a corps of armed bodyguards, hence the English-derived name). The Mir also had yerfa, or royal caretakers, men who were responsible for supervising the sowing, watering, reaping, and harvesting operations on the royal estates. There were, in addition, scribes, messengers, musicians, farriers, a stable master, royal herdsmen, scullions, and cooks. There was also an assortment of palace women, called yurghul, who entertained the ruler and his special guests. Finally, tahangum -- lowly servants and slaves -- were maintained as charcoal-makers, water-carriers, and sweepers.

At the head of the state's governmental bureaucracy was the Wazir, who functioned as prime minister, arbitrator, and military commander. He was duty-bound to serve the ruler. Below the Wazir were the trangfa, or village headmen. They operated under the direct supervision of the Wazir.

The trangfa oversaw the everyday affairs of the villages, the basic units of political organization in Hunza. These trangfa were responsible for ensuring that their respective communities fulfilled their tenancy obligations to the state. Trangfa also mobilized labor for public works projects and recruited men from their respective villages in times of war. These headmen were also accountable for making sure their villagers complied with the agro-managerial guidelines imposed by the state. Moreover, trangfa adjudicated minor legal cases and arbitrated disputes over the allocation of water. Finally, village headmen were in charge of appointing and overseeing
darago, special officers who monitored the water channels and supervised their proper operation.

The Wazir and trangfa were drawn from a small class of landed aristocracy, the karpating (or "Great Ones" in Burushaski; they were also referred to as akabir, the Persian honorific of the same meaning). Below this aristocracy was a large class of cultivators, who worked small landholdings, usually of about one to two hectares. The akabir and small landholders were permitted to carry arms and were compelled to perform military service.

The boldakoyo, meaning "load carriers," were tenant farmers, a class ranked beneath the small landholders in traditional Hunzakut society (Pl. VII). They were obliged to provide compulsory labor for the Mir; carrying his goods from village to village, and sowing and harvesting his crops. In return these load-carriers received an annual payment of grain. The boldakoyo also had to provide two men to work for each akabir family. Moreover, in spring and fall, the load-carriers were compelled to work, under the supervision of the Wazir and trangfa, as gold-washers for the state. The boldakoyo were forbidden to bear arms and, in times of war, functioned as military porters.

Finally, there were the Bericho, the lowly caste-like group at the bottom of the Hunzakut social scale. Besides their services as musicians and blacksmiths, these Bericho had to provide compulsory personal service to the Mir himself,
such as collecting and transporting night-soil and animal manure for his fields, fetching firewood, or, occasionally, taking care of his livestock (Lorimer 1979:30). The Bericho, like the boldakoyo, were forbidden to wield weapons, but they were recruited in wartime to perform the often-dangerous job of military reconnaissance.

Traditional Hunzakut society was characterized by a remarkable degree of social mobility; almost anybody who displayed outstanding merit or valor, was exceptionally loyal to the Mir, or possessed some special skill, might be rewarded with land (the principal source of wealth), and so be elevated in rank. But the Mir also had the indisputable right to confiscate estates that he had previously granted, demolish people's houses, and remove anyone from office. Moreover, he commanded the power to punish, imprison, exile, execute, or sell into slavery recalcitrant subjects, along with their entire families. In this manner, the Mir controlled the economic, political, and personal fortunes of his subjects.

State organization revolved around various duties and obligations associated with land. These included payment to the Mir of a specified amount of grain, butter, firewood, fodder, and head of livestock, as well as providing visiting state officials with food and shelter, maintaining paths and irrigation works, and performing military service. In addition, the class of small landholders and tenant farmers
were obliged to provide rajaki ("King's work" in Burushaski), or corvée labor.

The Anthropological Study of Irrigation

In Hunza, state-formation and the development of large-scale hydraulic works occurred simultaneously. Hunza commands one of the largest and most complex irrigation systems in the whole of the western Karakoram mountain range (Charles 1985). Built during the 18th and early-19th centuries, Hunza's hydraulic system not only facilitated the expansion and intensification of agriculture, but it also contributed significantly to the process of political centralization and the emergence of the Hunza state.

The role of irrigation in the evolution of centralized political organization has attracted considerable scholarly attention (Coward 1980; Downing and Gibson 1974; Johnson 1972; Steward 1955). Much of this research has been influenced by Karl Wittfogel's "hydraulic hypothesis" (cf. Bloch 1983:113; Bailey and Llobera 1979:550; Ulmen 1975). Wittfogel (1981a, 1981b, 1969, 1957a, 1957b, 1956, 1931) maintains that, under certain circumstances, the organizational tasks of building and operating a large-scale irrigation system can produce increased political integration and centralization.

Wittfogel is interested principally in what he terms the "Asiatic/hydraulic state," which he sees as having derived its
essential characteristics from what Karl Marx (1853) had earlier defined as the "Asiatic mode of production."\textsuperscript{14} The "hydraulic state," Wittfogel maintains, followed a radically different evolutionary course than did the state-level social formations in Western Europe and elsewhere. The evolution of the "Asiatic state," he argues, was tied directly to the special circumstances associated with large-scale irrigation.

This type of social formation, Wittfogel observes, developed in arid plains and valleys, where land was made cultivable by means of government-operated waterworks. The creation and maintenance of these immense canal systems, Wittfogel argues, required the mobilization, coordination, and deployment of labor on a massive scale. The hydraulic enterprise, Wittfogel (1957b:18) says, had decisive sociopolitical implications:

A large quantity of water can be channelled and kept within bounds only by the use of mass labor; and this mass labor must be coordinated, disciplined, and led. Thus a number of farmers eager to conquer arid lowlands and plains are forced to invoke the organizational devices which --on the basis of premachine technology--offer the one chance of success: they must work in cooperation with their fellows and subordinate themselves to a directing authority.

\textsuperscript{14} Karl Marx (1853) developed this concept through his analysis of the traditional political systems of ancient India and China; he intended to apply it to Asian and African societies in place of the Eurocentric model of feudalism (cf. Bailey and Llobera 1981:12-45, 109-112; Wittfogel 1969). There are a number of theoretical problems with Marx's concept of Asiatic mode of production, such as its positing the existence of a state without classes (see Taylor 1979:172-186, Turner 1983, and Bailey 1981 for a review), but these need not detain us in the context of the present discussion.
The effective management of such large-scale hydraulic systems, according to Wittfogel (1957b:27),

... involves an organizational web which covers the whole, or at least the dynamic core, of the country's population. In consequence, those who control this network are uniquely prepared to wield supreme political power.

The managerial tasks necessary for constructing and maintaining great hydraulic networks, flood-control, and allocating water, Wittfogel (ibid p. 27) suggests, generated a complex administrative bureaucracy, subordinated to a single ruler, who personified "the state" and wielded total and absolute power. The state itself (in the person of the ruler) assumed ownership of land (one of the principal means of production), granting usufruct rights to particular village communities in return for payment in the form of taxes, strategic materials, and corvée labor on a huge scale for public works projects.

The "hydraulic state," Wittfogel observes, differs from other types of state-level polities because of the special economic functions it fulfills; namely, its role as the provider and organizer of the means of production. The "hydraulic state" is not merely a "political superstructure," overlaying an "economic base," or "infrastructure," to use Marx's own terminology, but a vital component of the economic infrastructure itself (cf. Wittfogel 1969:362). Because its political structure represents an ecological adaptation -- i.e., agro-managerial and state-directed action representing
the only solutions to the problems posed by the natural environment (Wittfogel 1969:361) -- the "hydraulic state" displays an enduring and static nature, possessing a remarkable capacity to restore itself, despite numerous dynastic upheavals and periodic conquests by invaders (cf. Harris 1979:104, 1977:155-160).

Because the state controlled the productive resources and the surplus produced with them, Wittfogel adds (1957b:27), it also organized agricultural activities and set production priorities through its taxation programs. The personnel of the state "agro-managerial bureaucracy," a group of professional functionaries who were in charge of the governmental machinery and controlled the economy of the country, but who did not own the means of production, emerged as the "ruling class" (Wittfogel 1969:361). Politically and economically they dominated the vast numbers of immediate producers, the illiterate peasantry.

The immense governmental apparatus of the "hydraulic state," however, was offset by a relatively underdeveloped "civil society," whose members represented an exploited class, existing in a general state of slavery. The basic units of political and economic organization under a "hydraulic regime," Wittfogel adds, comprised autonomous, economically self-sufficient, and internally undifferentiated villages, where land was held under communal tenure and cultivated through elementary production techniques.
Wittfogel (1969:362-364; 1956:153-155) himself is concerned mainly with the origins of a particular pattern of authority -- the immutable agro-managerial despotism that characterized the political systems of ancient China and India -- rather than with the origins of "the state" per se (contra D. H. Thomas 1989:566). It was Julian Steward (1949, 1955:1-2), the influential proponent of the ecological approach in American anthropology (cf. Bloch 1983:130; Harris 1968:655), who incorporated the hydraulic hypothesis into a broader evolutionary framework, in order to explain the origins of the pristine states in Mesopotamia, Egypt, Mesoamerica, and the Central Andes (cf. Harris 1968:671).

The study of the rise of the state is, as Murphy (1967:24) has put it, of particular anthropological interest in so far as ethnographers have collected firsthand data on nascent states in modern times, while many archaeologists are concerned with the rise of pristine states (cf. Rosman and Rubel 1989:150; R. Cohen 1978:1-20). It is not surprising, therefore, that Wittfogel's thesis has attracted considerable interest among anthropologists.

---

15 I use the term "pristine states" in Fried's (1960:713) sense, that is to refer to those political entities whose origins were sui generis, out of local conditions, rather than through acculturation due to pressures emanating from already existing, but separate, state-level social formations.

16 Steward (1968:323; 1970:200,212-216, 220; 1977:91) later amended his position, maintaining that irrigation represents one of a number of causal variables in the evolution of political complexity.
Archaeologists have sought to test the hydraulic hypothesis by examining the temporal relations between the development of large-scale irrigation networks and the evolution of socioeconomic and political characteristics commonly associated with state-level social formations, such as evidence of social stratification based on class (and concomitant changes in sociopolitical organization and residential patterns), monumental public edifices, the appearance of cities, etc. Such investigations have led to two divergent positions. Some researchers have found a positive correlation between centralized political authority and large-scale irrigation. Others have reached the opposite conclusion, claiming that the establishment of great hydraulic works was more often a "consequence" than a "cause" of political complexity and state formation, however much the

17 MacNeish (1967:325-326), Wittfogel (1972), Harris (1977:155-160), Service (1978:30), and Murphy (1986:125) point to irrigation as an important causative factor in the development of first cities and pristine states in Mesoamerica, the Central Andes, Mesopotamia, and China. V. G. Childe (1951:89-90, 114) also stressed the importance of canal irrigation on the evolution of social complexity and the "urban revolution" in the Near East. See also Sanders and Price (1968:178-188) and Sanders and Marino (1970:104-105) on the importance of irrigation in the evolution of states in Mesoamerica and the Central Andes, Sedov (1968) and Coèdes (1968) for the importance of irrigation for the state of Angkor in Cambodia, Elliott (1978) for Central Thailand, Potter (1976) for Northern Thailand, and Tichelman (1980) for Indonesia.
requirements of large-scale irrigation might have subsequently influenced the development of administrative bureaucracies.\textsuperscript{18}

The problem has been tackled somewhat differently by ethnographers working with data from contemporary societies. These researchers have sought to ascertain whether the successful construction and operation of canal irrigation systems require some form of authority structure and whether large-scale irrigation systems need centralized management (cf. Hunt 1988:336). Again, research has led to conflicting views over the precise effects of irrigation on political authority.

Mencher's (1966) comparative ecological study of Kerala and Tamil Nadu (two regions in south India), for example, shows that highly nucleated villages, well-developed road systems, and centralized and bureaucratized political organization tend to occur in the Tamil Kingdoms, where rainfall is unpredictable and insufficient for dry farming and where food production depends on canal irrigation (Mencher 1966:137). In Kerala, by contrast, where there is abundant rainfall and wells for irrigation, one finds dispersed settlements, absence of roads, and less centralized and

\textsuperscript{18} For example, Adams (1966, 1968:371) and Hole (1968:356) argue that in Mesopotamia and Mesoamerica the establishment of great hydraulic works followed state formation. For a rebuttal see Sanders and Price (1968:183-186) and Harris (1977:160-161). Wolf and Palerm (1968:350) have reached a similar negative conclusion for Mexico. Comparable results are reported by Butzer (1976:111) in his study of irrigation in ancient Egypt. For a rejoinder to Butzer see Harris (1977:160-161). Carneiro (1970) rejects Wittfogel's irrigation thesis in favor of his own population pressure/circumscribed environment model.
bureaucratized political organization (*ibid* pp. 162-163). This relationship appears to confirm Wittfogel's general proposition.\(^{19}\)

Millon's (1962) comparative study of seven ethnographic cases (from different regions of the world), focusing on the linkages between the size of irrigation systems, the total number of individuals supported by them, and the degree of centralized authority, on the other hand, has led him to conclude that there is no clear relationship between the degree of centralization and the size of an irrigation system. Millon concludes also that, so far as his sample is concerned, the practice of irrigation has not resulted in any significant growth of central authority.

This lack of consensus over the role of irrigation in the evolution of political complexity is in part due to a misunderstanding, or neglect, on the part by many writers of the pertinent variables delineated by Wittfogel (*cf.* Mitchell 1973:533; Hunt and Hunt 1976:390; Hunt 1988:337-338; Kelly

---

\(^{19}\) For other ethnographic studies that suggest a clear connection between irrigation, centralization, and political authority see the study by Hunt and Hunt (1974) in Mexico, Emerson's (1990) work in Baltistan (northern Pakistan), and my own preliminary findings in neighboring Hunza (Sidky 1993a, 1993c).
Some of these variables have been clarified by Mitchell (1973:532-533), who notes that Wittfogel's detractors operate on two mistaken assumptions: (1) that large-scale irrigation must be found prior to state-level organization for the hydraulic thesis to be confirmed (e.g., Friedman 1974); and (2) that irrigation requires centralized coordination (e.g., P. T. Cohen 1993:178; Geertz 1980:69). But, according to the hydraulic thesis, Mitchell (1973:533) argues, "one would expect irrigation and political control to develop together, interacting with each other in a synergistic fashion, somewhat as automobiles and paved highways developed in the United States."

Leaf's (1992) recent study of irrigation in the North Indian state of Rajasthan is a good example of the analytical imprecision displayed in the literature on the hydraulic hypothesis. Leaf (1992:116, 118, 120) reports that Rajasthan has a large-scale, "state built, state owned, state

---

20 Other ethnographic studies suggesting that authoritarian control is not a necessary concomitant of irrigation include Fernea's (1970) study of canal systems in southern Iraq, Gray's (1963) analysis of the Sonjo chiefdom in Tanganyika, Leaf's (1992) work in Rajasthan, India, Spooner's (1974) study of irrigation practices by villagers on the Iranian plateau, Netting's (1974) study of a village irrigation system in the Swiss Alps, and Mitchell's (1976) investigation in the Quinua, in the Peruvian highlands. One may also mention Leach (1959:7-14, 23-24), who has used the historic example of the massive irrigation works of ancient Ceylon -- believed to have been built piecemeal, over several centuries, and without governmental control or a hydraulic bureaucracy -- to question the assumption that large-scale irrigation necessarily entails centralized coordination.

21 Another example is Winzler's (1976) review article on state formation in South Asia (cf. Hunt 1976:27).
run" irrigation system. Moreover, he points out, Rajasthan has a tradition of authoritarian government second to none in India. Leaf (ibid p. 116) surmises that, if large-scale irrigation systems require state management that is bureaucratic, centralized, and despotic, then the canal systems in Rajasthan ought to support Wittfogel's hydraulic thesis. But Leaf's (ibid p. 118) findings indicate no management system in Rajasthan that could possibly be described as despotic in Wittfogel's terms. Leaf considers this ample grounds for rejecting the hydraulic hypothesis. Rajasthan, however, does not meet the ecological, historical, or sociopolitical conditions specified in the hydraulic hypothesis. First, according to Leaf's (1992:117-118) own account, more land there is irrigated by wells and other sources than by canals. Second, the major hydraulic networks discussed by Leaf were constructed (and are managed) under the auspices of a "non-hydraulic" national government (ibid p. 117). Third, these canals were constructed following Independence,22 after the traditional political structure of Rajasthan's authoritarian monarchies had been radically transformed (ibid p. 117, 120). Fourth, Rajasthan's canals, built with considerable international assistance (ibid p. 117), represent modern engineering accomplishments, and cannot

---

22 Apart from Ganga Canal in Ganganagar district, which was built in the 1920s by the British Government in India, under an agreement with the Maharajahs of Bikaner and Bahawalpur.
be treated on equal terms with the hydraulic structures created through "pre-machine technology," as specified by Wittfogel.

Leaf's study illustrates a point stressed many years ago by the Hunts (1976:390), that assessments of the hydraulic hypothesis have often been made on the basis of information from areas that do not meet the relevant conditions for the emergence of a "hydraulic order" (cf. Hunt 1976:632). Indeed, Wittfogel (1957b:12) has explicitly stated that irrigation becomes politically significant only under specific "geohistorical" conditions:

Large enterprises of water control will create no hydraulic order, if they are part of a wider nonhydraulic nexus. ... too little or too much water does not necessarily lead to governmental water control; nor does governmental water control necessarily imply despotic methods of statecraft. It is only above the level of an extractive subsistence economy, beyond the influence of strong centers of rainfall agriculture, and below the level of a property-based industrial civilization that man, reacting specifically to the water-deficient landscape, moves toward a specific hydraulic order of life.

Leaf seems not to have grasped the fact that Wittfogel (1957b:12) never intended his hypothesis to cover situations where irrigation is brought into modern peasant societies already politically unified (cf. Orenstein 1965:1530; Murphy 1967:25; Kelly 1982:4-5).23

---

23 This criticism, of course, can be directed at others who have used data on modern irrigation systems to assess the hydraulic thesis, for example Millon's (1962) use of Fernea's (1970:26-32,118-153) data on Iraq.
Focus of the Present Study

Despite considerable research on the subject, it is clear that Wittfogel's thesis remains a controversial one (cf. Wright 1986; M. Cohen 1981). Moreover, as we have seen, there is still much confusion over the precise variables involved. Nevertheless, I submit that the hydraulic hypothesis has potential analytical value for the study of irrigation and political authority in Hunza. This is because some of the particular ecological and historical circumstances in Hunza -- an arid environment, potential source of water for irrigation, pre-industrial technology, and isolation from the influence of neighboring state-level polities -- appear to correspond closely to conditions under which irrigation, according to Wittfogel, becomes politically decisive.

My primary purpose in this study is to explore the causal relationships between canal-building, hydraulic agriculture, and state formation in Hunza. In Chapter II, I describe the ecological setting under which Hunzakut farmers operate, focusing on the particular circumstances that made the construction of a large-scale irrigation system not only feasible, but imperative. In Chapter III, I investigate the development of Hunza's irrigation system and ascertain how the hydraulic apparatus contributed to increased political centralization and the efflorescence of the Hunza state. In Chapters IV, V, and VI I describe the form and function of Hunza's state-managed hydraulic production system.
CHAPTER II
HUNZA: THE ECOLOGICAL SETTING

The Physical Environment, Climate, and the Growing Season
Wittfogel posited a causal connection between specific ecological conditions, the hydraulic mode of production, and the development of a particular pattern of political authority. In this study I shall examine the interrelationships between these variables, beginning, in this chapter, with environmental and ecological considerations.

Hunzakut farmers have had to adapt to the special climatic and geophysical conditions of their high-mountain environment. Lorimer's (1935:xxxvii) observations are useful in conveying a general impression of the landscape and the physical conditions (Pl. VII) under which Hunzakut farmers operate:

Among the vast and savage mountains of the Western Karakorum, which are generally devoid of a blade of grass, and of which the surface[,] by falls of cliff and boulders, the slipping of detritus, and the downpouring of mud-floods, is kept in a constant raw and unstable state, nature has made it possible for a small population to maintain itself, in the sweat of its brow, by agriculture and the pasturing of small cattle.
Plate VII. Hunza's terrain; top, landslide (left) on unstable mountain slope, a perennial problem for Hunzakut farmers; bottom, Hunza River flowing below farmlands (Photos M. Sidky)
This trans-Himalayan region is unaffected by the southwest monsoon rains; annual rainfall in the valley bottoms (2,000 - 2,400 meters), where Hunzakut farming communities are to be found, rarely exceeds 130 - 200 mm (Goudie et al. 1984:370), and is insufficient for dry farming. The Hunza River, dissecting the width of the Karakoram range, carries water from the Batura, Passu, Hispar, and Barpu glaciers. It runs nearly 100 meters below the lowest point on the valley floor and, therefore, is unusable as a source of moisture for natural vegetation or for irrigation purposes.

Classified as "desert-steppe," this environmental zone displays characteristics of desert biomes, with moisture constituting the main limiting factor on biological productivity. Natural vegetation here is extremely sparse (as is animal life), with species of the drought-resistant Artemisia (sagebrush) predominating (cf. Paffen et al. 1956:1-10; Kreutzmann 1988:240).

Above the valley floor, however, precipitation increases, enabling the intermittent growth of a juniper (Juniperus macropoda, J. semiglobosa) and cedar (Cedrus deodara) forest belt, extending roughly from 2,800 meters to 3,000 meters (cf. Ogino et al. 1964; Paffen et al. 1956:25-26; Goudie et al. 1984:375-376; Sheikh and Aleem 1975). Grassy patches, comprising species of Agropyron, Festuca, Poa, and Bromis (FAO 1978), form alpine pastures extending from 3,000 meters up to the snowline at around 4,000 meters.
Precipitation in the form of snowfall, approximately 2,000 mm a year, occurs at altitudes above 6,000 meters, feeding the massive glaciers which, in turn, serve as the principal source of water for the agricultural communities located in the desert-steppe zone below (2,220 m - 2,400 m).

Aside from the extreme aridity, other conditions in the Hunza Valley are somewhat more favorable for plant growth and agricultural production. Hunza receives between 65 to 70 percent of the maximum possible hours of sunshine (Whiteman 1985:19). The potential for photosynthesis, and hence for crop plant production, is therefore very high. Moreover, because the atmosphere at these altitudes is thin and low in humidity, more radiant energy is available for plant growth and enhanced agricultural yields (Whiteman 1988:73).

Since the rarified atmosphere in Hunza cannot absorb and retain heat, warmth is dependent on direct sunshine. This, in combination with the long nights at this latitude, produces a diurnal temperature range of between 15° to 20° C. Cooler nights diminish the loss of plant dry matter (DM) due to respiration, resulting in high agricultural productivity (cf. Edmond et al. 1975:95).

There are negative effects associated with a thin atmosphere as well. Because the air cannot retain heat, shading, or an unusually high number of overcast days, result in considerable drops in temperature (up to 10 degrees Celsius or more). There is a direct relationship between the total
amount of warmth (referred to by agronomists as "accumulated temperatures," or "heat units") during a growing season of a given length and the growth, development, and maturity of crop plants. Thus, in Hunza, shading and cloud cover, which reduce the total number of heat units, can have an excessively detrimental effect on crop production.

Solar radiation receipts determine temperature regimes and the "thermal growing season" (Duckham and Masefield 1970: 29-31). This is defined as the length of time when the mean average daily temperatures are continuously above a certain threshold within which plant growth and development take place (Tivy 1990:30).

The months with the greatest number of sunshine hours (more than 200) and warmest temperatures in Hunza are May through August. This is the most favorable period for agricultural production. The number of sunshine hours drops to around 150 during September and October, just sufficient to allow a fast-maturing cultigen, such as millet or buckwheat, to ripen. November has an average of a little less than 100 sunshine hours, with a marked decrease in solar radiation receipts and seasonal temperatures towards the second half of the month. Temperatures during the first two weeks of the month are warm enough, however, for the autumn wheat crop to be planted, and for the seedlings to reach a frost-resistant stage before winter sets in. From December to February there
are less than 90 hours of sunshine per month. Temperatures are below freezing and plant growth ceases altogether.

Sunshine increases once again in March and April, averaging close to 100 hours. Increasing solar radiation receipts are accompanied by warmer temperatures, marking the start of the growing season.

Although warmth is determined primarily by the amount of incoming solar radiation, altitude, aspect, and topographical shading are locally important in modifying temperature regimes (Duckham and Masefield 1970:31). Such variations not only have important effects on crop maturity and yields, they also determine whether one or two crops can be cultivated a year.

In general, the length of the growing season and agricultural productivity decrease with altitude (cf. Guillet 1983:563; Groetzbach 1988:25). As one travels from Gilgit (1,454 m), the administrative center of the Northern Areas, to the Khunjarab Pass (4,733 m), some 275 km to the north, one moves through a continuum of double- to single-cropping zones.

In the lower double-cropping zone (up to 2,000 m), where the Shin are the demographically-dominant group, the principal cultivated crops are wheat, maize and barley. Domesticated animals include goats, sheep, cattle, donkeys and horses. Farmers here have an eight month growing season, with sufficient time to plant maize as a second crop after wheat.

In the upper double-cropping zone (roughly 2,000 m to 2,400 m), inhabited entirely by the Hunzakut, wheat and barley
are the principal cultigens, followed by fast-maturing millets and buckwheats. Livestock here comprises mostly sheep, goats and cattle.

At elevations of 2,400 m and higher one enters the single-cropping zone, where the Wakhi constitute the predominant population. Wheat and barley are cultivated here as the primary crops, and livestock include yaks in addition to sheep and goats. Farmers in this attitudinal zone have an available growing season of about four to four-and-a-half months, sufficient only to cultivate a single annual crop (barley, wheat, potatoes, and beans simultaneously) per year.

In addition to differences in the length of the growing season between the Shin, Hunzakut, and Wakhi areas, there are also microvariations in the growth period of crops cultivated in villages located at slightly different elevations within each of the above mentioned attitudinal zones. For example, in Central Hunza, crops in Murtazabad mature four to five days before crops in Aliabad and Ganesh, while crops in the latter two villages ripen four to five days before those grown in Baltit and Altit.

As a general rule, with every 500 meter increase in altitude there is a one month decrease in the length of the growing season (Whiteman 1985:25). However, the effects of altitude may be modified by local conditions. For instance, aspect (whether land slopes towards or away from the sun), can have important effects on local temperatures and the overall
growing season (Duckham and Masefield 1970:32). In general, temperatures are lower on north-facing slopes, compared to south-facing ones (cf. Edmond et al. 1975:94). Thus farmers in the village of Hini, situated at an elevation of 1,800 m, but with fields on north-facing slopes, must plant the fast-maturing, but less preferred, millet as a second crop, while their neighbors in Nomal, situated at the same elevation, but with fields situated on south-facing slopes, are able to cultivate maize after harvesting their wheat crops (Saunders 1984:62, 72). Similarly, farmers in Baltit, located at 2,400 m, and with south-facing fields, can grow two crops per year, while villagers in Gulmit, at the same elevation, but with north-facing fields, can only grow a single crop each year.

Topographical shading also causes significant drops in temperature (and heat units) and is detrimental to overall agricultural productivity. A dramatic example of the effects of topographical shading can be observed in the central valley, where Hunzakut farmers can double crop, while villagers in Nagar, located just across the river, and at the same altitude, but with fields subject to topographical shading, can grow only one crop a year (Pl. VIII).

Due to the complex interaction of the climatic and geophysical conditions described above, Central Hunza has a seven-and-a-half month growing season. With careful scheduling, and the use of appropriate cultigens, farmers are able to grow two crops successfully up to an elevation of
Plate VIII. Topographical shading; Hunza (left) receives adequate sunshine for double cropping; Nagar (right) sufficient only for single cropping (Photo M. Sidky)
2,400 meters, well above the maximum altitudes for double-cropping practiced elsewhere in the region (Whiteman 1988:65). However, as there is barely enough time (and heat units) for two crops to mature, scheduling is crucial; the loss of even a few sunny days can delay, or even prevent, crop maturity. This is why, in the past, all aspects of agro-pastoral production were carefully coordinated by the state, resulting in a high degree of management seldom found in association with such subsistence economies (cf. Whiteman 1985:41).

Land and Water: Hydraulic Ecology and Mountain Oasis Environments

Topography, soils, and water resources determine what is physically possible, thus setting limits on the scale and intensity of agriculture. An examination of these ecological factors, therefore, is crucial for our analysis of the Hunzakut agro-pastoral production system and the hydraulic infrastructure upon which it depends.

Intensive cereal production, horticulture, and arboriculture in Central Hunza are feasible in the lower zones of the valley (2,000 to 2,400 m). Arable lands here are located on glacial outwash fans (Pl. IXa), along the south-facing slope of the valley wall. The farming potential of a piece of land depends on several factors. It must be located in an area with a sufficiently moderate slope-angle to permit access; it must also receive adequate sunlight, and it must have soils of suitable depth (0.3 to 0.9 meters) to allow the
development of the plant root system. Such a tract of land must also be free of rocky outcrops and large boulders that hinder terracing and tillage. But above all else, to be of any agricultural use, the land must command a water supply.

Agriculture in Central Hunza is possible only because the Hunzakut have made significant modifications to the natural landscape, by converting steep slopes into level fields through terracing, and by artificially channeling water into the desert-steppe environmental zone. Such modifications have been achieved through heavy investments of human effort and energy.

Hunzakut terraces cling to the mountainsides like colossal staircases (Pl.IXb). To construct such terraces the farmers first select a suitable area, mark out the desired parameters and, starting at the highest part of the slope, excavate the site. Boulders, rocks, and other debris are separated from the soil. The rocks and boulders are carefully fitted together to construct a vertical retaining wall that, depending on the angle of the original slope, can be up to 10 meters high. Small field stones are used as fill, on top of which the sifted soil is then deposited.

These terraces not only facilitate plowing, watering, and manuring; they also serve to capture and preserve heat, moderating the effects of the naturally-cold early- and late-season temperatures by receiving sunlight at a higher angle than unmodified slopes. Agronomically, such effects are
Plate IX. Hunzakut farmlands: top (a), fields on outwash fan; bottom (b), terraces with fitted stone walls (middle foreground showing manure piles for barley fields) (Photos M. Sidky)
especially significant at the beginning and end of the growing season, when crops are growing near their lower temperature thresholds and temperature differences of as little as half a degree can substantially affect growth potential (cf. Tivy 1990:30-32; Whiteman 1988:60). (The minimum, optimum, and maximum temperature thresholds for temperate crops are 0-5°C, 25-31°C, 31-37°C [Yao 1981:189-192].) Terracing also allows the cultivation of crops at higher elevations than would be possible on natural slopes (Price 1981:397).

Hunzakut farmers obtain water for irrigation primarily from glaciers high above the valley. Ultar Glacier is the main water source for farms in Central Hunza (Pl. X). The Hasanabad and Muchichul glaciers provide water for the villages of Hasanabad and Murtazabad. Snowbeds and locally-occurring springs also serve as a source of some water for Hunzakut farming communities (Pl. XI).

Glacial melt-waters are conveyed to the agricultural fields by means of a sophisticated, man-made irrigation network (Pl. XII). These gravity-fed irrigation channels are several kilometers long and cling precariously to sheer cliff faces as they wind down to the villages below. Each village has its own distribution point, from where tertiary ducts convey the water on to its terraced fields.

The sandy, low-clay soils on the terraces, which are deposited on permeable layers of loose stones (see above, p. 57), have a low water-holding capacity. These factors, in
Plate X. Ultar glac r, Central Hunza's main water source (Photo M. Sidky)
Plate XI. Bulolo snowbed (top right), above Mir's palace at Baltit, a subsidiary water source for Central Hunza (foreground, Altit village) (Photo M. Sidky)
Plate XII. Irrigation channels (lower left) issuing from Ultar side-valley; the ancient palace of the Mir (above); apricot and poplar trees (with most of their branches cropped for fodder) growing along the slopes (Photo M. Sidky)
conjunction with low water-tables, insignificant rainfall, and high evaporation rates, contribute to the rapid loss of moisture from the fields. Any excess water in the soil is lost to seepage (Whiteman 1985:17-18). Thus, Hunzakut farms require no artificial drainage facilities (Pl. XIII).

Too little rather than too much water is the perennial concern of Hunzakut farmers, a problem solved by their magnificent hydraulic works. Hunza's irrigation channels, an engineering marvel, were constructed without the use of iron tools or modern survey equipment.¹ (Iron was locally-unobtainable since natural deposits of this metal were unknown. Hunza's extreme geographical isolation and lack of suitable trade goods precluded the import of any significant number of metal implements. The Hunzakut, therefore, had to rely primarily on stone, bone, wood, and horn for their tools and utensils. Only in British times did iron substitute for stone and other local materials for tool-making [E.O. Lorimer 1939:163], and even then the few shovels, picks, axes, or crowbars brought from the India and Kashmir were treated as treasured items. The Bericho, Hunza's local blacksmiths were more accurately repairmen rather than manufacturers of iron implements.)

¹ Their total inventory of metal implements comprised nothing more than metal tripods for cooking, razors, knives, and swords, all obtained from distant places and at great cost.
Plate XIII. Field irrigation: top, irrigation duct (right foreground) leading water into vegetable field; bottom, water from irrigation channel (right) slowly seeping into vegetable garden (Photos M. Sidky)
Hunza's irrigation network was once famous throughout Central Asia (cf. Schomberg 1935:112-113). Its construction was possible only through the combined labor of entire communities, mobilized by the state.

The irrigation system is shared by nine villages -- all linked together into a single regional hydraulic system -- and is under cooperative management. Ensuring the operation and maintenance of the hydraulic works requires the cooperation, not only of all the households in a single village, but also of many neighboring village communities. Each village is responsible for the upkeep and annual cleaning of its own sections of the total network; all communities relying on the system supply additional labor to repair obstructions and breaks as they occur.

There is considerable variation in the amount of glacial-melt waters available during different seasons. From early-February to mid-May water supplies are extremely limited, due to cold temperatures, which diminish the rate at which meltwaters flow from the glaciers and snowbeds. From mid-May to early-September, as temperatures rise, water flows abundantly. From early-September to early-November, as temperatures drop, water supplies begin to decrease. From mid-November until the start of February water supplies dwindle considerably and most of the irrigation system is inoperative.

The year-to-year supplies of water are affected by variations in seasonal temperatures. A cooler than average
spring will result in shortages early in the agricultural season, again because temperatures affect the flow rate of snow and glacial melt-waters. For the same reason, unusually cold temperatures in late-August and September will reduce the amount of water available for the second crops.

Hunzakut farmers attempt to cope with these fluctuations in their water supplies through a careful disbursement program. In the past, water allocation was based on a complex state-controlled system of distribution jointly supervised at the local level by a jirga, "water monitoring committee," comprising two to three individuals (elected by the villages' state-appointed headmen), the village leaders themselves, a chawkidar (watchman) to guard the channel heads, and the individual farmers (Pl. XIV). A variant of this system is still in use today. Such rigorous control is needed to ensure the equitable distribution of water and to safeguard the terraces themselves. This is because the imprudent application of water by one farmer can easily undermine the stability of the whole network of terraces, stacked one atop another over an entire slope.

Glacial melt-waters channeled into the valley make it possible for the human settlements -- described by some writers as "mountain oases" -- to thrive in an otherwise barren and desolate landscape (Whiteman 1985; Emerson 1990:105-108). Such "oasis environments" present various
Plate XIV. Supervising water distribution: left, watchman guarding channel head; right, boys monitoring water flow into their fields (background) (Photos M. Sidky)
opportunities for human subsistence, as well as limiting and defining the scope of agro-pastoral production.

Farming communities in general are to be found in those relatively few areas where suitable tracts of land and a practicable source of irrigation coincide. Only 90 km², or 1.2 percent, of the total area of 7,900 km² comprising Hunza's territory (Map 2) meet these criteria (Kreutzmann 1988:244).

The physical location of arable lands (governed by the interaction of topography and geophysical conditions), in turn determines the location of houses and villages, as the latter are always strategically situated with respect to the fields and water supply, in an attempt to ensure the efficient use of resources.

However, past political conditions also had some influence on the location of many villages. British observers who visited Hunza during the 19th century described Hunzakut villages as comprising a central fort with dwellings built around it. This layout was in part the consequence of the near-incessant warfare between the Hunzakut and their neighbors, making it necessary for farmers to rely on the protection of fortified structures (Knight 1893:434, 437-438). The forts of Altit and Baltit (see Pl. VI) though now uninhabited, still stand as a reminder of past conditions. Following the 1891 invasion and the establishing of Pax Britannica, fortifications were made redundant.
Hunzakut villages (see Pl. V) typically consist of clusters of 50 to 100 houses, a mosque, water-driven mill, central meeting place, common graveyard, reservoir-tank, and a polo field; they are always located in proximity to cultivated fields (icit in Burushaski). All villages are circumscribed by rocky wastelands (das), bereft of almost all vegetation.

During the isolation of the past, when outside energy and nutrients were unavailable, and when self-sufficiency was crucial for survival, these environmentally circumscribed villages approximated energetically closed systems. For this reason, I have selected the "village" as one basic unit of analysis. There are, however, some general underlying theoretical issues associated with this choice that must be addressed before I proceed.

"System closure" is a complex issue that has been the subject of considerable debate among anthropologists over the last few decades (cf. Friedman 1974:466; Vayda and McCay 1975:293-295; Ellen 1986:174, 186; 1990:220; Moran 1990a:16; but see also Rappaport 1990, and Gross 1990). This is because cultural and natural boundaries rarely coincide, and often the sheer complexity of the flows of goods and services associated with human subsistence is difficult to chart under field conditions (cf. Burnham 1982:25). Indeed, some anthropologists, who once thought that the human communities they were describing represented "self-contained ecosystems"
governed by internal *homeostatic* regulatory mechanisms, have now realized the importance of exogenous flows of materials and exchanges of personnel in ensuring the stability and persistence of these communities over time (cf. Netting 1972; 1976; 1990:230-232, 235, 240). Where closure cannot be clearly established, the local system is no longer a suitable unit of explanation (Ellen 1986:180).

Hunzakut villages, which I have described here as approximating "closed systems," were also involved in the flows of materials and energy originating beyond their physical boundaries. Strictly speaking, the resource base of each village included its arable tracts, the alpine pastures to which it had access, the desert-steppes that briefly provided forage for its goats each spring, and the upland forests where villagers gathered firewood for cooking and heating.

There were also exchanges of personnel and goods between the villages that were integrated into the administrative structure of the Hunza state and linked together by the hydraulic system. Moreover, there were outflows of foodstuffs, fodder, firewood, and other goods from the villages (as taxes paid to the state). Finally, each village community had access to the stores of emergency food from the state granaries.

Thus, we may speak of Hunzakut villages as being energetically closed, in general terms, only if we have taken
into consideration all the nutrients and energy flows linking villages with one another and with the resources with which they were endowed.

Soils, Soil Management, and Land-Use Patterns
Soils provide the nutrients necessary for plant production. The nature of the soils on which Hunzakut farmers have traditionally cultivated their crops has had a direct impact not only on the total agricultural productivity of their fields, but also on their land-use patterns and overall farming practices.

Soils on glacial outwash fans are built up from geologically diverse sources (sedimentary, volcanic, igneous, and metamorphic parent rocks), rather than deriving from underlying bedrock materials of one type (cf. Whiteman 1985:28; Saunders 1984:44-46). Mostly sandy loams, these soils contain exiguous quantities of clay (about 15%), possess little structure, and have a low water-holding capacity. However, because of their heterogeneous origins, these soils have adequate levels of macronutrients, such as phosphorus and potassium, as well as most of the trace elements essential for crop production (Whiteman 1985:28-30).

Hunza's soils, however, contain very little organic matter (e.g., roots, earthworms, and decomposed plant and animal remains) and, consequently, have a severe nitrogen (N) deficiency. Although there are slight variations from village
to village, soils in Central Hunza typically contain about 1% organic matter and 0.5% N (cf. Whiteman 1985:30). This is due mainly to the extreme arid conditions in the desert-steppe zones and the consequent paucity of natural vegetation and animal life.

Nitrogen constitutes a major limiting factor on agricultural production, because the inherent capacity of soils to sustain crop production is directly dependent upon their nitrogen (and organic matter) content (cf. Brady 1974:161; Frissel 1977). Traditionally, organic matter served as the primary source of soil nitrogen in Hunza. However, organic matter was also vital because it enhanced soil porosity, its capacity to hold water and nutrients, and its overall structure (Russell 1973:27; Miner 1971; Klausner et al. 1971). (This is why in Hunza inorganic chemicals are unlikely to ever entirely replace animal manure as fertilizer.)

The nutrient status of Hunza soils is affected in several ways by local climatic and geophysical conditions. Organic matter in the soil is broken down by microorganisms into ammonia (NH$_4^+$), which is in turn broken down into nitrate (NO$_3$). High incidence of solar radiation and warm daytime summer temperatures, described above, contribute to the loss, or dissipation, of nitrogen through the volatilization of ammonia into gas (Hall 1948:160; Briggs and Courtney 1989:166).
Nitrogen is also lost as a result of irrigation. Sunny days and warm daytime temperatures in Hunza produce high evapotranspiration (evaporation of water from plant and soil surfaces). This, along with the relatively low natural water-holding capacity of the soils (due to their inadequate organic matter content and lack of structure) makes it necessary for Hunzakut farmers to irrigate their crops frequently. They typically water each crop between six to ten times per season. Such repeated irrigation contributes to the leaching of nitrates from the plant rooting zone (cf. Bayliss-Smith 1982:15) and is therefore detrimental to the nutrient status of Hunza's soils (cf. Whiteman 1985:31).

Nitrogen is depleted in other ways as well. Tillage, which disturbs the soil and exposes it to the air and sunlight, depletes soil nitrogen supplies (Brady 1974:162). This is because aeration and increased temperatures, due to exposure to sunshine, speed up the decomposition of soil organic matter (Tivy 1990:244). Nitrates are thus converted into nitrogen gas and lost to the atmosphere, while ammonia is dissipated through volatilization.

Finally, a significant amount of nitrogen is lost through removal as harvested crops (Bayliss-Smith 1982:150). At traditional output levels of roughly 2 tons/ha of grain and 5 ton/ha of straw in Hunza, wheat and barley each extracted about 100 to 200 kg/ha N from the soil (cf. Whiteman 1985:32). This represents a significant nutrient drain that has somehow
to be replenished, if the farmer wishes both to maintain the fertility of his fields and to obtain acceptable levels of output.

Hunzakut farmers have traditionally been confronted with an ongoing problem of how to maintain adequate levels of nitrogen and organic matter in their fields. Before the availability of outside nutrient subsidies, in the form of inorganic fertilizers (still frequently unobtainable for lack of hard currency), farmers had to depend on repeated applications of manure, supplemented by night-soil, compost, and tree litter, to fertilize their fields.

In fact, sustainable intensive agriculture in Hunza was possible only through the application of large quantities of manure to the soil, for which the farmers had to rely upon their ruminant livestock. However, maintaining livestock under the constraints imposed by a circumscribed oasis setting posed numerous difficulties. The absence of any significant natural forage resources outside the boundaries of the villages left farmers confronted with a perpetual fodder shortage.

To support a sufficient number of ruminant livestock, Hunzakut farmers had to allocate a considerable area of their total landholds for the production of fodder. In many villages, as much as 50% of all arable lands were used to grow fodder crops, such as lucerne (*Medicago sativa*) and meadow grass (*Poa spp.*), and fodder trees: poplars (*Populus spp.*) and willows (*Salix spp.*) that supplied leaves for livestock.
Lucerne, a perennial legume, has a high ratio of digestible protein and makes excellent fodder and nitrogen-rich manure. Its cultivation is an important strategy in the management of the nitrogen cycle. This plant has a symbiotic relationship with species of *Rhizobium* bacteria that live in its root nodules and have the ability to "fix" atmospheric nitrogen into the soil. Consequently, not only can lucerne be cultivated without the use of precious manure, but it actually increases the levels of soil nitrogen by as much as 100 to 200 kg/ha per year (Tivy 1990:68). The lucerne fields in Central Hunza may therefore be seen as "nitrogen catchment areas," operating to transfer atmospheric nitrogen into the soil.

Aside from allocating a considerable area of land for the production of fodder, Hunzakut farmers also treated many of their primary cultigens in a dual-purpose manner, in order to produce food for human consumption as well as fodder for livestock feed. They used local varieties of wheat and barley, selected through years of careful propagation, for high outputs of palatable straw (cf. Saunders 1984:23). Residues obtained from other traditional crops, such as millets and buckwheats, were fed to the animals as well. Farmers also fed their livestock with leaves from their fruit trees and residue obtained from their vegetable gardens (see Chapters 5 and 6 below).

Through such dual-purpose treatment of their cultigens, farmers could take advantage of the complementary relationship
between the crop and livestock subsystems of their economy (cf. Cornick and Kirkby 1981). This constituted an important adaptive strategy for coping with resource constraints.

* * *

In this chapter I have attempted to explicate the influence of interacting climatic and geophysical factors on agro-pastoral production in Hunza. I have also sought to underscore the material requisites for economic production in the context of the "oasis environments," created through the artificial channeling of water into the desert-steppe zones. Some of the information introduced here will prove indispensable for our analysis, in Chapters 4 and 5, of Hunza's traditional state-regulated economy; some is of immediate significance. We may conclude on the basis of the data presented in this chapter, for example, that intensive agro-pastoral production in Hunza would be impossible without the hydraulic infrastructure that I have described. Indeed, as we shall see in the next chapter, the expansion and intensification of agricultural production, essential for the development of sociopolitical complexity in Hunza, was the direct consequence of the hydraulic mode of production.
CHAPTER THREE

THE DEVELOPMENT OF HUNZA'S HYDRAULIC WORKS
AND THE RISE OF THE HUNZA STATE

In this chapter I turn from general environmental and ecological considerations to the historical circumstances leading to the construction of Hunza's large-scale hydraulic works,¹ and the impact the new waterways had on the political organization of Hunzakut society. My objective is to explore the precise causal connections between canal-building, the hydraulic mode of production, and the process of state formation in Hunza.

Because of the extreme difficulty of the terrain, the construction of complex hydraulic works in Hunza required a command of labor and materials far beyond the capacity of an individual farmer, or even of an entire village. It was only

¹ One of the problems in the ethnographic literature on irrigation is the inconsistent way in which the scale of irrigation systems has been defined by various writers (cf. Kelly 1983:883; Hunt 1988). In this work I define large-scale systems as those requiring inputs of labor and materials for construction, operation, and maintenance that are beyond the scope or capacity of any individual user, a group of individual users, or even an entire community. Wittfogel (1957b:18) proposes that such large-scale systems require hierarchical authority. Small-scale canal structures are defined as systems that can be operated and maintained by individual users. Agriculture based on small-scale irrigation systems allows the food supply to be increased, but does not involve authoritarian control and organization found in association with large-scale hydraulic works (Wittfogel 1957b:18; Hunt and Hunt 1976).
when the Mir had achieved sufficient control over the people of his principality to enable him to mobilize large-scale labor, as well as to demand that his nobles feed the laborers, that large-scale irrigation could be accomplished. Such a situation developed during the reign of Mir Silim Khan (1790-1824), a charismatic and influential leader and organizer, locally believed to have possessed magical abilities to produce rain and snow, as well as to quell storms.

At the start of Silim Khan's rule, the entire Hunzakut population of 2,500 to 3,000 (according to local tradition) was confined to three fortified villages: Baltit, Ganesh, and Altit (see Map 2). Each of these ancient settlements was effectively autonomous, under its own wazir. The three villages recognized the Thum as their supreme chief, but his rule seems to have been more nominal than real.

During the time of Silim Khan's predecessors, the actual political power in Hunza rested with clan elders and lineage heads, whose power was based on their control of local constituencies. The advocacy of such locally-based political groups not only determined which prince assumed the throne;

---

2 The only instance of a Hunza thum attempting to construct an irrigation channel prior to the reign of Silim Khan, according to oral tradition, is said to have occurred during the time of Thum Sultan, who ruled Hunza sometime during the early 17th century. Sultan, Hunzakut recall, attempted to construct a channel to irrigate the wasteland of Suriyas (now Karimabad village). But, tradition has it, the sheer physical hardships of canal-building, and Sultan's excessive demands upon a labor force over which he had insufficient control, brought the project to a halt. The villagers, it is said, simply refused to complete the work in a defiant act of protest.
but their continued support was also vital to the Thum's political future.

Clan elders and powerful lineage heads, oral tradition has it, perceived the Thum with a great deal of ambivalence. This was because the thums were considered to be "outsiders," whose ancestors had been imposed upon the indigenous population by the Tarkhany rulers of Gilgit. The Thum was seen as embodying a positive and cohesive force, around which separate descent groups could be united; at the same time he was viewed as wielding potentially threatening and unmanageable authority, that existed outside of the kin and affinal relationships that structured the political lives of descent-groups. The local leaders, therefore, sought to subject the Thum to their collective sway, to bridle his ambitions, and to limit his role to that of adjudicator, provider of weather-magic, and organizer of military defense (cf. Ali 1982:95-97).

For the Thum, on the other hand, the influence and power of clan leaders and their constituencies represented impediments to his princely mandate and political aspirations. He therefore sought to contravene, oppilate, bypass, and undermine their power and authority whenever he could.

As early as the 16th century, the thums of Hunza made several partially successful attempts to consolidate their political authority by eliminating their rivals, powerful local descent-based political factions. Oral tradition tells
of three such factions: the Diramheray (the descendants of Mogul Titam, see above, pp. 15-16, also called Diram Tapkients), who occupied Baltit and an extensive territory in Shishpar nullah (now said to be engulfed by glaciers); the Hamachating, the builders of the Hamachi irrigation channel (see Map 3, below), who lived in Ganesh; and the Osenkutz, who lived alongside the "Huns" in Altit.

It is said that Thum Mayori, who ruled during the latter part of the 17th century, massacred the Diramheray with the help of his henchmen and by enlisting the aid of the powerful Hamachating and Osenkutz factions. The perpetrators of this bloody deed, Hunzakut relate, divided amongst themselves the land and livestock belonging to the slaughtered Diramheray.

Mayori's son, Ayasho II, when he became thum, conspired with the Osenkutz and slaughtered the Hamachating. Again, the thum and his abettors seized and apportioned amongst themselves the lands and livestock of their victims. Finally, Ayasho turned against his former allies, the Osenkutz, sending his henchmen on a perfidious nocturnal foray on Altit, where they went from house to house, slaying Osenkutz men and taking captive their womenfolk and children. After the carnage, it is said, Ayasho seized all Osenkutz land and livestock for himself.

Despite these violent attacks on the indigenous clans, the thums were apparently unable to gain absolute political
supremacy over Hunza. Not until the reign of Silim Khan did the political situation begin to change.

Mir Silim's first major accomplishment, so far as present-day Hunzakut recall, was to consolidate his political authority. This he was able to do by relying on his powers of persuasion, personal popularity, and political maneuvering, through which he was able to bring Baltit, Altit, and Ganesh under his direct control. He then appointed one of his staunch supporters to be the Wazir and to administer all three villages. Silim Khan also installed loyal subordinates as trangfa in these villages.

Silim's next move, it is said, was to secure his domain from attack by neighboring Nagar. This he accomplished by reinforcing village fortifications, building watch-towers and protected-granaries, and appointing sentinels to stand guard, night and day.

With his power-base thus secured, the Mir began what were to be his most significant achievements: the construction of large-scale irrigation works and the establishment of new villages throughout the valley of Hunza.

The fact that some degree of political centralization was already present before Silim Khan began his irrigation projects does not contradict Wittfogel's hydraulic thesis (contra Taylor 1979:174; Carneiro 1970:734, 738). In fact, such centralization is a requisite for initiating and establishing large-scale irrigation systems. As Wittfogel
(1957b:26-27) writes, "It is the circumspection, resourcefulness, and integrative skill of the supreme leader and his aids which play the decisive role in initiating, accomplishing, and perpetuating the major works of hydraulic economy."

According to presently-accepted oral tradition, before Mir Silim's time Hunza had only a very small-scale irrigation network, comprising three channels: Baltit II, Altit Gotsil, and Hamachi. They brought water (as they still do) to Baltit, Altit, and Ganesh respectively (see Map 3, below). From a logistical and engineering standpoint, the three channels represent the least demanding of the hydraulic projects undertaken in Hunza. This is because of these canals are small in size and the terrain they traverse relatively easy to negotiate.

These small-scale waterways were built and maintained through the resources and labor supplied by each respective local community. Maintenance operations and water dispersion were handled, according to my informants, by the villagers through informal, ad hoc arrangements.

These channels, however, were capable of irrigating only a limited number of arable tracts near the villages. Moreover, they could not always provide sufficient water to meet everyone's needs. Indeed, farmers were perpetually short of water and had to supplement their irrigation needs whenever
they could by relying on the natural drainage system of snow-melt waters.

Silim Khan's hydraulic works were to be on an entirely different scale. Absence of written records makes it difficult to determine the precise reasons for Mir Silim's channel-building projects. In general, the construction of large-scale irrigation channels seems frequently to be linked to mounting population pressure on available agricultural lands (cf. Kappel 1974:161-165; Boserup 1965:11). In Hunza it is possible that demographic pressure was a factor, probably, as Kreutzmann (1988:244) writes, because of the principality's remoteness, and its hostile political relations with neighbors during the 18th century, which made outmigration either difficult, or impossible.

Hunzakut local tradition provides a rather different reason for Silim Khan's decision to build new canals. One day, Hunzakut still recall, the ruler of neighboring Nagar taunted Silim Khan over the smallness of his dominions. "You rule over three little villages," the ruler of Nagar said, "equal to my
penis and two testicles." Inclined at first to avenge this contumely in the traditional Hunzakut fashion, namely by raiding Nagari villages, taking captives, and selling them as slaves in Badakhshan (Afghanistan), Silim finally had a better idea. He would instead build his principality into a mighty nation that would one day engulf neighboring Nagar. This he would do by building irrigation channels and establishing new colony-villages throughout his land.

Mir Silim embarked on an ambitious project to build several great waterways, the likes of which Hunza had never seen before (Map 3). The first of these was Haligan Gotsil. This channel, which is said to have taken seven years to build, brought water from Harachi Har to the former wasteland.

Oral tradition attributes the hostilities between Hunza and Nagar to a blood feud between the royal families of the two principalities. According to local tradition, the first ruler of Hunza was Girkis, a prince from the Tarkhany (also known as Shahraeisi) royal family of Gilgit. It is said that Girkis, and his twin brother Maglot, were appointed by the ruler of Gilgit to administer the inhabitants of the Hunza valley. Girkis, founder of the Ayashkutz dynasty, was appointed as governor over the territory on the northern banks of the Hunza River (the former Hunza state), while Maglot, the founder of the Magloti lineage, was installed as ruler of the area on the opposite bank of the river (the former principality of Nagar). Shortly after Maglot and Girkis assumed power Maglot is said to have murdered his brother in an unsuccessful bid to gain ascendancy over the entire valley. The incident sparked-off bloody reprisals from the Hunzakut. Thus began a vendetta between the two ruling families and between their respective peoples that did not end until the 19th century. Hunzakut oral tradition is replete with accounts of daring raids, bloody skirmishes, and all-out battles between the people of the two principalities. There were, however, intermittent periods of relative peace, intermarriage between the two royal families (for example, one of Silim Khan's wives was the daughter of Raja Babur, ruler of Nagar, and Silim's maternal uncle), and unity against a common enemy (e.g., during the 1891 British invasion of Hunza).
Figure 3. Map 3. Central Hunza's major hydraulic works
of Bemal Das (das = desert, or wasteland in Burushaski). Here the Mir established a village, called Haidarabad. (A portion of this channel, according to some of my informants, was later incorporated into the Barbar waterway built during the reign of Silim Khan's successor, Mir Ghazanfar Khan, who reigned from 1824 to 1865.)

After the Haligan channel was completed, Mir Silim began a second major project, the building of the Samarqand waterway (also called Dala). This channel, a little over 10 kilometers in length and still the longest waterway in Hunza, brought water from Ultar Glacier (see Pl. X) to Buram Das, another formerly infertile area. Here Mir Silim founded a second new village, called Aliabad. The Mir then allowed the people of Ganesh to tap water from this new canal, permitting them to colonize another formerly-infertile area, Dorkhan. He further granted the people of Ganesh a part of the royal water share from the Samarqand, so enabling them to build a second village, Hasanabad. (Hasanabad's present-day irrigation channels, which bring glacial meltwaters from the Mochichul nullah [side valley], were constructed during the reign of Mir Ghazanfar Khan.)

Finally, Silim Khan was responsible for building the Ahmadabad Gotsil, which brings water from a glacier (now called the Ahmadabad Glacier) high above to irrigate the

---

4 It is possible that the use of such names as "Samarqand," or "Kabul" (the name of another canal), is a consequence of the Hunzakut's close cultural ties with Afghanistan and Central Asia.
wasteland of Tahny Das. Here people from Altit founded the village of Ahmadabad.

These new gravity-fed channels comprised a network of primary canals that tapped glacial-melt waters from high above the settled areas and channelled them into specially-built stone tanks. Here the high sediment load of the water was allowed to settle before being distributed for irrigation. From the tanks the water was channelled into a series of secondary ducts and sluices (see Pls. XII, XIII), which disbursed water to the various communities over roughly a ten square kilometer area. At each village's allocation point, tertiary ducts served to direct water on to the terraced fields. This system remains in use to this day.

To construct his irrigation network, Mir Silim had not only to solve daunting technical problems with the most rudimentary equipment, such as ibex-horn picks and apricot-wood shovels, but he also had to organize a huge labor force. Wittfogel (1957b:26-27), as we have seen, has stressed that central authority is indispensable in order to overcome the logistical and managerial problems associated with organizing labor for the construction of large hydraulic works. (It is interesting to note that today, in the absence of the former state's authoritarian labor arrangements, the Hunzakut are finding the task of canal-building extremely difficult (cf. Whiteman 1985:40,45), despite the availability of modern rock-drills, dynamite, and assistance from development agencies.)
To build the new waterways in Hunza, great chasms between mountains had to be traversed and precipitous cliffs and other topographical obstructions negotiated (Pl. XV). In several places wooden conduits had to be installed to carry water along sheer cliff faces. To position and secure these conduits, holes had to be gouged out of solid rock to hold wooden support spikes. The workers who accomplished this task had to be lowered by ropes from the mountain tops. This work was extremely dangerous and Hunzakut still talk of numerous people losing their lives during the construction of these channels.

To obtain sufficient labor to accomplish the work of building the hydraulic system, the Mir demanded compulsory labor, or rajaki ("King's work" in Burushaski) from one able-bodied man from each household in all three villages (Pl. XVI). The Mir and Wazir, "rods in hand," according to my informants, personally supervised these construction projects on which, it is said, the laborers toiled from sunrise to sunset. The Mir commanded his nobles to provide grain and to slaughter cattle and sheep each day to feed the work brigades.

It is significant that these channels were constructed with corvée labor demanded by the state. No village community could claim exclusive rights over the system; the Mir thus had total command over the hydraulic works. Such control, a central tenet of the hydraulic hypothesis (Wittfogel 1957b:27; 1956:153; Mitchell 1973:533; Murphy 1967:25), had
Plate XV. Irrigation channels clinging to precipitous cliff walls above Ultar side-valley (Photo M. Sidky)
Plate XVI. Bunzakut villager transporting boulder for irrigation channel wall; rajaki laborers once performed such work for the Mir (Photo M. Sidky)
decisive political and socio-economic implications for the Hunzakut.

Once the Mir had established his new hydraulic network, he was able to use the water to irrigate previously-barren lands. Subsequently, he disposed of these newly-arable lands for the furtherance of his own politico-economic interests. Indeed, such lands constituted an extraordinarily potent new source of wealth and power, both for Mir Silim and for his successors.

The Mir granted land parcels in Haidarabad and Aliabad to his Wazir, other aristocratic families, his engineers, persons who provided him with outstanding service, people who fostered his sons, and individuals demonstrating outstanding merit. Such royal land grants were exempt from taxation and so especially valuable to the grantees. From the Mir's perspective, such gifts helped to consolidate his position as supreme ruler of Hunza.

The remainder of the lands (here and in other new villages) was allocated to the people of Baltit, Altit, and Ganesh. The land distribution policy adopted by the Mir had significant effects on the composition and the socioeconomic organization of the village communities formed in the new

---

5 The mirs of Hunza customarily assigned surrogate parents, "milk parents," to raise their sons. This practice served as a means of cementing alliances with important families. For the surrogate family such an arrangement meant considerable prestige and economic benefits. The prince himself could count on the full support and aid of his foster father and his kinsmen during the bloody struggles for succession that inevitably followed the death of the Mir (see above pp. 28-29).
territories. When irrigation water was brought to new lands, areas suitable for agricultural fields, orchards, residential sites, and irrigated pastures (toq) were demarcated, divided into parcels of equal economic potential and, after a portion of the tracts had been appropriated by the Mir for his own use, were distributed among eligible parties and petitioners through a lottery system (Qudratullah Beg 1980:107-116). Each grantee received locationally-separate grain fields, a plot for an orchard, toq, and a site on which to build his house. The majority of the allocations were made irrespective of genealogical affiliations (cf. Ali 1982:172).

Settlements established under the aegis of the state differed from the original three villages in several important respects. First, the new villages lacked exclusive descent-based residential neighborhoods. Second, the new settlements were composed of heterogenous agglomerations of households with varied genealogical affiliations. Third, the rights, duties, and obligations of the inhabitants of the new villages were the consequence of residence rather than descent, and were constituted by the state. Fourth, the newly-founded communities were brought under the direct administration of the state through a hierarchy of resident governmental officials and functionaries. Through this process the Hunzakut, who essentially comprised a descent-based society, were integrated into the politico-economic structure of the emerging state.
Men who received a royal land grant could benefit from the use of such land so long as they fulfilled their various tenancy obligations to the state. The intricate set of obligations and duties attached to a piece of land enabled the Hunza state to function without the use of currency. Those who found the venture unprofitable could relinquish their rights to the property, returning it to state ownership.

The parcels of land, although usufruct was formally allocated to particular individuals, remained the property of the state. This legality notwithstanding, the grantees held their land under secure hereditary rights and were not precluded from dividing it. Consequently, Hunzakut families enjoyed considerable flexibility over the devolution of their land, enabling them to partition it, or not, according to their own particular personal, economic, and demographic circumstances.

Present-day landholding patterns in Hunza represent, for the most part, the devolution of rights to land originally granted by the Mir to the patrilineal descendants of the initial grantees. The picture is complicated, however, by the exchange of tracts among the initial recipients, abandonment of parcels (with subsequent reallocation by the state), and cases of intestate inheritance (cf. Ali 1982:161). Also, village landholdings were expanded in some cases when suitable areas contiguous to existing fields were (with the permission of the Mir) brought under irrigation by local communities.
Customarily, rights to land passed from father to son in accordance with the principle of primogeniture. According to my informants (cf. Lorimer 1979:169), at the death of the father only the eldest son received the arable fields, while the others (if there were any) inherited the orchard, poplar trees, livestock, and any other movable properties. In this way, the original landholdings remained intact, under the control of a single peasant proprietor, while all the other sons were reduced to the rank of boldakoyo, or landless tenant farmers.

There is evidence, however, that after the new villages were fully colonized, many landholdings were partitioned into increasingly smaller parcels. This is evident from the steady increase in the number, and a corresponding decrease in the

---

6 Daughters usually could not inherit any of their parents' property, apart from items of jewelry and personal clothing. On the other hand, a man who had no male heirs could, in the presence of witnesses, bequeath his house, an orchard, or a field to his daughter. Upon their marriage daughters received a certain amount of grain from their parents, or from their brothers if the former were deceased. If a man with no sons died without having willed his property to his daughter, or daughters, or if he had no offspring at all, his brothers and their children became his beneficiaries.

7 Research in remote high-mountain regions elsewhere, e.g., the Indian Himalayas (Berreman 1978:49,355) and the Swiss Alps (Netting 1990:235-236), has shown that the opportunity to migrate to the lowlands can prevent the creation of "landless proletariat." For the Hunzakut, however, the prospect of migrating to other areas in any significant numbers became an option only after the 1891 British invasion. But even then, the Mir actively discouraged his subjects from leaving Hunza (cf. Schomberg 1935:139). However, any precise estimate of the out-migration of people from Hunza during the 18th and early-19th centuries is impossible, because of the absence of the written records and vital statistics necessary for such demographic analysis (cf. Netting 1981).
size, of landholdings in many of these settlements (Saunders 1984:14).

Such fragmentation of landholdings in Hunza was probably due to an apparently sudden population growth towards the middle of the 19th century (Müller-Stellrecht 1978:105-123; 1984b:26; Kreutzmann 1988:247). The reasons for this demographic surge are difficult to determine. Müller-Stellrecht (1978) and Kreutzmann (1988), German ethnographers who have conducted field research in Hunza, link this population growth with increased wealth generated by booty that Hunzakut seized during raids on caravans travelling between East Turkestan and Ladakh. However, since such booty was largely destined for the use of the Mir and members of the upper class, this explanation seems hardly sufficient. A more likely reason is the increase in available arable lands and consequent increase in food supply made possible by Silim Khan's new waterways.

The relationship between agricultural intensification and population growth is complex. Boserup's (1965:41) comparative ethnographic and historical study has led her to suggest that intensification of production follows, rather than precedes, population growth. But other research suggests that population growth may either trigger or follow agricultural intensification (cf. Bronson 1972; Brown and Podolefsky 1976). It is generally recognized, however, that agricultural intensification, with the consequent enhancement of nutrition,
not only enables a larger number of people to be fed, but also influences fertility (cf. Katz 1972).

It is useful to consider, briefly, the mechanisms of population control that may have been at work prior to Silim's coming to power, and how these may have been influenced by his new hydraulic works. According to Japanese medical researchers Harada and Miyoshi (1963:4), it is possible that high infant mortality (due to nutritional stress) was an important check on population growth in Hunza. To cope with the acute food shortages experienced by the Hunzakut during late-winter and spring, households were compelled to ration their dwindling food supplies, with men receiving more than women, and adults more than children. Harada and Miyoshi (ibid) suggest that such food rationing resulted in an "unconscious" starving of infants and children, leading to high infant mortality rates. This, they believe (ibid p. 4), may have functioned as a kind of Malthusian check, maintaining a balance between Hunza's human population and its productive resources. Harada and Miyoshi base their conclusion on data gathered during the post-colonial period, when rapid increase in population once again resulted in land scarcity. One may speculate, however, that land shortage must have been even more pronounced in the days before Silim Khan's irrigation

---

8 Such food rationing may have also influenced population growth by its effects on reproductive females. Fewer calories and poor nutrition among females prevents the accumulation of body fat, which, in turn, suppresses ovulation (cf. Frisch 1978).
works were in place. The Mir's new hydraulic system must surely have helped alleviated winter hunger and so allowed the population to grow.

The rise in population in Hunza may have also been fostered by the state's expansionist policy during Silim Khan's rule. The Mir's increasing demand for obligatory labor to intensify production, establish new colonies, wage war, and augment the political boundaries of his state may have acted as catalysts for demographic growth. Studies elsewhere suggest that states may indeed expand their population in these ways (cf. Harris 1979:102), since the intensified demand for labor encourages people to have larger families (McElroy and Townsend 1985:150). One must admit, however, that in the absence of demographic records and vital statistics, observations such as these are speculative at best.

Whatever the ultimate stimulus for population growth in Hunza, it is clear that pragmatic priorities, stemming from the concrete problems of everyday life in the oasis villages, superseded the formal rules for the inheritance of land. Thus, wherever possible, large holdings were not inherited, as per tradition, solely by the eldest son, but partitioned among all male heirs (cf. Saunders 1984:14). Estate fragmentation into increasingly smaller units continued over several generations, until further division could only result in parcels too small to meet subsistence needs and tax requirements. Ultimately the
subdivision of land created landless tenant farmers, in much the same way as did the traditional practice of primogeniture.

It is clear that Silim Khan's hydraulic works had both beneficial and negative effects on the Hunzakut people. Initially, the new irrigation works provided the people with additional farmlands, thus freeing them from what must have been very congested and stifling living conditions in the three original settlements. The hydraulic enterprise allowed the people to raise more children and so to maintain larger families. However, once all potential arable lands had been brought under cultivation, the consequent population increase caused the Hunzakut to find themselves once again confronted with land shortage and overcrowding.

For Mir Silim himself, the newly-arable lands proved to be a great source of benefit. He appropriated for the royal estate the best land parcels in each of the new villages. Such properties were worked for him through a system of corvée labor (rajaki). These rajaki laborers were supervised by the Mir's yerfa, one of whom, as mentioned earlier, was to be found in every village where the ruler owned land.

Besides the revenue obtained from the royal estates themselves, the Mir taxed (both in kind and in labor) those ordinary Hunzakut to whom he had allocated parcels of the new farm lands. To ensure the proper development of these tracts, the Mir provided each grantee with seed grain, apricot saplings, lucerne seeds, and the use of draft animals.
Land grantees had to begin paying taxes within one to two years of their tracts becoming productive. The amount of this tax varied according to the productivity of each allotment. The majority of my informants maintained that up to a third of the grain produced on these plots had to be remitted to the state as tax, but others said that it was only a fifth. In addition to grain, grantees had to provide the state with a fixed number of livestock and a determined quantity of butter, fodder, and firewood.

The state grain tax was used to support the Mir and his family, court functionaries, guests, palace guards, scribes, a stable-master, cooks, musicians, craftsmen and artisans, yurghul (royal prostitutes), servants, and slaves. The Mir stored any remaining grain in his fortified-granaries in Altit, Baltit, and Aliabad. This was then loaned to needy individuals during emergencies, or in times of food scarcity. Such loans were dispensed in spring by minor village officials called chirbu. The loans had to be repaid in late summer, after the recipients had harvested their autumn- and spring-sown wheat crops. As for the butter, livestock, fodder, and firewood, the Mir appropriated these for his own use.

By levying such taxes in certain specified commodities, the Mir was able both to intensify the economic output of his subjects and to set the goals and priorities for agro-pastoral production within his domain. Moreover, such taxes enabled him to amass greater wealth than ever before; this, in turn,
allowed him to embark upon further canal-building enterprises.

As chief controller of the irrigation networks, the ruler of Hunza determined the allocation and distribution of water to each community. For example, after the Haligan aqueduct had been constructed, he ruled that its water was to be used for seven days and nights by the residents of Baltit. Subsequently, Haidarabad was to receive its share over the following four days and nights. But in Haidarabad's case, the Mir ruled that all water taken by day was to be used exclusively to irrigate his own properties. Only at night could ordinary landholders channel water for their own needs.

The Mir's power to reward deserving subjects with additional rights to water is a further example of his control over the state's irrigation system. For instance, he rewarded the men of the Khurukutz clan of Baltit for their special services during the construction of the Samarqand Canal, when they surmounted a natural obstruction that threatened to terminate the whole project. The delighted ruler granted these clansmen an extra share of water from the new aqueduct, establishing a special stone sluice (the Khurukutz tori) in their name, which allowed the permanent flow of a specified amount of water into their farmlands adjacent to the Samarqand Canal.

Water distribution, based on specified shares for the various villages, was formalized and enforced by village trangfa and by channel supervisors, called darago. These
officials were directly responsible to the state, rather than to the local communities in which they lived. The distribution system was flexible enough to accommodate year-to-year variations (due to the presence or absence of cloud cover) in the quantity of available glacial meltwater. Such rules were strictly enforced during times of water shortage, but less rigidly when water was abundant (cf. Lorimer 1935:351-357; Lorimer 1979:56-57).

Rigorous state water control in Hunza was instrumental in preventing disruptive disputes among villages, and between neighbors dependent upon a common irrigation channel. Any dispute over the distribution of water was usually resolved by the local village headmen. But, if they could not settle the matter, the case would be referred to Wazir. His decision could also be appealed to the Mir in person. (It is interesting to note that, since the abolishment of the Hunza state in 1974 by the Government of Pakistan, the efficacy of Hunza's traditional system of water allocation has much deteriorated, with present-day Hunzakut caught up in an increasing number of disputes over water distribution [Miller 1982:120]. The importance of supra-local authority in the allocation and distribution of water, which is crucial to Wittfogel's thesis, is evident from the data presented here.)

Mir Silim's control over the new waterways further contributed to Hunza's administrative centralization. This is because potentially autonomous communities were compelled to
obtain water through canals that were beyond their local control. As such, these communities were obliged to abide by the rules and associated obligations that the Mir laid down for the use of state water. Villages and land owners refusing to meet their obligations, or to abide by state regulations, risked losing their irrigation privileges. This was indeed a powerful sanction. My elderly informants could remember only one incident in their lifetime when the Mir actually resorted to it. This, they said, was in the 1920s, when the small, eight-household, hamlet of Gurman had its irrigation privileges revoked for its failure to comply with state water regulations.

The Mir's absolute power over Hunza's water works confirms part of Wittfogel's (1957b:18) hypothesis, namely that water is not only a vital natural resource, but one that can be exploited for political ends. Cross-cultural ethnographic data have demonstrated that through such water control central authorities can integrate closed corporate communities into the state's administrative system (cf. Lees 1974).

The organization of irrigation in Hunza, encompassing the entire range of activities -- from the construction of the irrigation facilities, canal maintenance operations, and water allocation, to the resolution of conflicts over the distribution of water -- was thus handled through the state's hierarchy, from Mir to local water-monitors. Where the state
exerts such control as this over irrigation and irrigators, we may speak of the irrigation system as being "centralized" (cf. Kelly 1983:882-884).

As the Mir expanded Hunzakut settlements, by developing irrigation networks and founding new villages, he was able also to establish control over his people's agricultural and pastoral production. This he achieved by transferring the right to make decisions concerning the agricultural calendar from local communities to his own central authority. In this way, the Mir compelled the inhabitants of each village that was linked to the state-controlled hydraulic network to synchronize its water-demanding agricultural operations with the state's water rotation time-table. Henceforth the state would decide when people should fertilize and irrigate their fields, which crops they should water during a particular irrigation cycle, when they should plant and harvest their crops, and when livestock were to be taken to and brought back from the alpine pastures. Those who did not follow the official timetable were punished or fined. The state's role as coordinator of agricultural activities was reinforced through a series of public rituals, over which the Mir presided in his capacity as chief provider of supernatural fertility.

In this manner, the political economy of the Hunza state -- the pattern of resource allocation, and the manner in which production was organized and appropriated -- was linked
directly to the state-controlled waterworks and the hydraulic mode of production.

State coordination of agro-pastoral production was crucial in ensuring that no village delayed its agricultural operations, for this would not only interfere with the official water distribution timetable, but also jeopardize the chances for maximum yields, thus diminishing the amount of grain tax payable to the state. As evidenced in other parts of the world, state-level societies characteristically use administrative control over agriculture as a strategy to increase productivity (cf. Redman 1978:232; Harris 1979:102; Taylor 1979:178; Johnson and Earle 1987:270). Hunza was no exception (see Chapters 4 and 5 below).

The exploitation of upland forests, which served as an important source of wood for fuel, was another economic activity brought under state control. No trees could be felled without the permission of the Mir and the village trangfa. Moreover, villages had to pay a modest tax based on the total amount of wood collected from the forests.9 (Since the Government of Pakistan has assumed ownership of Hunza's alpine forests, such traditional controls over the use of this natural resource have ceased to operate. Islamabad's administrative writ, however, is not fully enforceable in this still relatively-remote area [Dani et al., 1987:26-27, 32].

---

9 Reckoned by the trangfa on the basis of the number of backpacks of wood (approximately 30 kg/pack) brought in by each household.
Thus, while traditional conservation practices have disintegrated, effective substitutes have not been instituted. The indiscriminate felling of trees is increasingly evident in Hunza, a practice threatening the region's upland forests [Bilham et al., 1984].

Aside from extending his authority over the agricultural production of his people, the Mir also assumed control over the reproduction of his subjects. This he achieved by imposing a tax on all marriages held within his domain. All weddings were celebrated simultaneously, at the conclusion of the agricultural cycle; no other time was permitted.\(^{10}\) The Mir himself officiated over these mass weddings. The families of both groom and bride had to pay a marriage tax; the former a stipulated amount of gold dust, the latter a certain amount of grain, butter, and other foodstuffs. Men whose families were unable to pay the gold tax were thought incapable of mustering sufficient resources to support a wife and children, and so were not permitted to marry (cf. Lorimer 1979:184).

In an attempt to undermine the prestige of the nobility, lineage heads, and wealthy landowners (all of whom were always a potential threat to his authority), the Mir also brought under state control prestige-generating social activities, such as the building of public structures: mosques, shelters

---

\(^{10}\) But when a woman died leaving behind young children, it was recognized that her husband would want to marry again as soon as possible, in order to have someone to take care of his children. Such "out-of-season" marriages were permissible, but they required the payment of a stipulated amount of gold dust as tax to the state.
along mountain-paths, and watch-towers. The Mir achieved such control by demanding an enormous tax for staging the "feast of merit," which always marked the completion of a project of this kind. According to Silim's new regulation, the construction of a mosque, for example, required the payment of 100 goats, 100 loaves of bread, 100 lumps of butter, and the flesh of 40 slaughtered oxen, a third of all this going directly to the state (cf. Lorimer 1979:142). Even the wealthiest families in Hunza were incapable of amassing such vast amounts of foodstuffs; consequently, the construction of public buildings, along with the prestige derived from them, became the sole prerogative of the Mir.

As Silim Khan's political and economic powers increased, he began to extend his control over the lower and upper portions of the Hunza Valley. He ordered some Hunzakut families to settle Maiyun, in lower Hunza (Map 4). Shin people from the neighboring village of Hini, who were his vassals, were already farming here, but had not established domicile for fear of being raided by neighboring Nagar people. After Mir Silim had set up a small Hunzakut colony in Maiyun, he proceeded to appropriate a large portion of the land for himself. In accordance with the rajaki system, he made his Hini vassals work this land for him, under the supervision of a yerfa.

Next, the Mir turned his attention to Herber, the area immediately north of Central Hunza (Map 4). Here he
Figure 4. Map 4. Expansion of Silim Khan's political control in the Hunza Valley

[Map showing the expansion of Silim Khan's political control in the Hunza Valley, with labels for different districts and settlements.]
encouraged the settlement of Wakhi refugees from Afghanistan, who thus became his vassals. The Mir exacted tribute from his new subjects both in kind and in corvée labor. The Wakhi paid two kinds of taxes: *ilban* (a certain number of goats and sheep, as well as a fixed amount of butter) and *otaq* (the produce of a certain number of fields). To increase productivity in Herber, Mir Silim built new irrigation channels in Gulmit and Ghulkin (Map 4).

Finally, Silim Khan decided to bring under his control the areas that lay at the headwaters of the Hunza River (Map 5), occupied at that time by Kirghiz pastoral nomads from China's Taghdumbash Pamirs (now part of the PRC's Autonomous Province of Xinjian). Silim launched a successful military campaign against the Kirghiz, establishing sovereignty over Shimshal Valley and Taghdumbash Pamirs, territories that had been under Chinese control since 1759. The Kirghiz were obliged to become Silim's vassals and to pay regular tribute to him. China's military weakness at that time forced its government to acquiesce to Silim Khan's encroachment.

Stage by stage, Silim Khan thus extended political control beyond the core area of his state's hydraulic economy. Wittfogel's (1956:154) hydraulic thesis forecasts just such a development; once a centrally-controlled hydraulic system is in place political expansion is likely to follow.

---

11 Shahrani (1979:87-168) provides a useful description of the Kirghiz and their culture.
Figure 5. Map 5. Territorial expansion of the Hunza state during the reign of Silim Khan III.
Mir Silim's acquisition of these northern territories opened the way for the Hunzakut to raid caravans plying the trade route between Yarkand and Badakhshan. It was not long before the spoils from such raids began to provide Hunza's ruler with yet another significant source of income (cf. Müller-Stellrecht 1978:139).

Müller-Stellrecht (1981:54-55) maintains, as we have seen (see above p. 91), that such raiding was the principal cause for the rise of the Hunza state. Historically, however, the raiding of caravans by the Hunzakut came after the emergence of the state in Hunza; it was not in itself, as Müller-Stellrecht (1981:54-55) proposes, a primary factor.

The growth of new settlements outside the central valley created a need for improved communications between the center and outlying communities. Mir Silim developed such links by establishing an administrative hierarchy of state officials that stretched from his capital, Baltit, to the most distant of the new settlements. The Mir conveyed his dictates to his Wazir, who relayed them to the trangfa, or village headmen. Each trangfa, in turn, passed the royal messages to his subordinate officers, uyum (announcer of official orders and collector of state revenue), chirbu, and darago (who, as we have seen, dealt with matters relating to the operation of the irrigation channels and supervised the yatguin, the actual watchmen of tanks and waterways above the valley).
To facilitate the collection of taxes and the mobilization of rajaki labor, the Mir divided his state into four administrative districts, called maqsu, all of which were of an equivalent rank. The three original settlements in Central Hunza constituted the first district; the thuantkhanan, or new fort-villages in Central Hunza, the second; the Shin-Hunzakut villages in lower Hunza, the third; and the Wakhi-Hunzakut villages in Upper Hunza, the fourth (Map 4). The successful incorporation of the new settlements along with the original three villages into a single political framework represented the ultimate affirmation of the Mir's paramountcy in Hunza, where political power had traditionally rested in descent-based associations within the original three villages.

Under Mir Silim, the political structure of Hunza was radically transformed. For the first time, state business was conducted by a formal council, called marika. This was headed by the Mir himself and attended by the Wazir, the village trangfa from all the administrative districts, and by members of the aristocracy. Modern Hunzakut recall that during these meetings nobody dared speak out of turn. The proceedings were conducted with great formality, the Mir and his officials being both respected and feared. Another of Silim Khan's innovations was to form a royal bodyguard, comprising a corps of swordsmen and musketeers, who guarded him wherever he went; they also attended his court.
It should be clear from the foregoing discussion that the political and administrative structure of the Hunza state was significantly influenced by the power Silim Khan had acquired as a result of his control over the irrigation works. The data presented here confirms Wittfogel's (1957b:27) observation that:

No matter whether traditionally nonhydraulic leaders initiated or seized the incipient hydraulic 'apparatus' or whether the masters of this apparatus became the motive behind all important public functions, there can be no doubt that in all these cases the resulting regime was decisively shaped by the leadership and social control required by hydraulic agriculture.

The growth during Mir Silim's reign of a large class of relatively wealthy land owners and state officials stimulated the demand for prestige goods, such as precious stones, knotted carpets, silk robes, cotton cloth, sugar, tea, spices (clove, black pepper, and turmeric), salt, iron implements, weapons, and horses. In most ancient state-level polities such luxury items for the elite were obtained through trade, or else by pillaging less powerful neighbors (cf. Flannery 1972:412). Hunza's physical inaccessibility, as well as its lack of suitable export commodities, hampered the establishment of significant trade relations with neighboring states. The Hunzakut had little to trade, aside from small quantities of gold dust (washed from the Hunza River every fall and spring by specialists called kharapguen, who belonged to the rank of the load carriers), dried fruit, wool, and butter. All economic transactions with neighboring peoples were under the
personal control of the Mir, who was also the chief recipient of the benefits derived from such commerce.

Trade as a means of obtaining luxury goods was thus unfeasible; however, plundering was certainly possible. According to local tradition, men from Hunza used to travel long distances to waylay caravans moving between Leh and Yarkand. Indeed, by the 19th century the Hunzakut had become famous for their daring raids, which they called "striking the road," on caravans plying the ancient Silk Road. It made little difference to the raiders whether a caravan was travelling from the north, or from the south (Biddulph 1880:28, 29; Schomberg 1936:213-218). Neither the authorities in Chinese Turkestan nor in Kashmir could prevent the Hunzakut attacks (Knight 1893:329).

Besides looting goods from caravans, Hunzakut raiders also took slaves, whom they did not keep, but bartered for weapons, livestock and other desired goods, either with individual slave-owners in Chinese Turkestan, or else with Kirghiz or Badakhshani slave dealers (Knight 1893:329-330; Leitner 1889: Appendix 1:6; Nevill 1912:132). By the early 1800s slaves had become Hunza's principal export commodity (Cobbold 1900:22; Curzon 1926:181-182). Gordon (1873:147), a British military officer who travelled the Pamirs during this period, noted that a male or female slave commanded the same value: 10-15 bullocks, 5-8 yaks, or two Kirghiz rifles.
The only people, apparently, who were permitted safe passage by Hunza raiders were merchants and slave-traders from Badakhshan, with whom the Hunzakut had economic and religious ties, the latter reinforced by common membership in the Ismailia sect (Leitner 1889:54; Montgomerie 1866:157-172). In fact, according to Biddulph (1880:28), by the 19th century Hunza had become the "chief place of resort for slave-merchants from Badakhshan."

All goods obtained either directly through caravan raids, or indirectly through the barter of slaves, had to be given to the Mir, who would distribute them as he saw fit, usually with an eye on reinforcing his alliances with the noble families of his state.

Silim Khan's control over Lower and Upper Hunza, his acquisition of Shimshal Valley and Taghdumbash Pamirs, coupled with the improvements he made to the state's administrative structure and communication networks, and the economic gains realized through organized caravan raiding, further cemented his paramountcy over Hunza. The new socio-political conditions also stimulated Hunza's legal development. Whenever unprecedented legal cases were brought before the ruler, he convened the marika and, after listening to the opinions of the council members, rendered a decision regarding the matter. After the Mir had passed judgement, laws were enacted that laid down the procedures for dealing with similar cases in the future. Such innovative legal practice produced a codified
body of state legislation that, according to my Hunzakut informants, was still in use until a few decades ago.

Finally, with Silim Khan's hydraulic works as a new and unprecedented source of wealth and political power, the premises underlying the Mir's claim to authority were significantly altered. Until this time the Mir's political legitimacy rested on his reputed supernatural abilities, said to have their source in a special relationship he claimed to enjoy with the pari, or mountain spirits. The Mir's claim to such supernatural communion was validated by the bitan, soothsayers, oracles, and earthly spokesmen of the pari. (Nineteenth- and early twentieth-century travelers to Hunza described the bitan as religious practitioners who inhaled the smoke of juniper branches, danced to a special music, entered ecstatic trance states, drank goat's blood, and conversed with the pari [Durand 1899:212-219; Leitner 1889:263-264; Lorimer 1929a, 1979:263-264; Schomberg 1935:209-212; Muhammad 1905:10-105]. In traditional Hunzakut society, bitan were an integral part of the state's ritual and politico-ideological apparatus. They were consulted during national celebrations, agricultural feasts, other important state-sponsored events, and before military expeditions and the departure of raiding parties. These oracles always spoke of contemporary events and concerns, and their revelations were often seen as indicating

---

12 According to traditional Hunzakut cosmology, these supernatural beings manifested both the life giving and the life threatening forces of nature.
supernatural approval for state-sponsored activities. Bitan usually validated the activities of the Mirs, while the bitan's legitimacy, in turn, depended upon recognition by the Mir [cf. Sidky 1994].)

It was because of their special relationship with the pari that the rulers of Hunza claimed to possess the power to make rain, melt glaciers, and quell storms. According to local sources, farmers depended on their ruler's weather magic, and a Mir who was unable to make rain, or increase the flow of glacial meltwaters, at a critical time would be assassinated and replaced by another member of the royal family (cf. Müller-Stellrecht 1981:53). In consideration of their supernatural abilities to control the weather, the Hunza Mirs, according to my informants, levied a special tax of several sheep, called haraltemari, on each village. The village of Hini in Lower Hunza, dependent solely upon snow and rainfall for irrigation (see Map 4), continued to pay haraltemari to the Mirs until the late 1800s.

Silim Khan, though he would radically change these traditional tenets, is nonetheless reputed to have possessed such magical powers himself. It is still told how Silim, shortly before he usurped the throne from his brother, Ghuti ("fat") Mirza ("under whose rule the land was dry because he

---

13 Oral tradition tell of numerous thums who possessed such magical abilities. For example, Haidar Khan, son of Ayasho II, is said to have been able to produce violent rainstorms at will; to this day Hunzakut refer to exceptionally powerful rainstorms as "haidarkhani."
could not make rain"), astonished everyone with a dramatic display of weather magic. He is reputed to have caused a violent snow storm in mid summer. "The snow accumulated on the ground," Hunzakut aver, "up to the length of an arrow." This miracle is said to have convinced many Hunzakut of Silim's legitimacy to the throne. People are said to have rallied around Silim in great numbers, while Mirza was deposed and executed.

Silim Khan's own belief in the importance of the Mir's weather magic is evident from his remarks during the official opening of the Samargand Canal. He is reported to have exclaimed: "Now that the people no longer depend upon the powers of their Mir over the weather, anyone can become the Thum of Hunza!" However, as Silim established control over the hydraulic system, his mundane power over water became more important than his magical power to make rain. In other words, with Silim's rule, a new ideology of legitimacy emerged in Hunza, as the Mir's divine mandate from the mountain spirits was subordinated to his earthly control over the hydraulic works and, through them, land and water, the principal productive resources of the state. Silim (and his successors), nevertheless, continued to affirm their special relations with the mountain spirits.

As Silim Khan's administrative powers increased, he also extended his hegemony over the spiritual affairs of his people. This he achieved by personally inviting khalifa,
Ismailia missionaries from Badakhshan in northern Afghanistan, to preach their sect's doctrine among his subjects. In this way, Silim Khan undermined the influence of the mainstream Shia akhund, or teachers, over his subjects. Once the Hunzakut were converted to the new creed, the Mir appropriated for himself the position of spiritual leader of his people, thus commanding authority in both secular and religious domains. This corresponds to Wittfogel's (1957b:90) observation that once a hydraulic ruler achieves absolute secular power, he is likely to assume the role of supreme religious leader as well. That Silim Khan was the highest religious authority in Hunza is evident from the fact that he never made any attempt to place either himself or his followers under the religious authority of the Agha Khan, the spiritual leader of the Ismailia sect. Moreover, before the

14 I have noted elsewhere (Sidky 1994) the possibility of an early 14th-century intrusion of Ismailism in Hunza. But we cannot be quite certain that the new creed was propagated among the Hunzakut before the reign of Mir Silim, in the 18th century. The Mir had learnt about Ismailia doctrines while living as an exile in Badakhshan (Lorimer 1979:213-214). His successor, Ghazanfar (d. 1865), and the latter's heir, Ghazan Khan (d. 1886), were enthusiastic proponents of Ismailia teachings and regularly invited Ismailia missionaries to Hunza.
British conquest of Hunza in 1891, the Hunzakut refused to send the mandatory annual tithes to the Aga Khan; instead they gave this customary religious offering to their Mir (Gordon 1873:139).

During his 34 year reign (1790 - 1824), Silim Khan managed radically to change the political, social, and economic foundations of Hunzakut society. In this relatively short time he was able to construct sophisticated, large-scale hydraulic works, establish new colonies throughout the Hunza Valley, bring Shin, Wakhi, and Kirghiz communities under his direct authority, expand the political boundaries of his principality, and forge a centralized government, in which he himself wielded supreme secular and spiritual authority. By the time of his death in 1824, Hunza had grown from three small semi-autonomous villages into a powerful centralized state, feared by its neighbors and able to launch military campaigns against Chinese Turkestan and Wakhan to the north, and against Gilgit to the south.

15 Only after the British invasion did the Hunzakut establish direct contact with the Agha Khan, then living under British protection in Bombay (Madelung 1987:249). Agha Khan Hasan Ali Shah served as an ally during the British conquest of Sind, receiving in return the support which enabled him to legally establish his authority over Ismailia communities throughout the subcontinent (cf. Madelung 1987:250; Lewis 1980:17). In 1892, at the suggestion of the British Viceroy, a visiting Hunzakut delegation to India established contact with the Ismailia leader in Bombay. Upon its return to Hunza, the delegation presented to the Mir the Agha Khan's genealogy, which traced his lineage through the Lords of Alamut, thence to the Fatimid of Egypt, and ultimately, through Caliph Ali and his wife Fatima (daughter of Prophet Muhammad) to the Prophet himself. The Mir accepted the legitimacy of the Agha Khan's claim and decreed that henceforth the Hunzakut would acknowledge him as their imam, or spiritual leader.
Under Silim's successors, Ghazanfar (1824-1865) and Ghazan Khan (1865-1886), the building of irrigation channels continued. The most important new waterway was the Barbar Canal (see Map 3), constructed circa 1834 by Mir Ghazanfar, according to my informants, in order to channel additional water to Baltit, Haidarabad, Dorkhan, and Aliabad. Also, it was Ghazanfar Khan who further tightened state control over the economy by decreeing that the timing of all aspects of economic production, including the manuring of the fields, the milling of grain, and movement of livestock within the villages would be determined by the state (cf. Lorimer 1979:268-269).

The looting of caravans along the Leh-Yarkand route, as well as slave raiding in Sarigol (Chinese Turkestan), Nagar, and Gilgit also continued. Hunza's military victories against Nagar, and against the Sikh troops of the Maharajah of Kashmir (who occupied Gilgit from 1842 to 1848)\(^{16}\), led the Hunzakut to believe that no foreign army could be their match (Schomberg 1935:149). Probably this was the reason for Mir

\(^{16}\) The Maharajah of Kashmir launched several military campaigns against Hunza. The first of these took place in 1848, during the reign of the Dogra Maharajah Gulab Singh. It was executed at the request of the British Government in India in order to put a stop to Hunzakut raiding. Ranbir Singh, Gulab Singh's heir, sent two further expeditions against Hunza, one in 1865 and other in 1866. All three campaigns were unsuccessful. The Hunzakut continued their attacks until 1869, when, under pressure from the British, the Mir agreed to recognize the Kashmiri authorities and to pay them a nominal tribute, provided that it was channeled through the British Political Agent in Gilgit. The Mir also insisted that no Kashmiris were ever to enter his territory. Despite this agreement, however, the Hunzakut did not abandon their marauding, much to the chagrin of the British (cf. Crane et al. 1956:66).
Safdar Ali Khan's (1886-1891) defiant attitude toward the British, which would result in his being overthrown from power. In 1891, the British occupied Hunza and brought to an end many of the Mir's traditional prerogatives, especially those of chief recipient of looted goods and profiteer from the sale of slaves (Durand 1899).

* * *

In this chapter, I have examined the evolution of political complexity and centralization in Hunza. I have focused specifically on the linkages between large-scale, centrally-controlled irrigation works and state formation. Hunza's relative geographical and political isolation, demographic pressure on resources, and hostile relations with neighboring groups during the 18th and 19th centuries were also factors in this process. Anthropologists such as Carneiro (1970:736-737, 1967, 1972), Dumond (1972), Webb (1975), Webster (1975), Harris (1977:78-79), and M. Cohen (1981:121-122) see such social and environmental circumscription, accompanied by population growth and warfare as of primary significance in the evolution of the state. Pakistani anthropologist A. S. Ahmed (1988:193) believes that warfare and Hunza's need to resist invasion were the major catalysts for state formation. I maintain, however, that the decisive factor in the evolution of the state in Hunza was the development of its large-scale hydraulic works.
The construction of Hunza's major waterworks, as we have seen, was accompanied by an ever-increasing concentration of political power in the hands of the Mir. The hydraulic works contributed to this process for several reasons.

First, because the Mir alone could control the labor and material resources necessary to build such an irrigation network, local communities were compelled to surrender control over water, a principal means of production, to a supra-local power.

Second, once the new irrigation system was in place, the Mir was able further to expand his political power base. This he achieved by channeling water to previously-uninhabited areas, establishing new settlements, and granting tax-free farming lands, both to reward those who had served him well and to cement political alliances with other noble families.

Third, the Mir was able to acquire new royal estates, which brought him additional revenue through the rajaki system. He was able also to tax those of his subjects to whom he had granted usufruct rights to tracts of newly-arable lands.

In sum, command over the hydraulic apparatus gave the Mir control over the means of production. This enabled him to intensify agriculture, dictate economic priorities and objectives, and to appropriate a significant portion of his subjects' produce in the form of taxes. In these various ways, the Mir acquired unprecedented political strength,
administrative control, and wealth. These, in turn, enabled him to undertake further irrigation projects, establish additional new villages, and acquire strategic northern territories. We may thus speak of Hunza as representing a true "hydraulic state," in which irrigation constituted the primary source of political power.
CHAPTER IV

HYDRAULIC AGRICULTURE AND STATE AGRO-MANAGERIAL CONTROLS

The Agricultural Cycle and State Regulation of Crop Production

The Mir's control over Hunza's hydraulic works not only gave him command over land and water, the principal productive resources of his state, but also enabled him to acquire managerial powers over the agro-pastoral production of his subjects.

All phases of agricultural production (as also pastoral production) were coordinated by a series of rituals, over which the Mir presided in his role as provider of fertility. The state deemed such coordination crucial, since delays either in the initiation or completion of critical farming operations could disrupt the water-disbursement cycle and the sequential planting and harvesting timetables. Compliance with the ritualized, state-ordained agricultural program was enforced through castigatory measures, such as the withdrawal

---

1 Researchers working elsewhere have argued that centrally-controlled, large-scale hydraulic systems tend to be more inefficient, unstable, and prone to breakdown than are small, locally-managed ones (e.g., Leach 1961:165; Netting 1974; Moran 1979:195). In Hunza, however, centralized control and coordination played a vital role in ensuring the stability, efficiency, and continued operation of the hydraulic infrastructure.
of irrigation prerogatives, fines, and the infliction of corporal punishment.

State managerial controls fulfilled crucial resource-management functions, by ensuring the optimal use of seasonal conditions and limited time and space. They served also to regulate and maximize the flow of goods and materials in accordance with the interests of the state.

The agricultural year was initiated by the channel-opening rite held in late-January, or early-February. The Mir consulted with his Wazir and village elders in deciding when to open the channels. His decision was based upon the consideration of such factors as the volume of snowfall during the winter (which determines the amount of snow-melt waters available for spring planting), seasonal temperatures, and the quantity of water flowing from the glaciers. On the predetermined day, village headmen and clan elders went to the channel heads at Ultar nullah (Map 3), poured milk and oil into the water, sacrificed a goat, and prayed for abundant harvests in the year to come. Possibly, though my informants did not say, this may have been an offering to the mountain spirits believed to reside amidst Ultar Glacier.

The opening of the channels marked the start of a strict water allocation program, which lasted until June when water normally becomes plentiful. Water was made available to each village sequentially and for a specified number of days. Villagers mobilized at once and worked jointly, and around-
the-clock, to ensure that all operations associated with the watering of the fields were accomplished promptly and efficiently. In this way, people in the villages linked together by the hydraulic network were compelled to coordinate their farming operations with the state's water allocation timetable.

To give priority to plants most likely to suffer harmful effects from inadequate moisture levels, the state designated each water-distribution cycle for the irrigation of specific crops. Plant physiologists studying the effects of moisture on plant growth and development have found that various cultigens have critical stages during which suboptimal levels of moisture cause harmful and irreversible agronomic effects (Salter and Goode 1967:5-10; Langer and Hill 1991:344; Russell 1973:32). Hunzakut farmers also seem aware of the critical relationship between plant growth and moisture during certain growth stages. The establishment of irrigation priorities was an attempt to minimize the parching of the crops during crucial growth stages.

The moisture-sensitive periods for wheat and barley are during the early stages of growth, and also when their leaf canopies are at their highest (cf. Salter and Goode 1967:18, 32; Langer and Hill 1991:344). In Hunza, autumn-sown wheat attains its maximum leaf canopy during the third week of April, while spring-sown wheat reaches this stage in June. Barley achieves its maximum crop canopy in late May.
Vegetables are most sensitive during the time of organ formation (cf. Shimshi 1973:384), which in Hunza occurs around late May and June. Lucerne is most susceptible after each cutting (Bielorai 1973:391-396). Hunzakut farmers normally cut their lucerne fields in mid-April, early June, and late September. The critical stage for fruit trees is during the main fruiting season (Bielorai et al. 1973:397-399), which in Hunza occurs roughly between mid-May and early June.

During the month of February water was allocated strictly for irrigating autumn-sown wheat (corresponding to the early, water-sensitive stage of this crop), and for the preparation of fields to receive the barley crops. Once these tasks were completed, water was made available to prepare fields for receiving spring-sown wheat and vegetables in late March. Barley and autumn-sown wheat were watered again in late April, the moisture-sensitive periods of these two crops. Towards the end of May, the barley, spring-sown wheat, and vegetable crops were watered. By this time barley had passed its critical moisture-sensitive stage, but still needed watering. The spring-sown wheat and vegetables, however, were at their critical stage at this time. In June (when, under normal circumstances, the water increases) farmers were allowed to irrigate their fruit trees, lucerne and grass fields, along with their autumn- and spring-sown wheats and barley crops. Thus, so far as possible, the efficient use of precious water resources was achieved through a close coordination between
the amount of water available and crop-plant water requirements.

The sowing of barley was marked by the Bopfau, or seed-scattering ritual, held in early February. The Mir determined the actual date of the ceremony, after seeking the opinion of his court officials and village elders. His decision, according to my informants, was based on particular climatic conditions, especially seasonal temperatures and the amount of glacial melt-water flowing in the channels. No Hunzakut was permitted to sow his crops until the Bopfau had been held.2

The night before Bopfau, the Mir sponsored a national celebration and dance. The next day, people of every village in Central Hunza swept their houses, cleaned the soot from their ceilings, and ritually rubbed flour on the roof beams and rafters of their homes. (This use of flour seems to be associated with the idea of fertility, as evidenced by the fact that the "ritual initiator" [see below], who coordinated the rites intended to ensure abundant harvests, also has flour rubbed on his face.) Then they made a special gruel and ate it in celebration of the seed-scattering ritual.

As the preparations were being made in the villages, the Wazir, village trangfa, and clan elders gathered in Baltit, where they sacrificed a goat and recited prayers for blessings. Then, according to ancient custom, they rubbed

2 Shore (1955:283-285), who visited Hunza in 1949, gives an interesting account of this ceremony as it was performed in British times.
flour on the face of the ritual initiator, whose task it was to ceremoniously carry the pouch containing barley seeds from the Mir's palace in Baltit to Altit, where the ritual planting took place.

The initiator was always a man from the Diramitting clan of Baltit. These Diramitting are believed to be descendants of Diram Chiram, the sole-surviving child of the Diramheray clan, whose members were ruthlessly killed by Thum Mayori (see above, pp. 76-77). Members of the now-extinct Diramheray clan claimed descent from Moghul Titam, the mythical founder of Hunza. (Diram Chiram's descendants, for reasons which are not quite clear, took the name Diramitting.) It is said that they were beloved of the pari, or mountain spirits, and that, after they had been massacred, the Hunzakut found their crops to be affected by a strange disease. For five successive years the barley was ruined and people went hungry. Finally a bitan revealed that it was the pari, angered by the death of their favorite Diramheray people, who were blighting the crops. The bitan foretold that the pari would continue to blight any crops not sown by Diramheray hands. On hearing this many began to despair, for they believed that every member of that clan had been slain. However, they later discovered that a woman of the neighboring principality of Nagar, pregnant with her child by a Diramheray man, had escaped the massacre, having been away at her parents' home when Mayori Thum's men struck. The Hunzakut sought out this child, brought him to
Hunza, and made him broadcast the barley seeds over their fields. In due course, the crops emerged disease-free. Since that time, Hunzakut say, one of his descendants, a member of the Diramitting clan (still the people most cherished by the mountain spirits), has had to initiate the agricultural season by casting the first Bopfau seeds. (With the rise of the state, and the emergence of powerful hydraulic rulers, the act of casting the seeds was appropriated by the Mirs themselves, while the Diramitting initiator was relegated to the capacity of ritual coordinator.)

The ritual initiator took with him to Altit, not only the barley seeds, but also some specially-made bread, also to be used during the ritual. He carried this bread on his head, in a bowl that Hunzakut say was made during "the time of Alexander the Great." The Wazir and other officials followed closely behind the ritual initiator, while a crowd of people from villages in Central Hunza also participated in the procession.

As soon as the procession reached Altit's polo field (the village gathering place), the Bericho musicians (who had been awaiting its arrival) began to play special Bopfau tunes on their pipes and drums. State officials and clan elders now joined the Mir in the recitation of prayers, following which everyone proceeded towards Altit's sacred mamutsha field, where the seed-scattering ceremony would be held. (Hunzakut informants were unable to explain why this particular site was
used for the ritual; but it is locally believed that the field once belonged to the Osenkutz faction, and later seized by Thum Ayasho, after he had exterminated these clansmen [see above pp.76-77]. Since the word mamu means "breast" in Burushaski, it is possible that this field was once the site of ancient pre-Islamic fertility rites.) On the way to the sacred field, the Mir rode on horseback, while his officials and the ordinary people walked. The Bericho musicians accompanied the procession, playing as they went along. Once the Mir and his party arrived at the sacred field, the crowd formed a wide circle. When everyone was in position, the musicians stopped playing and all eyes focused on the Mir and dignitaries.

The royal steward now took a piece of bread from the initiator's ceremonial bowl and presented it to the Mir and the officials. This done, everyone sat down for bano, a ritual meal consisting of bread and meat, provided by the Mir as a sacrificial offering. The ruler himself apportioned the flesh among his people according to their rank and social standing.

After the meal people rose to their feet, as an akhund (religious divine) offered prayers for fertility and abundance during the coming year. It was now time for the most eagerly-awaited part of the ceremony, the scattering of the barley seeds. The Mir produced three small bags of gold dust that were wrapped in sheep heart skins. After he had shown these to his people, he handed two of them to the ritual initiator and
held the third one in the palms of his hands. The Wazir now took a handful of barely seeds from the initiator's seed pouch and poured them over the bag that the Mir was holding. As he did this, everyone recited a prayer in unison:

Oh day of blessing, may it be fruitful and fortunate!
May joy be granted, sickness disappear!
May golden ears of grain come up!
May one grain produce one hundred grains!

After this prayer the Mir tossed the grain and the packet of gold into the air and the spectators scrambled to catch them in their shirt-tails. Exceptional prosperity and good luck, Hunzakut believed, were in store for anyone who could catch the little bag of gold. But the gold itself, according to ancient tradition, had to be given as alms to the poor. Those who caught seeds were also regarded as particularly fortunate.

This whole procedure was repeated two more times, but on these subsequent occasions the initiator and the Wazir also tossed some grain into the air. Following the seed-scattering, the initiator again recited a prayer:

O Thum, Lord from the Heavens!
O Titam from the land of Ti!3
Oh day of blessing!
May it be fruitful and fortunate!
May joy be granted, sickness disappear!
May golden ears of grain come up!
May one grain produce one hundred grains!

---

3 This is a reference to the divine origins of the Hunza mirs, said to be "descended from heaven." The Titam here is Moghul Titam, the legendary founder of Hunza, said to be the ancestor of the Diramheray clansmen and, through them, of the Diramitting clan as well. "Ti" refers to Moghul Titam's land of origin, the precise location of which is obscure. One local Hunzakut narrative I was able to record places Ti somewhere in Taklamakan to the north.
This prayer was repeated three times, after which those who were fortunate enough to have caught the scattered grains, according to Lorimer's (1929b) unpublished notes, ate them there and then.

An elder akabir (aristocrat) now lashed a yoke over the necks of a pair of oxen and harnessed them to a plow. After scattering some manure on the field, the akabir elder handed the plow handles to the Mir, while the initiator repeated the prayers for abundance. The Mir then drove the oxen from one end of the field to the other, until he had cut three furrows. By this act, he symbolically initiated the agricultural year.

The Mir now handed the plow to the Wazir, while the initiator, pointing to the latter, shouted, "He is the grandson of Titam!" and once again repeated the prayers for blessing. (Like the initiator, the Wazir was a man of the Diramitting clan and this announcement stressed his descent from an ancient indigenous bloodline, in contrast to the alien (i.e. divine) origin of the Mir, whose ancestors had been imposed over the Hunzakut by the rulers of Gilgit.) The Wazir then plowed three furrows across the field, just as had the Mir, before handing the plow to the gushpur (crown-prince). The proceedings were completed with the prince also cutting three furrows.

Public festivities followed the seed-scattering ritual, with all the villagers participating in the merrymaking, dancing, and wine-drinking (Pl. XVII). Hunzakut warriors on
horseback engaged in archery and lance-throwing contests. Performing a ritualized sword dance, involving two men who mimicked combat by wielding their swords and shields (but without their weapons ever actually touching); they also displayed their skills as swordsmen.

The day following these celebrations, the farmers began their heavy agricultural work. The first of these was to put in the barley, a task they completed by the third week of February (Fig. 6). They now had sufficient time to concentrate on cleaning the desilting pools, irrigation channels, tanks, and village reservoirs, and on repairing those sections of the irrigation network that had been damaged during winter by rockfalls. Before this work on the hydraulic infrastructure could start, my informants told me, trangfa from all the villages would assemble before the Mir, ceremoniously kiss his hand, and ask his permission to start servicing the canals. Although my informants did not mention it in so many words, this act may be seen as a symbolic acknowledgement of their Mir's sovereign control over the state's hydraulic works. As for the actual cleaning work, this was organized by the Wazir
Figure 6. The Hunzakut agricultural and ritual cycle
Plate XVII. Activities during public festivals: clockwise from top left, polo game, eating buttermilk and barley during Ginani festival; bitan's oracular performance; sword dancing (Photo M. Sidky)
and village headmen themselves, who deployed work brigades for the various crucial operations mentioned above.

In late March, during the first day of the Vernal Equinox, the Hunzakut celebrated Nawroz, the Muslim New Year. On this day the Mir invited the Wazir and members of the aristocracy to the royal palace, where he presented them with gifts: horses, robes, weapons, tea, spices, and other luxury items. While the ruler was entertaining his guests, villagers swept clean Baltit's polo field and set out mats for the dignitaries. The Mir's Bericho musicians then took up their position to one side of the field, as people from all the settlements gathered for the celebration. The festivities began when the Mir arrived from his palace.

Such state-sponsored celebrations were occasions when government officials and members of the landed aristocracy displayed their silk robes, decorated weapons, and other costly apparel and trappings — rewards from the state for outstanding service or merit. The Mir himself, garbed in formal regalia, acted as Master of Ceremonies.

The traditional inaugural dance was opened with the Bericho musicians playing their drums and pipes. The Mir would now grant permission to dignitaries and village headmen (according to their social status and rank) to dance, either individually or in groups. The highly ritualized Hunzakut dances expressed both communal solidarity and the allegiance

The dance finished, the Mir presided over a contest of marksmanship, during which warriors on horseback fired arrows or bullets at stationary targets placed along one edge of the field. Winners received the Mir's personal praise and were honored with royal gifts as well. Polo matches (a Hunzakut national sport) now followed (see above Pls. XVII). Six-man teams from different villages competed against one another; the first team to score nine goals was the winner. In the Hunzakut version of the game all means of foiling an opponent, including strikes to his body, are permissible (cf. Fleming 1936:368-369). After the polo match there were exhibitions of horsemanship.

Following the games, the Mir provided oxen to be butchered and their cooked flesh distributed among the villagers, once again according to rank and social status. The Mir also arranged for the state's bitan, or shaman, to dance and prognosticate the events of the coming year (see above Pl. XVII). A prediction of bountiful crops served to alleviate people's anxieties about upcoming harvests, ever a matter of great concern in Hunza's unpredictable and harsh high-mountain environment. The bitan's performances, always preceded and accompanied by music and dance, provided much anticipated entertainment, offering a welcome change from the tedium of everyday agricultural work (cf. Sidky 1994).
The day after Nawroz, Hunzakut farmers began planting spring-wheat, vegetables, grapevines, and tree saplings.

During the last week of April, Hunzakut celebrated Shikamating, the apricot-blossom festival. This was the time for farmers to inspect their orchards for signs of insect infestation, as well as to prune and graft their trees. After completing these activities they would go to Altit to pray at the grave of Bulchitoko (a saintly figure credited with the ability to understand the language of animals4), asking that he protect their fruit trees and vines and ensure for them bountiful crops. The Mir hosted a celebration of music, dancing, and wine-drinking, during which people ate a special bread which had been soaked in oil. Once again the Mir would call on his bitan to foretell the future.

The first barley harvest was also marked by ritual. This was the Ginani ceremony held in early June, usually at the Summer Solstice, which the Hunzakut determined by the position of the Pleiades star cluster (Lorimer 1979:70). The actual date, however, could vary, depending upon seasonal temperatures. A cooler than usual July, for example, would delay the harvest date by as much as a week to ten days, while

4 By listening to the language of wild beasts, Hunzakut say, Bulchitoko was able to find -- and help place on his rightful throne -- Su Malik, the lost son of Azur Jamshed, the Persian prince who became ruler of Gilgit. The thums of Hunza, according to my informants, claimed Su Malik as their ancestor, which is the reason why Bulchitoko is buried here.
a warmer than normal season could advance the festival by up to five or six days.

Ginani began with the Mir inspecting his own barley fields (some of which were to be found in every village) to ascertain whether the crops were ready for reaping. If they were, the Mir would next confer with village elders, court officials, and a khalifa. The latter, according to my informants, consulted Persian astrological texts in order to set the precise time for the harvest to begin. The chirbu in each village would then announce the date to the people of his village and instruct them to have their shepherds bring down cheese for the Ginani celebration.

The day after the chirbu had announced the date of the festival, men from the villages would go to their barley fields to pray for a good harvest and to eat there a special meal, consisting of bread and some of the cheese brought down from the alpine pastures. Afterwards, they would pluck a handful of barley by the roots and return home. Some of the cereal they tied to the central pillar of their homes, to ensure good fortune, the remainder they roasted and then sprinkled over a bowl of buttermilk. Each household member would then ritually consume a spoonful of the mixture.

After the first of the Mir's barley crops had been harvested, people could begin work on their own fields. In the past, no one was permitted to touch his crops until after Ginani. Hunzakut even warned their little children, as Lorimer
(1935:327) recorded, "If you [touch] the barley the Tham [sic.] will cut out your tongues...".

The barley harvest was a joyous occasion, signifying the end of the spring hunger. The day after Ginani, the Bericho played music at the Mir's command, while villagers celebrated by singing, dancing, drinking wine, and playing polo. The Mir again arranged for his bitan to dance and foretell future events.

Two days after Ginani the Hunzakut celebrated a thanksgiving feast called Piakemar, for which they slaughtered a sheep or goat. Only after this feast would they begin the harvesting of their barley. It is significant that meat (along with the first of the dairy products brought down by the shepherds for Ginani) became available just before the heavy agricultural work associated with the barley harvest (and the plowing of vacant fields, sowing millet, harvesting the autumn-sown wheat, and planting buckwheat that followed immediately in succession5). These foodstuffs were especially welcomed supplements to the protein-deficient diets on which the Hunzakut had had to subsist from late winter or early spring.

5 The Ginani, it may be argued, did more than simply mark the date for the barley harvest to begin; it set into motion a sequence of operations, beginning with the reaping of barley, and ending with the harvesting of autumn wheat and the planting of millets and buckwheats. In other words, the timing of all subsequent agricultural operations was set by the Ginani ritual.
The date for planting autumn wheat, the final agricultural task of the year, was set to follow immediately after the harvest of the millet and buckwheat crops in late October. It was mandatory that this critical planting be completed by the second week of November, at which time the Mir officially closed the agricultural year by sponsoring a thanksgiving celebration.

The start of winter (recognized by the disappearance of the Pleiades star cluster) was ritualized by the Thumushelling festival, a nocturnal torch-lighting ceremony, celebrated at the Winter Solstice. People from all the villages lit fires, sang songs, and danced. The festivities continued all night. Just before dawn, villagers carrying torches made of juniper branches converged on Baltit Fort. Here they lit a great bonfire, sang songs glorifying the ancient thums of Hunza, and awaited the appearance of their ruler. The Mir and his officials would finally emerge and, along with the people, offer thanks to God for the successful conclusion of the agricultural season and pray for abundance in the coming year.

Winter was the traditional marriage season, when the Mir presided over a communal nuptial ceremony for couples from all the villages. After the marriage celebrations, each household slaughtered some sheep and goats, an occasion called yoshaes. The meat would be eaten by members of the household throughout the winter season.
Six weeks of high winter followed. No agricultural work was possible and people occupied themselves playing music, telling tales, drinking wine, and dancing. According to E.O. Lorimer (1936: 235-236), during winter Hunzakut women busied themselves spinning wool, stitching homespun cloaks, and embroidering caps; they also pounded their stored apricot kernels, extracting oil for their stone lamps. The men spun goat's hair, wove different types of baskets, and repaired their plows, hoes, and loom-frames. Above all, it was during winter, when Hunzakut families sat around their stone lamps, that children were taught their cultural heritage, by means of tales and legends of mythical heroes, monstrous rulers (such as Sri Badat, the cannibal king of Gilgit), powerful sorcerers, pari and demons. They also learned of former great battles and raids (E.O. Lorimer 1936:236). The winter rest period was ritually ended with the Apitso dance, sponsored by the Mir in his capital, Baltit, in which headmen and dignitaries from all the villages participated.

In the past, the Hunzakut placed great emphasis on their rituals. Failure to perform a ceremony on time, and according to correct procedures, they believed, would usher in a period of sadness and misfortune. Today, however, the ritual cycle is no longer followed. With it has gone the precise state management and coordination of agricultural production. As one Hunzakut farmer said to me, "who has time for the old ceremonies anymore?" Nevertheless, Hunzakut farmers still
plant many of their traditional crops and follow roughly the same timetable as I have described in the pages above.

Rituals and Ecological Regulation
The extant ethnographic literature on Hunza, for the most part, contains little beyond purely descriptive accounts of the ritual cycle (cf. Lorimer 1935; Müller-Stellrecht 1973). It is true that Pakistani anthropologist Ali (1981, 1982:113) has provided an analysis in terms of the sociological functions of some of these rituals, i.e., their ability to express and reinforce existing sociopolitical relations. Nevertheless, the vital ecological-regulating functions of Hunzakut agricultural rites have largely been ignored.

The cultural regulation of ecosystems has been the focus of several influential (and now much criticized) studies during the past three decades (e.g., Rappaport 1968; Odum 1971; Harris 1966, 1974, 1977, 1985; Vayda et al. 1961; Piddocke 1965; Moore 1965). Such studies have focused on how ritual behavior can sometimes function as "purposive," cybernetic, or homeostatic (having positive feedback) mechanisms that regulate human-environment interactions by maintaining certain crucial variables (such as population size, intensity of land-use, density of livestock, regional distribution of foodstuffs, and hunting pressures on wildlife
resources) within a range that ensures the stability and continued operation of the ecosystem over time.

Such homeostatic mechanisms are said to operate "serendipitously," without the actors being fully aware of the material consequences of their ritual activities (cf. Little and Morren 1976:5). Rituals are thus explained, not in terms of demonstrable human objectives, but with respect to their role in ensuring the operation of ecosystems, in which humans are considered to constitute one of many interacting and interdependent components.

Studies of this nature have been criticized for overemphasizing the "stability," "equilibrium," and "self-organizing" properties of ecosystems at the expense of system-transforming processes. They have also been faulted for over-reliance on explanations using "latent functions," that is, automatic, or "non-mediated" cultural regulation of human-environment interactions. Moreover they have been criticized also for extrapolating evidence from single sites to macrosystems, and for ascribing teleological characteristics to "ecosystems," which, arguably, are essentially analytical constructs (cf. Moran 1990:17-25; Ellen 1986:73, 179-191; Lees and Bates 1990:250; Bennett 1976:184-185, 234; Friedman 1974:446-448; but also see Rappaport 1990).

More recently, researchers have recognized the possibility that societies may develop ritual means of resource conservation and environmental regulation, based on
conscious planning and decision-making and direct actions intended to match available resources with particular human objectives (cf. Bennett 1976:35; Ellen 1986:185, 192-193). The Hunzakut ritual cycle may best be described in these terms.

There is another general issue which must be addressed before I proceed with my analysis. Researchers who have sought explanations for cultural traits in their environmental contexts have often been accused of "the functionalist fallacy," i.e., showing that a certain practice has an effect and then assuming that this is its purpose. Critics of materialist research strategies contend that to demonstrate how a cultural trait functions, is not to explain why it arose in the first place, nor why it persists (Friedman 1974:457). I have already discussed the historical circumstances leading to the establishment of ritualized, state-managed controls over agro-pastoral production in Hunza. Here, and in the subsequent chapter, I proceed in terms of the demonstrable human objectives underlying Hunzakut rituals, and the resultant empirical consequence of the ritual activities themselves.6

Careful analysis of Hunzakut calendrical rituals, in terms of what is known about the physiological and the

---

6 In Chapter 5 I shall argue, in reference to Hunzakut supernatural beliefs regarding their upland pastures, that concrete end results may also explain the persistence of traits that perform latent functions, even when such traits may have arisen originally as a consequence of mere historical chance.
environmental basis of agronomic yields, suggests that many of their rites served as a means to synchronize and regulate critical agricultural (and pastoral) operations with optimal sunlight conditions, seasonal temperatures, and available water and nutrient supplies, so as to ensure the most efficient use of time and space. The Hunzakut ritual cycle fulfilled ecological-regulating functions, not through unconscious "biocultural mechanisms" that ostensibly operate in a covert fashion to regulate human-environment interactions, but because it was based on years of practical experience and a sound understanding of plant physiology.

I begin my analysis by first considering two basic questions (cf. Langer and Hill 1991:328). First, what are the physiological factors that underlie the growth and productivity of crops plants, and how are yields affected by environmental conditions, both above and below the ground? Second, how can human management and manipulation of plants and environmental factors ensure efficient crop production and the stability of the agro-ecosystem?

A principal factor affecting agronomic yields (provided that temperatures are favorable and there is no shortage of water or nutrients\(^7\)) is the amount of incoming sunlight received at a particular location and the efficiency with

---

\(^7\) This is because nutrients such as nitrogen contribute to the growth of larger leaves, and hence of a more complete crop canopy for photosynthesis. The leaf area available for photosynthesis is roughly proportional to the quantity of N supplied by the farmer (cf. Russell 1973:30-32; Langer and Hill 1991:344).
which it is intercepted and utilized by vegetation (Tivy 1990:21).

Hunza, as we have seen, experiences significant seasonal variations in the amount and intensity of solar radiation over which farmers have no control. They can, however, enhance plant growth and yields through management practices that ensure their crops intercept the maximum amount of incident light energy available for conversion into plant dry matter (DM).

They can achieve such efficiency by making sure that their fields are completely covered by vegetation during the climatically-favorable period of the year (seven-and-a-half months in Hunza), so that incoming sunlight does not strike bare ground (cf. Langer and Hill 1991:337). In other words, efficient use of sunlight depends on whether farmers can obtain a high ratio of leaf surface area (i.e., crop canopy) to ground surface area, or what agronomists refer to as the Leaf Area Index (Langer and Hill 1991: 336; Tivy 1990:94,96).

The rapid establishment of crop canopy depends on the growth rate, size, and longevity of leaves, all factors which, in turn, depend upon favorable temperatures and adequate amounts of water and nutrients (Thorne 1966:100; Langer and Hill 1991:344). These limiting factors must be overcome through careful management practices. However, even under optimal conditions, leaf formation and development are slow
during the early stages of crop growth; inevitably some light energy is wasted because of immature leaf canopy.

Additionally, because the life-cycle (i.e., emergence, tillering, heading, ripening, and maturity) of the principal grain crops in Hunza (barley and wheat) is shorter than the potential seven-and-a-half-month growing season, solar energy may be wasted toward the end of the crop plant's life because of leaf senescence (cf. Tivy 1990:109), when photosynthesis no longer takes place and growth has ceased.

Given environmental constraints such as these, it is crucial for Hunzakut farmers to schedule the planting dates of their cultigens to coincide as closely as possible with optimal environmental conditions. Such scheduling facilitates the earliest possible establishment of complete crop canopies, promotes photosynthetic efficiency, and ensures satisfactory and dependable yields (cf. Langer and Hill 1991:324). Similarly, under circumstances such as those that pertain in Central Hunza, where the loss of even a few days of sunshine could prevent the maturity of a second crop, harvest dates are no less crucial. Precise harvest dates, determined through a careful examination of the progress of crop plants growing in fields situated at slightly varying elevations -- and consequently a few days apart in reaching maturity -- can ensure that farmers clear their fields at the earliest possible date. In this way, the relatively few precious sunny days (and heat units necessary for crop maturity) that remain
of the agricultural season can be put to the fullest use. Such precision, I maintain, was achieved through the state-regulated agricultural cycle, which I shall now examine in detail.

Hunzakut Agricultural Production

I have already examined, in Chapter 2, the material constraints on the Hunzakut agricultural production system, arguing that it would be difficult to explain the nature of traditional Hunzakut crop (and livestock) production systems without consideration of the crucial "non-cultural" variables associated with geophysical conditions. Of particular significance in understanding Hunzakut land-use and cropping patterns, I maintained, are the local hydrological cycle and soil nitrogen levels, both of which act as limiting factors on the Hunzakut agricultural enterprise. In this section I shall focus on the crops themselves, and on the particular strategies that Hunzakut farmers traditionally employed for their cultivation. (The analysis of the vital livestock production component of Hunzakut farming will be the subject of the following chapter.) My primary interest here is to clarify traditional state managerial controls over agro-pastoral production, rather than to provide a quantitative analysis of present-day Hunzakut agricultural production strategies. There are nine villages in Central Hunza (Map 2), cultivating a total of 2,123 hectares of irrigated
farmland (Table 1). Today these villages total some 2,455 households, comprising roughly 15,700 people (cf. Charles 1985:19-26; Khan 1983:130). During the height of the hydraulic state in the 19th century, I estimate that the total area of arable land was roughly 1,900 ha, and the total population, around 7,800. Farmers in these villages cultivated a variety of crops suited to specific microenvironmental zones and complementing each other in tolerance, maturation rates, and yields. Using a regimen of multiple-cropping, careful scheduling, intensive labor inputs, and the application of substantial amounts of manure (see Chapter 5), Hunzakut farmers did their best to make optimal use of a short growing season and limited arable lands.

Villagers generally used around 30% of their total arable lands for the production of cereals. The grain fields were intensively farmed by planting wheat and barley and, as soon

---

8 To estimate 19th-century population figures, I have used the following procedures: (1) Land. We know that the present total area of arable lands is 2,455 ha. Elderly Hunzakut informants are able to identify those areas brought under production after the establishment of British rule in 1891. These I estimate to account for roughly 10% of the present total area. Therefore we can say that after the construction of the Samargand and the Barbar canals, during the late 18th and early 19th centuries respectively, some 90% of the present arable area, or 1,900 ha, was under cultivation. (2) Population. Central Hunza's population in the 19th century was probably half of what it is today. I have arrived at this figure by taking into account informants' reports of a doubling of households in the villages since the turn of the century. On the basis of informant recollection, I estimate that the average household had approximately 7 members, a figure corroborated by official census data during this century. Taking for example Baltit, counts in 1911 (Census of India, 1911) and 1984 (Saunders 1984) suggest that, although the number of households has indeed doubled from 281 to 570, and the total population has grown from 1,971 to 3,800, household population (a mean of 7.0 persons per household in 1911, and 6.6 individuals in 1984) has remained more-or-less constant. An estimate of 7,800 for the 19th century is therefore not unreasonable.
Table 1. Estimates of present-day population and size of arabal lands in the villages of Hunza Valley

<table>
<thead>
<tr>
<th>Village</th>
<th>No. of Houses</th>
<th>Irrigated/Ha</th>
<th>Total Pop.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baltit</td>
<td>600</td>
<td>420</td>
<td>3,840</td>
</tr>
<tr>
<td>Ganesh</td>
<td>200</td>
<td>195</td>
<td>1,340</td>
</tr>
<tr>
<td>Altit</td>
<td>300</td>
<td>290</td>
<td>2,010</td>
</tr>
<tr>
<td>Haidarabad</td>
<td>300</td>
<td>295</td>
<td>1,350</td>
</tr>
<tr>
<td>Aliabad</td>
<td>600</td>
<td>484</td>
<td>4,040</td>
</tr>
<tr>
<td>Dorkhan</td>
<td>80</td>
<td>75</td>
<td>560</td>
</tr>
<tr>
<td>Garelt</td>
<td>100</td>
<td>92</td>
<td>670</td>
</tr>
<tr>
<td>Hasanabad</td>
<td>80</td>
<td>72</td>
<td>538</td>
</tr>
<tr>
<td>Murtazabad</td>
<td>195</td>
<td>200</td>
<td>1,312</td>
</tr>
<tr>
<td>Ahmadabad</td>
<td>75</td>
<td>82</td>
<td>--</td>
</tr>
<tr>
<td>Gulmit</td>
<td>205</td>
<td>308</td>
<td>--</td>
</tr>
<tr>
<td>Gulkin</td>
<td>83</td>
<td>85</td>
<td>--</td>
</tr>
<tr>
<td>Hini</td>
<td>300</td>
<td>270</td>
<td>--</td>
</tr>
</tbody>
</table>


As these crops had been harvested, putting in millets and buckwheats in their place. About 13% of land was under fruit and nut production and roughly 5% under vegetables. Hunzakut farmers used their remaining arable lands primarily to produce fodder for their livestock (25% for lucerne, 12% for fodder trees, and 15% for grass). But even though the nine villages were linked to the same hydraulic system, variations in resource endowment and microclimatic conditions led to slight differences in the land-use pattern just described. Nonetheless, the figures I present here are fairly representative of the study area as a whole.

Barley (*Hordeum vulgare* L.) and wheat (*Triticum* spp., possibly *T. compactum* [cf. Witcombe 1975]) were the principal cultigens. Through years of careful propagation, Hunzakut
farmers have selected local varieties of wheat and barley, more for their output of high-quality straw than for their grain-yielding capacity (Saunders 1984:22). Yields vary according to the amount of manure the farmers apply to their fields. Both crops require a minimum of 10 tons/ha; but to obtain the best yields, up to 20 tons/ha are necessary. Traditionally, the sources of manure have included cattle, sheep, and goats. Moreover, in the past, when villages approximated energetically-closed systems, farmers also relied upon night-soil to provide them with an important source of fertilizer (see Chapter 6).

Barley matures faster than any other cereal (Tivy 1990:13), and is well suited to Hunza's high altitudes and arid conditions. The crop was planted in February and harvested in early to mid-July, about 10 to 15 days before the autumn-sown wheat crops were brought in. The early February planting date for barley allowed the crop's highest Leaf Area Index to occur in May, the first of the four sunniest months in Hunza. Thus the farmers were able to make the most efficient use of available solar radiation (see Fig. 6). A

---

9 In contrast, modern "improved" varieties have been manipulated genetically so that the carbohydrates from the stalks are translocated to the grain-producing organs, resulting in high outputs of grain, while reducing the quantity and quality of the stover used as livestock feed (Cornick and Kirkby 1981:15). For this reason, the introduction of new "improved" varieties in Hunza has been only partially successful.

10 In their capacity for fast maturation, local Hunzakut varieties compare very favorably with those from Peru and Japan, the fastest maturing barleys known (Saunders 1984:55).
February planting ensured also that the farmers had sufficient time to complete all work activities for which water was essential (plowing fields, manuring, and sowing) well before the spring planting of wheat and vegetables, when irrigation water is very scarce.

Barley could not be sown earlier because the species that the Hunzakut planted was a naked variety, its seeds lacking a husk (cf. Whiteman 1985:63), and thus unable to withstand the cold winter temperatures, which continue late into January. Barley was not planted later either (for example in March) because, in the past, Hunzakut farmers needed the harvested crop in early July, in order to replenish their nearly-depleted food stores. A late July or early August harvest would have spelt starvation for them. Moreover, a March planting would have left insufficient time before the onset of the cold season for the maturation of the millet crops that followed the barley.

Given the environmental constraints we have just described, it is clear that the ritualized dates for planting and harvesting barley, corresponding to the Bopfau and Ginani festivals respectively, fulfilled important ecological functions. They enabled Hunzakut farmers to synchronize their agricultural activities with optimal sunlight conditions, seasonal temperatures, and available water and nutrient supplies. Harvesting in early July, marked by the Ginani ritual, ensured that the fields were cleared in sufficient
time to allow for the planting and harvesting of the succeeding millet crops before winter set in.

Wheat, the Hunzakut's preferred grain, was sown in early November and harvested in late July, during the following agricultural season. The harvest began immediately after the barley crop had been removed from the fields and stored; the vacated land was then planted to millet or sweet buckwheat, a sequence of operations that were set into motion, as we have seen, by the Ginani ritual.

Hunzakut farmers seldom used more than about half of their grain fields for wheat, principally because of its late July harvest. An exclusive reliance on this crop would have led to starvation because, in the past, most Hunzakut households would have nearly depleted their food stores by late June and early July. Such starvation was alleviated or prevented by the early July harvest of the fast-maturing barley that was cultivated on the remaining half of the grain fields. A farmer's actual field area under wheat was ultimately determined by the amount of manure available to him. Land not planted to wheat in autumn, for lack of sufficient manure, was left fallow to receive wheat in spring.

The planting date for autumn-wheat followed immediately after the July- and August-planted millets and buckwheats had been brought in and stored. In the past it was mandatory that Hunzakut farmers completed their wheat-sowing by mid-November, before the Mir declared the official start of winter, marked
by a thanksgiving celebration. This ritualized "deadline" was essential for the successful propagation of wheat, which germinates only when soil temperatures exceed the freezing point (Briggs and Courtney 1989:220). Early November temperatures in Hunza are sufficiently high to allow wheat to germinate and reach a cold-resistant stage before winter frost sets in and terminates all plant growth. If farmers had planted wheat any later than early November, the seedlings would have been subjected to frost damage, thus jeopardizing the entire crop (Whiteman 1985:21). An early November planting, moreover, gave wheat a head start when growth resumed in March. A complete leaf canopy was established by mid-May (Fig. 6), thus increasing the efficiency of photosynthesis, which allowed for yields two- to three-times greater than could be obtained from a spring-sown crop (cf. Whiteman 1985:49).

Agronomists familiar with this region of Pakistan say that farmers could obtain even better yields if they were to plant their wheat still earlier, for example, in October (Saunders 1984:38,40). However, in the past, such early planting was unfeasible in Central Hunza for two reasons. First, before November farmers would not have accumulated sufficient amounts of manure to fertilize the crop. Second, at this time most of the grain fields would still have been occupied by buckwheat and millets, which could only be harvested in late-October. In light of these material
constraints, it is clear that the state's ritualized deadline for wheat planting also served a vital ecological function, enabling farmers to make the best use of available arable lands, manure supplies, and seasonal temperatures and sunlight.

Those farmers who had insufficient manure to allow them to sow all their wheat in November put in a spring-wheat crop in March, at which time they would have accumulated a sufficient amount of dung from their stalled animals. However, a late March planting date was less preferred than a November one for two reasons. First, because spring wheat did not achieve complete crop canopy until mid- to late June (Fig. 6), and hence yields were well below those obtained from an early-November planting. Second, because wheat sown in spring could only be harvested in August, there was an insufficient number of warm sunny days left in the year to plant sweet buckwheat. The farmers were thus compelled to put in the less acceptable bitter buckwheat (see below).

Hunzakut farmers traditionally followed their main cereal crops with millets and buckwheats, thus obtaining more food per unit area of land than would have been possible under a single-cropping regime. Moreover, in the past, a multiple-cropping strategy was essential because the farmers had not only to meet their own needs, but also had to provide the state with grain as tax. But even with such an intensive, multi-cropping regime, many households were unable to produce
enough food and partial famine commonly occurred every year, from spring until the barley crop was harvested in early July (cf. J. Clark 1956:64).\(^{11}\)

Hunzakut farmers sowed two kinds of millet (*Setaria italica* L. and *Panicum miliaceum*). Both are fast-maturing grains and were sown simultaneously in fields cleared of barley. Millets were harvested during the last week of October. Both millet varieties perform well under local conditions, but the Hunzakut have traditionally favored *S. italica*, because it can be stored for long periods without spoiling. Its stems, however, are not palatable to livestock. *P. miliaceum*, on the other hand, was planted both for its food value and because its stalks make excellent animal fodder.

Millet has the lowest water requirement of any cereal (FAO 1988) and is well suited as a second crop in Hunza, where it is planted in late summer, when there are few remaining growing days and water supplies are decreasing. Millet also requires less manure than do the main cereals. Farmers relied on residual nutrients from their previous crops and usually dressed the fields with only about 3.5 to 4 tons/ha of manure. The actual area that a farmer planted to millet was determined

---

\(^{11}\) This was the case following the 1891 British invasion, as we know from the accounts written by the Lorimer (1979, 1935), Schomberg (1935, 1936), J. Clark (1956), and others, when the Hunzakut population had increased significantly. Whether farmers suffered such critical food shortages during the time of Mir Silim Khan, or his two successors, is unclear. Hunzakut oral tradition suggests that these were times when food was plentiful.
by the amount of manure he had been able to accumulated since his spring planting.

Hunzakut farmers planted two types of buckwheat: sweet and bitter. Sweet buckwheat was planted in late July in fields vacated by autumn wheat and was ready for harvest in late October. Bitter buckwheat was grown in early-August, on fields cleared of spring wheat, and was harvested during the third week of October.

The sweet variety, *Fagopyrum esculentum*, was preferred for its flavor and because its stalks could be used as fodder. On the other hand, it needs an abundance of sunlight and is susceptible to frost and requires at least two more weeks to mature than the bitter variety. The bitter *Fagopyrum tataricum* was less desirable because its grain is only acceptable for human consumption if mixed, in equivalent proportions, with wheat or barley and milled into flour. Moreover, its stover is not palatable to livestock. On the other hand, bitter buckwheat matures faster, is hardier, and is more resistant to frost than is *Fagopyrum esculentum*. It was only sown when the spring-wheat fields became available in August.

Buckwheat is a fast-maturing crop and, like millet, requires significantly less manure and water than do barley and wheat (cf. FAO 1961). Farmers dressed their buckwheat fields with roughly 3.5 to 4 tons/ha of manure. Again, the actual area planted to buckwheat depended on the total manure at the farmer's disposal.
Other traditional Hunzakut cultigens, mostly vegetable sidecrops, included carrots, onions, turnips, pumpkins, tomatoes, and pulses.\footnote{Potatoes, first introduced into Hunza after the British invasion of 1891, are today the most important vegetable crop. Potatoes are ideally suited to local conditions and yields of as much as 50 tons/ha have been reported in modern times (Whiteman 1985:101). Under traditional production conditions, this crop could provide up to one-and-a-half times more calories per hectare of land than wheat; moreover, it requires no threshing, winnowing, or milling. On the negative side, however, potato stover has little value as animal fodder, which explains why, during the isolation of the past, when nearly all crops had to serve dual-purposes (food for humans, and fodder for livestock), Hunzakut farmers did not allocate more land for potato cultivation.} They were planted in spring, along the edges of grain fields or in small gardens roughly 3 to 4 m², the latter being areas of land too small for cereal cultivation. All vegetable crops were brought in by mid-October.

Aside from food crops, Hunzakut farmers traditionally used a significant portion of their arable lands (between 25% to 30%) for the production of lucerne (alfalfa) for fodder. Lucerne production, as I have already mentioned in Chapter 2, was an important strategy in the management of the nitrogen cycle. This plant can withstand repeated cuttings, and has a total per hectare yield up to three times greater than that of wheat or barley straw. Lucerne is well suited to Hunza's environmental conditions. The plant's extensive root system, including its deep-penetrating tap-root, allows it to extract moisture from a large volume of soil, thus giving it drought resistance (Gill and Vear 1969: 160, 165). Lucerne remains
productive under conditions of water stress, when other legumes (such as clover) show little or no growth. Hunzakut farmers cut their lucerne in early June, early August, and mid-October.

Another source of fodder was grass, and every household owned toq, or irrigated grass fields. Located mostly on unmodified slopes adjoining the cultivated areas, where water was available but in insufficient amounts for cereal production, these grass fields were both cut and grazed. Farmers cut the grass in early July, early September, and mid-October. They used the toq for pasturing their sheep and goats in spring, before the herds were sent to the alpine pastures, and in fall, when the animals returned from the upland grazing grounds (see Chapter 5 below). Cattle, which in the past were rarely sent to the upland pastures, were allowed periodically to graze on the toq during summer.

Hunzakut farmers also raised great numbers of fruit and nut trees. The privately-owned orchards depend on irrigation water, but, as noted above (pp. 124), receive water only after the needs of cereal and vegetable crops have been satisfied.

Arboriculture, a non-labor intensive production strategy, was a vital part of the traditional Hunzakut economy. Although subsidiary to the production of cereal crops, this strategy provided storable and nutritious foods, which constituted an important part of the Hunzakut diet. Among the fruits, the foremost in importance were apricots, apples,
pears, peaches, and mulberries. Grapes were also grown, but, due to land scarcity, few households could afford the luxury of a vineyard. Grape vines were instead planted in the orchards and allowed to grow up the fruit trees.

The abundant consumption of fresh fruit in summer and fall enabled farmers to conserve their grain stores for the winter months. Moreover, from around the beginning of spring, when the household stores of grain had dwindled, the Hunzakut traditionally subsisted almost entirely on fruits gathered and dried during the previous agricultural season. Because of their crucial dietary importance, fruit trees -- especially apricot trees -- were treated as a form of wealth that was bequeathed by fathers to their sons and daughters.

The number of fruit trees a farmer planted was dependent on the amount of land at his disposal. Land suitable for arboriculture had to meet the farmer's need for fruit as well as for fodder. Because fruit trees are unable to sustain intensive leaf-cropping, they cannot substitute for fodder-trees. Farmers with limited space had therefore to strike a balance between the number of fruit and fodder-trees they planted.

Apricots and mulberries ripen in late July and August (Fig. 6). Young boys climbed the trees and shook the branches, while women and smaller children stood below with stretched-out blankets, which they held at all four corners to catch the fruit. Apricots were split open, stoned, and set out
on rooftops to dry in the sun. The kernels were either eaten raw, or else they were pounded and squeezed for cooking oil; bitter kernels, obtained from "wild trees," were squeezed for lamp oil. Mulberries, which require no preparation other than cleaning, were put out to dry at the same time as the apricots. Apples and peaches ripen by mid-September. Grapes are ready for harvest between late-August and mid-October and walnuts and almonds may be collected from mid-September.

Besides fruit, orchards served as a source of precious timber and fodder. Whenever the Hunzakut farmer planted a new orchard, he usually interspersed poplar and willow among the fruit tree saplings in order to obtain additional economic benefit. Poplar and willow trees were also planted along the southern boundaries of fields and their branches were used for firewood. Poplar trunks were used for house construction, 10 to 15 year-old poplars making excellent house beams.

* * *

The various production strategies related to agriculture, horticulture, and arboriculture described in this chapter, enabled Hunzakut farmers to make a living in an otherwise harsh, resource-scarce natural environment. I have demonstrated here how Hunzakut agricultural production was adjusted to ecological conditions through state agro-
managerial controls, as well as by employing cultigens that were suited to specific microenvironmental conditions and which complemented each other in tolerance, maturation rates, and yields. State controls over production were implemented by means of the carefully-coordinated calendrical rituals described in the pages above. During the isolation of the past, when outside energy and nutrient subsidies were unavailable, self-sufficiency was a necessity for survival and sustained intensive production imperative. State management ensured that village communities, linked together by the hydraulic network, made optimal use of seasonal conditions and the limited land and water resources available for agricultural production.
Livestock, Rituals, and Transhumant Pastoralism

The preceding chapters have, in passing, mentioned the importance of domestic livestock in Hunza's traditional economy. This chapter will be the place to examine in greater detail the livestock component of the Hunzakut agro-pastoral production system. A discussion of animal-rearing practices may, at first glance, appear somewhat removed from the central concerns of the present study: irrigation and state formation in Hunza. However, animal husbandry has played such a crucial role in Hunza's hydraulic mode of production that its careful analytical consideration is imperative.

Sustainable intensive agriculture in the oasis villages of Central Hunza was possible only through the application of huge amounts of animal manure to the soil, for which Hunzakut farmers had to rely upon their ruminant livestock. The stability and continued operation of traditional Hunzakut agro-pastoral production depended upon the complimentary interaction between its crop and livestock components. As with the farming sector of the Hunzakut economy, the critical phases of livestock production were coordinated by the state.
Hunzakut farmers traditionally kept sheep, goats, and cattle (Pl. XVIII). All animals were local species, small in body build, hardy, and well adapted to the high mountain-environment of Hunza (cf. Saunders 1984:41).¹

In the past the Mirs and some members of the Hunzakut upper class maintained a few horses. For the majority of the people, however, horses were not an economic proposition. As non-ruminant herbivores (unable to easily digest cellulose) they require substantial amounts of high-quality fodder (cf. Tivy 1990:116), such as lucerne, which few Hunzakut farmers were able to spare. The wealthy maintained horses primarily for sport (polo) and transportation, while the Mir sometimes gifted the animals to those who had rendered him exceptional service (Qudratullah Beg 1980:134). According to my informants, horses, which are unable to effectively reproduce in high-altitude environments (cf. Shahrani 1979:105), could not be found locally and had to be imported from places such as Afghanistan.

Ruminant livestock were an integral part of the Hunzakut subsistence economy for several reasons. First, the ability of these animals to digest plant materials high in cellulose

¹ The *mirs* used to maintain some yaks. However, the majority of their herd was not kept in Central Hunza, but rather in the high pastures of Shimshal in Upper Hunza. Yaks play no significant part in the present-day economy of Central Hunza (cf. Kreutzmann 1986:99), there being only one herd of about 25 animals (belonging to the former Wazir), which is kept all year round in the high-altitude pastures of Shishpar (cf. Sidky 1993d).
Plate XVIII. Hunzakut livestock: clockwise from top left, ram with owner's marker; sheep in front of winter shed; small-bodied Hunzakut cow; goats being driven to desert-steppe for winter grazing (Photos M. Sidky)
enabled them to use agricultural by-products, as well as vegetation from areas where physical factors (e.g., aridity, slope, and altitude) made crop cultivation either difficult or impossible. Second, as noted in the previous chapter, livestock were a vital source of manure that was necessary for maintaining sufficient levels of soil nitrogen. Third, livestock made a contribution to the Hunzakut diet by converting low-quality vegetation into high-quality milk and meat protein.

For Hunzakut farmers, who lived in an oasis environment with a dearth of natural forage and fodder resources, meeting the dietary needs of their livestock was a constant hardship. Only by exerting considerable human energy and effort to collect scanty fodder resources and to manage the fragile forage areas at their disposal could Hunzakut households sustain their animals throughout the year. Nearly all straw and crop residues obtained through the production of cereals were fed to the livestock; moreover, farmers allocated considerable areas of land for the cultivation of lucerne (Medicago sativa) and grass (Poa spp.), which comprised an important portion of the total fodder requirements. In addition, the farmers regularly fed their livestock with fresh leaves from fodder trees: poplars (Populus spp.) and willows (Salix spp.), as well as mature and dead leaves, both from their fruit and fodder trees.
Hunzakut farmers sought to make the best use of their available fodder and forage resources by adjusting the size and composition of their herds, as well as by taking advantage of the physiological and behavioral characteristics of their different ruminant species (see below). Herd size and composition were generally determined by the amount of farmland available for the production of fodder, access to alpine pastures and other sources of forage; the farmers' needs for various animal products (hair, wool, and hides), which were vital for their survival during the isolation of the past were also significant factors.

Large Ruminants: Cattle
Each Hunzakut household managed its own large ruminants, owning at least one or two milk cows and, in the case of a few families, a bull as well. Hunzakut cattle (Bos spp.) are local breeds, small in body size, with an adult weighing about 200 kg.

Cattle husbandry and the gathering of the animals' manure, were tasks assigned either to women or, more frequently, to young boys and girls. Researchers working in high-altitude regions elsewhere (cf. R. B. Thomas 1976:397) have observed that such a labor strategy has energy
conservation functions. In the past cattle remained in the villages all year and each household had to allocate about six man-hours of labor per day for cattle husbanding.

During summer and a part of fall (a total of about 180 days) cattle were grazed in the immediate areas around the village, along the edges of the waterways and fields, and occasionally underneath the fruit trees. They were also fed on fodder-leaves, grass, and fresh barley and wheat stalks, which, as I have noted in the previous chapter, the farmers obtained by thinning their grain fields. In winter and early-spring (a total of about 180 days) cattle were allowed to scavenge around the village by day and were stall-fed at night from the stores of straw and dry lucerne.

In comparison with sheep and goats, cattle were costly to maintain for several reasons.

First, an adult cow requires 6 kg dry matter (DM) fodder a day, nearly three times the requirement of an adult sheep or goat.

Second, because each household tended its cows separately, the Hunzakut cattle-husbanding enterprise entailed considerable duplication of effort. This was in marked contrast to the joint management of sheep and goats, which allowed many animals to be tended by a few herdsmen. Cattle

---

2 The argument goes that, because herding involves only light-to-moderate work levels, children, by the age of 12 years, can complete the same amount of work as adults, but use up roughly 30 percent less calories than adults performing identical work.
husbandry consumed nearly four times as many man-hours per household than did the care of the small ruminants (see below).

Third, cattle contributed minimally to the Hunzakut diet. This is because local animals are poor milk-producers, yielding typically no more than 170 liters per seven-and-a-half to eight month lactation period. This is well below the milk output of Hunzakut sheep and goats (see below). (Cow's milk was either consumed directly, or else, if sufficient was available, it was churned into butter and made into cheese.) Cattle were also an impractical source of meat protein because of the considerable time, effort, and large quantities of fodder needed to rear and maintain them. Consequently, Hunzakut ate beef very infrequently, slaughtering their cattle either when a beast became old and unproductive, or when it sustained an injury (such as a broken leg), from which it was thought unlikely to recover.

Finally, cattle are reproductively less efficient than sheep and goats, reaching sexual maturity at around 18 months, having a nine-and-a-half month gestation period, and virtually never having multiple births. Sheep and goats, by contrast, reach sexual maturity at 13 months, have roughly a five month gestation period, and may have multiple births.

Low productivity and high maintenance costs notwithstanding, Hunzakut cattle were indispensable, both as draft animals and as a source of manure. Only with the use of
ox-drawn plows could farmers prepare their fields within the time allotted by the state agricultural cycle. Even so, plowing was strenuous work for both man and beast, and tilling a one hectare tract took as much as a week to ten days. Farmers plowed their fields by lashing a yoke over the necks of a pair of oxen and harnessing the animals to a metal-tipped wooden plow. The farmer would then drive the oxen lengthwise over the field to produce parallel furrows.

The farmers also used their oxen for threshing their barley and wheat crops (millet and buckwheat were threshed by hand). Lashing several animals together by their muzzles, the farmer drove them across the grain that he had piled on a circular, earthen threshing floor constructed at the edge of his field. As the animals trampled the harvested crops, their hooves separated the husk from the grain, which was then ready for winnowing.

An equally important function of cattle was their role as providers of manure. Without this precious commodity sustainable agricultural productivity under the ecological conditions associated with the oasis setting would not have been possible. A typical adult cow produces about 2.9 kg DM of manure per day (1,058 kg a year). Dung was allowed to accumulate in the cattle sheds; in addition it was collected from the grazing areas and added to the that in the sheds. Hunzakut farmers used this dung to fertilize their fields prior to the sowing of spring, summer, and autumn crops.
Under traditional conditions, I estimate that cattle manure constituted nearly 39% of the total nitrogen applied to the fields.

Small Ruminants: Goats and Sheep
Hunzakut households maintained about 15 to 20 goats. All goats (Capra spp.) were local breeds with distant genetic affiliation with the ibex (Capra ibex) that once roamed the Karakoram Mountains in great numbers (cf. Devendra and McLeroy 1982:16-17; Mason 1981:73-75, 97-98, 104-105). Goats are well adapted to the harsh high-mountain environment of the Western Karakorams, able to tolerate extreme temperatures and thrive on vegetation too poor to sustain sheep or cattle.

Goats are the most versatile feeders among the ruminants (Tivy 1990:118), consuming a wide range of plant materials, shrubs, weeds, and low trees, and able to procure a diet of greater nutritional value than is possible for sheep or cattle grazing the same area (cf. Wilkinson and Stark 1987:109-110). Hunzakut farmers used the feeding versatility of their goats to exploit the sparse vegetation cover in the desert-steppe zones surrounding their villages, an area unusable for agricultural purposes or for pasturing sheep or cattle.

An average adult goat weighs about 40 to 45 kgs and consumes about 2 kg DM per day. The small size of goats,  

---

3 The carrying capacity of similar Trans-Himalayan desert-steppe zones is estimated at 0.06 livestock units (goats) per hectare (cf. Rajbhandary and Shah 1981:55).
their lower fodder requirements, and the fact that farmers could maintain more animals per unit of feed, made them economically more viable than large ruminants. Moreover, maintaining many small-sized animals, rather than one or two large ones, minimized the owner's investment risk should a few of his goats die. Finally, a sizeable herd enabled its owner occasionally to slaughter a few animals for meat, without incurring a dangerous loss of stock. (According to my field estimates, a goat weighing 40 kg, provides a 20 kg butchered carcass, and 15 kg of flesh.)

The Hunzakut, it must be observed, could not afford to eat goat flesh very frequently. The rare occasions on which they did eat meat included the barley harvest (as observed in the previous chapter, a time when household members needed to build up strength for the heavy agricultural work involved) and in mid-winter (when dwindling fodder supplies made it difficult or impossible to keep all the stock alive).

Goats reach reproductive age roughly at 13 months and, unlike cattle, are seasonal breeders (Fig. 2). The mating season begins in early-September, triggered by decreasing day lengths. At this time, the goats are still on the alpine pastures, well nourished, and in good condition for ovulation and implantation. Mating continues for six to eight weeks after their return to the villages in late-
Figure 7. The Hunzakut pastoral cycle
September. The average gestation period for goats is roughly five months and kidding occurs in late-winter and early-spring, as new vegetation begins to appear. The average size of a litter is one to two kids. These several factors make the goats reproductively more efficient than cattle.

Goats were the Hunzakut's principal dairy animals, an adult female producing about 300 liters of milk per lactation period, three times more than that of a sheep, and twice that of a dairy cow. Goat milk was mixed with that of the sheep (see below), and then converted into butter and cheese. Moreover, goats were traditionally an indispensable source of hair, hides, meat, and manure. Hunzakut used goat hair for making rugs and rope, and the hide for shoes and vessels for carrying water and churning milk.

Aside from their goats, a Hunzakut household maintained roughly 10 to 15 head of sheep (*Ovis* spp.), all local breeds. Originally natives to much lower hill regions and mountain foothills (Tivy 1990:118), sheep are not as well adapted as are goats to Hunza's high-altitude environment and cannot survive on the coarse plant materials on which goats are able to thrive. Sheep are dependent on upland grass resources and, in the past, the total number of these animals that any particular village maintained was dictated by the amount of accessible pasturage available to it.

An average adult sheep weighs about 45 to 50 kg and consumes about 2 kg DM per day. As small-size ruminants, they
have for the Hunzakut farmer the same economic advantages over the large herbivores as do his goats. But sheep differ from goats in their feeding habits. As grazing rather than browsing ungulates, their ability to bite off foliage near the ground enables them to efficiently utilize the short grasses on Hunza's upland pastures. Thus Hunzakut herdsmen were able to pasture their sheep and goats together, thereby maximizing their exploitation of the available alpine vegetation.

Sheep reach reproductive age at 13 months and, like goats, are seasonal breeders. The mating season is the same as that of the goats and lambing also occurs in late-winter and early-spring. Sheep are relatively poor milk producers, with a single animal averaging about 100 liters per lactation cycle. Their milk, however, has a higher fat content and caloric value than that produced by cows or goats (Kon 1972; Pyke 1970:43). As already noted, the Hunzakut mix milk from the sheep with that from the goats, thereby assisting the manufacture of butter and cheese by increasing the overall fat content.

The major value of sheep was not, however, as milk producers but as providers of wool and meat. (A sheep weighing 45 kg, provides a 23 kg carcass, and 17 kg of flesh.) The Hunzakut used sheep's wool for making robes, hats, and blankets, while mutton was the most favored meat. Like the other livestock they were important providers of manure for the crops.
Goats and sheep are the Hunzakut's true pastoral animals. The two species are behaviorally well adapted to graze together and their flocking instincts enable a single herdsman to manage a large number of animals. The goats and sheep belonging to the whole village were generally entrusted to the care of a few herdsmen (each handling an average of 50 head), who drove all the animals together to the alpine pastures each spring. The duplication of effort associated with cattle husbandry was thus avoided.

Sheep and goats, although they may be pastured together, utilize different ecological niches as a consequence of their different feeding habits (Pl. XIX). The goats browse on scrubs and bushes found among the rocks on the precipitous slopes, which their remarkable agility allows them to reach. Sheep are unable to negotiate the higher and steeper terrain and so must remain at the lower levels, where they graze on grassy patches. Grazing the two species together, therefore, allows for the most efficient use of natural vegetation resources (cf. Snaydon and Elston 1976:52-53; Holmes 1980:171). Herdsmen often permit the goats to forage on their own for most of the day, but have to pay more attention to the sheep, which are prone to falling off steep ledges and cliffs. Also, because sheep are intensive grazers and feed in clusters, they can quickly damage the fragile pastures unless the herdsman moves them on.
Plate XIX. Sheep and goats grazing on alpine pastures; left, goats on steep terrain; right, sheep on gentler inclines (Photos M. Sidky)
Transhumant Pastoralism and the Ritual Regulation of Alpine Grasslands

The annual transhumance cycle in Hunza began in early-May and ended in late-September or early-October (Fig. 2). In the past the state organized all pastoral activities, just as it did all agricultural operations. The Wazir was charged with determining the time the animals were to be assembled for the drive to the mountains, the itinerary for the move itself, and the date for the flocks to return to the villages. The implementation of the official timetable was the duty of the village trangfa and their assistants. The drive to the mountains was marked by a ritual known as Odi, in which all villages in Central Hunza had to participate. The Odi was held about a week before the flocks were sent to the mountains (Fig. 2). The date for the ritual was set by the Wazir and announced by the village officials.

The decision to hold the Odi ceremony was based on the rate of plant growth (both in the village fields and on the upland meadows), which in turn depended primarily on such seasonal climatic conditions as solar energy receipts and temperatures. Farmers and herdsmen going to the mountains in mid-April to plant barley would evaluate the condition of the grass swards on the pastures and inform the villagers accordingly.

The timing of the Odi ritual ensured that sheep and goats were evacuated from all the villages before field crops had reached the stage when they could no longer recover from
accidental damage by grazing animals. But driving the sheep and goats to alpine pastures was more than a matter of simple crop protection for the Hunzakut. It was a strategy that enabled them to convert otherwise unusable high-altitude biomass into high-protein, high-fat dairy produce.

After the official date for the Odi ritual had been announced, a resident herdsman of the ritual-initiating Diramitting clan visited each house in his village and milked its goats. These animals, thin from their winter stall-feeding, and with suckling kids, could provide very little extra milk at this time of the year. The whole village herd was capable of producing no more than one or two gourds of milk (about 8 liters). The resident herdsman took whatever milk he could draw to the Wazir's house in Baltit. There it was processed into cheese, before being taken to the Mir's palace to be blessed. The Mir received the cheese, ritually tasted a small piece, and blessed the remainder. This act inaugurated the pastoral season and people now had to take their livestock to the upland pastures. Those who did not follow the state's schedule were deemed to have committed a ritual offense and were fined a sheep or a goat.

The Odi ritual fulfilled vital ecological functions. The coordination of pastoral activities in this manner enabled the Hunzakut to match the increased nutritional needs of their lactating goats and sheep with optimal grass growth on the upland pastures. Such coordination was also important in
preventing the haphazard exploitation of the upland grasslands. Present-day Hunzakut herdsmen maintain that the untimely arrival of livestock on the pastures early in the season, before sufficient growth has taken place, adversely affects subsequent grass growth. Moreover, livestock allowed to graze arbitrarily, Hunzakut say, will quickly devour the best patches of vegetation and leave less desirable ones. Such uneven grazing intensities, it should be observed, can adversely alter the botanical composition of upland grasslands, reducing the proportion of desirable grasses and encouraging the establishment of undesirable species (cf. Holmes 1980:132-134). Moreover, haphazard grazing results in the uneven distribution of animal excreta (and hence vital nutrients), thus also contributing to the degradation of the grasslands (Briggs and Courtney 1989:166). In sum, whatever its ideological rationale (such as harnessing the Mir's supernatural power to ensure a successful pastoral season), the Odi ritual may be seen as a means by which the Hunzakut were able to conserve their upland grass resources.

Alpine Pastures, Pastoral Ideology, and Environmental Conservation

Exclusive grazing rights over certain alpine pastures belonged to particular patrilineal clans and lineages. These pastures could be used by all member households and individuals throughout the valley. Grazing rights to other pastures belonged exclusively to the residents of particular village
communities; they were not open to households and individuals from elsewhere in the valley (Map 6).

Rights to the upland grazing grounds were generally incontrovertible. The Mir alone had the power to rescind such prerogatives, as well as to grant them to anyone he pleased. It is said, for example, that Uistar pasture above Baltit once belonged to the people of Ganesh, but that they lost their grazing privileges through the deception of men from Baltit village. Baltit men, Hunzakut say, had instructed Shudan Kabpuri, a woman from their village, to sit on the narrow path leading to Uistar and prevent the Ganeshkuts from passing through. When the Ganesh herdsmen arrived with their livestock, they found this woman blocking their way. They demanded that she move aside, but she refused to budge. When the exasperated herdsmen shoved her aside, Baltit men hiding nearby rushed forward and accused the Ganeshkuts of molesting their "sister," thus precipitating a major quarrel between the two villages. Eventually the Mir intervened, prohibiting the Ganeshkuts from ever again using the Uistar pasture, the grazing rights to which he now transferred to the Baltitkuts, and to his own royal herdsmen. Another example of royal intervention that present-day Hunzakut recall concerns Altitkuts-sat, a pasture located above Altit village. Although the particular circumstances of this case are no longer remembered, people say that the Mir terminated the Altitkuts'
Figure 8. Map 6. Central Hunza's upland pastures
traditional grazing rights to this pasture in favor of the Baltitkuts and the Bericho.

Central Hunza's principal pastures are located at altitudes between 3,300 m to 4,200 m. Most pastures are within a day's walk from the villages, but driving the animals there is no easy task. Vertical distances of 1,500 m to 2,000 m are common and incredibly narrow and steep footpaths, ascending through dark, constricted, and sometimes treacherous ravines, have to be negotiated. These trails eventually lead to spacious meadows, although the terrain is still fairly rough (Pl. XX). The vegetation comprises patches of grass interspersed with shrubs and willow scrub, with recumbent juniper along the steeper inclines.

The upland pastures comprise species of Agropyron, Poa, Festuca, and Bromis. Of these, Festuca and Agropyron have the highest grazing value (cf. Van Swindern 1978). The rate of growth for the various grasses varies somewhat during the pastoral season. Typically, however, growth begins in late-March, accelerates in April and May, and is at its peak from about the middle of June to the first half of August.

Pastures are productive only during the short summer season, but even then they cannot sustain intensive and prolonged grazing. This is because such areas constitute fragile environments with thin and immature soils, limited biomass, and slow rates of plant growth (cf. Briggs and Courtney 1989:167-169). Consequently, to prevent grassland
Plate XX. Summer pastures; left, rock strewn alpine grasslands at 3,200m a.s.l.; right shepherds inside upland stone hut (Photos M. Sidky)
degradation, Hunzakut shepherds, like herdsmen elsewhere (cf. Rhoades and Thompson 1975:540), had to move their flocks over wide distances and between successive elevations.

Traditionally the Hunzakut have regarded these upland grasslands, and the mountains beyond, as sacred places, the hallowed domain of the pari. These are supernatural beings thought capable of bringing good fortune and prosperity, but also of being able to harm and kill people, injure livestock, and blight crops. Shepherds who spend their summers tending flocks in the high alpine pastures are the ones to feel most keenly the presence of these supernatural beings. On numerous occasions when I talked to such men about their life and work in the mountains they would casually mention their hearing of pari voices and the eerie supernatural music they make (Sidky 1993d).

The pari seem to embody the life-giving and life-threatening natural forces of the mountains. Hunzakut say that the pari jealously guard their domain against human encroachment. Shepherds who behave improperly, for example by neglecting their flocks, or by allowing them to damage the fragile meadows, are sure to invoke the wrath of the pari, so Hunzakut say.

Women on the upland pastures, Hunzakut say, offend the pari. This may be associated with the traditional belief in female menstrual impurity. (In the past, Hunzakut recall, their villages had a special building in which women were
confined during their menstrual periods.) Because of the belief that the spirits associated with these upland places were hostile to females, lone Hunzakut women almost never visited them (cf. Qudratullah Beg 1980:134; E.O. Lorimer 1939:42). But if women visited the mountains in a group, and did not stay overnight, it was thought that they would be relatively safe from the pari's anger. Occasionally, therefore, a large number of Hunzakut women would climb up to the alpine meadows in late May and early June to weed the barely crops that had been planted there in mid-April. Such weeding (typically a female task) was so crucial for a successful harvest that it was convenient to have some ideological justification for women to circumvent the traditional proscription on their visiting the mountains.

Cattle, too, were prohibited from the upland meadows. Hunzakut say that this was because they were once thought to be unclean animals, whose presence offended the mountain spirits (see below). This explanation, the ideological underpinnings of which are obscure, is especially interesting
from an ecological standpoint. Cattle on these upland pastures would have competed with the sheep for the sparse vegetation. Moreover, they would have consumed the available vegetation in greater quantities than the small ruminants. In addition, cattle hooves could easily have torn up the thin, moist grass cover, thus endangering the fragile alpine ecosystem. (The deleterious effects of having cattle in the upland pastures is evident from the damage they have been seen to cause in recent times, with the lifting of the traditional restrictions [cf. Sidky 1993d].)

In marked contrast to the cattle, Hunzakut saw their goats as particularly well-suited to the upland grazing grounds. The mountain spirits are said to especially favor the goats, because these animals resemble the ibex (Capra ibex)

4 Similar beliefs are found among the Dardic-speaking peoples of Shinkari to the south of Hunza. Such beliefs, which have received considerable scholarly attention (e.g., Biddulph 1880: 37-38; Drew 1875:428; Jettmar 1961: 87-91; Staley 1982: 178), appear in their most coherent form in the "pastoral ideology" of the Kalash Kafirs, a non-Islamic people in the Hindu Kush mountains of northern Pakistan (Parkes 1987: 647; 1992:38). Kalasha believe that goats, descended from the sacred ibex and markhor, were first given to their ancestors by the mountain deities. Kalasha view their goats, therefore, as constituting a link between men and the supernatural world (Parkes 1992:38). As such, the herds must be protected from contamination by women, because they menstruate (cf. Staley 1982:179), and from cattle, impure animals because of their earthly origins and association with farming. These Kalasha beliefs are associated with a strict division of labor, whereby the husbandry of goats, including their removal to the upland pastures, is an exclusively male prerogative; cattle-herding and valley farming, by contrast, are assigned to women. Though admittedly speculative, it is possible to conjecture that the Hunzakut once had a pastoral ideology similar to that of the Kalash Kafirs, of which only such fragmentary beliefs as I have just described remain. Possibly, Hai-Haial, one of the ancient names of Hunza, also reflects the once primary importance of goat-herding among these people. This name, according to my informants, is derived from the call that Hunzakut herdsmen make as they drive their goats to the mountains.
and *markhor* (*Capra falconeri*), the "pets of the mountain spirits," according to Hunzakut belief. The traditional importance of these caprids in Hunzakut cosmology is evident from their numerous representations on ancient petroglyphs near Ganesh village. It is also significant that a wooden image of an ibex is to be found atop the Mir's castle at Altit. According to local informants, it is a symbol of strength and good fortune.

The association of goats with the ibex and *markhor* made them, in Hunzakut eyes, sacred animals, indispensable for the rites of initiation and oracular performances of their *bitan*, as well as their principal sacrificial beasts (cf. Sidky 1994).

Sheep were permitted to graze the upland pastures because the Hunzakut saw them as having a ritually-neutral status, neither pure nor impure. This is also why sheep and goats could be safely herded together.

---

5 The Ibex and *markhor* were hunted for their meat, horns (as trophies and knife handles) and hides (for shoes, gloves, and other leather goods). But, because they were believed to be the property of the *pari*, hunters had first to pray to the spirits to appear to them in a dream, both to grant their permission and to direct them to where the animals might be found. Without the spirits' acquiescence, it was believed, the hunters would surely encounter mishaps, or even be killed. More prosaically, such ritual restrictions (since the *pari* did not always appear to the dreaming hunters) may be seen as a conservation measure against unrestrained hunting. Over the course of the last century, however, as a consequence of the introduction of modern firearms, there has been an excessive slaughter of ibex and *markhor*, leading to a sharp decline in their respective populations (cf. Ali Akbar 1974:211; Rasul 1982:49-50; Ricciuti 1976:32; Schomberg 1935:56, 136; 1936:59, 135). This, in turn, has deprived such carnivores as the snow leopard (*Panthera unica*) of their natural prey, forcing them to attack domestic livestock on the high pastures.
Pastoral Production
Once the goats and sheep reached the pastures, where they could graze all day long, they rapidly gained weight (roughly 10 to 12 kilograms in 5.1 months), and soon reached peak lactation. Approximately half the flock would be lactating at this time. Goats and sheep were milked twice each day, once in the morning, and once at night. The herdsmen mixed together the milk from the two species and from it made curds, using rennet (a small piece of the inner membrane of a butchered goat's stomach) as the coagulant. The curds were poured into a goat-skin and churned into maltash (butter). Buttermilk, the by-product of butter-making, was boiled to make burus, a type of cheese (Pl. XXI).

The herdsmen stored all the dairy goods that they produced in small pools of ice-cold glacial melt-water. A quarter of the produce belonged to the herdsmen themselves; along with the flour, tea, and dried fruit that were supplied by the owners of the animals under their charge, they were the herders' payment for their services. Periodically the herdsmen carried the bulk of the dairy produce halfway down the mountains, to be received by women and children, who took it back to their villages. Some of the cheese and butter would be consumed immediately, but a significant amount was stored for future use. Becoming available just before the heavy agricultural labor associated with the first barley harvest, butter and cheese provided important supplements to the
Plate XXI. Dairy production in alpine pastures: left, pouring buttermilk from goat skin container, butter remains inside; right, boiling buttermilk to make cheese (Photos M. Sidky)
protein-deficient diet on which the farmers had had to subsist since late-winter or early-spring.

Driving the herds to the upland pastures, besides benefitting dairy production, had several additional advantages. First, the sheep and goats were on the high pastures for nearly five months a year, during the spring and summer months. Because forage resources were plentiful at this time of the year, the Hunzakut could rear more kids and lambs than would have been possible had the flocks been compelled to rely solely on the fodder resources produced on the village farms. The additional animals thus raised could be traded for grain or other foodstuffs, or used as replacements for old and unproductive animals, which could be slaughtered for meat, especially during the harsh winter season.

Second, the manure generated by the goats and sheep on the upland meadows constituted an external source of nitrogen and organic matter for fertilizing the agricultural fields. Although less abundant than cattle dung, sheep and goat manure contain greater amounts of nitrogen, calcium, and potassium than cattle excreta; they also contribute to more rapid bacterial action and humus formation (cf. Price 1981:425; Winterhalder et al. 1974:100). Hunzakut shepherds gathered the precious goat and sheep dung from the corrals in the upland pastures, which they dried on the roofs of their huts. Periodically they would bring loads of dung down to the villages. Dung from outside the corrals was not collected.
Hunzakut believed that this was best left to fertilize the alpine grasslands themselves.

The herdsmen drove the livestock back to the villages at the end of September, around the time of the Autumnal Equinox. However, if the ewes and she-goats were still producing plenty of milk, or if the villagers below were behind schedule in harvesting their second crops, the return could be delayed by as much as a week to ten days. On the other hand, if the weather conditions in the mountains were unfavorable (unseasonably heavy precipitation or low temperatures) this could hasten the herdsmen's return by as much as a week or more. In this event, because the harvesting operations would not have been completed, it was the duty of state officials to make sure that the animals were restricted to sheds until the fields had been completely cleared of grain.

On their return to the villages, the goats and sheep were left to graze for about a month on privately-owned irrigated pastures, orchards, and on the recently-harvested fields (Fig. 2). During this time, farmers meticulously collected all manure that the animals produced, stockpiling it for the spring planting. (Dung produced by goats and sheep during the winter -- when they were kept indoors most of the time -- was allowed to accumulate in the sheds.) By mid-November, the herds would have devoured all available vegetation and crop residues in the village fields; thereafter they were confined to their sheds.
Just before the animals were stalled for the winter, the Hunzakut observed a brief purification rite for their goats. The male head of each household cleaned his animal shed, after which he ritually fumigated the structure with smoke from the leaves of the juniper, a plant sacred because of its association with the mountain spirits. Finally, he prayed for the health and fertility of his animals. The goats and sheep were stalled together, but the cattle had their own sheds. The traditional Hunzakut belief was that the sacred goats must not be polluted by cattle; sheep, as we have just seen, were considered to be of a ritually neutral status.

During the winter months, Hunzakut goats and sheep survived primarily on the households' stores of fodder, carefully accumulated during the previous agricultural year. Cattle were allowed to scavenge by day; however, because of the dearth of available plant matter in the villages, they had to be stall-fed at night. But, despite all their efforts to accumulate sufficient fodder supplies, Hunzakut were unable to provide their animals with a diet of a sufficiently high nutritional value throughout the winter and early spring seasons. Consequently, the animals lost considerable weight. Livestock-fodder imbalances were somewhat rectified by slaughtering a few beasts during the Thumushelling festival, as mentioned in the previous chapter. Additional animals would be killed as household fodder supplies dwindled in late winter and early spring.
During the first half of January, about three weeks after the Thumushelling celebration, Hunzakut observed a ritual known as Gerakus. Herdsmen visited the household's goat-shed, to examine the female goats for signs of pregnancy (Lorimer 1979:40-48). The herdsmen then prayed for the successful birth of many animals, receiving some food in return for these services. The Gerakus marked the end of the annual Hunzakut ritual cycle related to pastoral activities.

Sheep remained in the villages and were stall-fed for almost 180 days, until the start of the next pastoral season. The goats were stall-fed for a little over 100 days. Then, from March until early-May, for roughly 70 to 80 days, they were taken to browse on the desert-steppe zones outside the villages. This strategy enabled the Hunzakut to allocate the remainder of their winter fodder stores to their sheep and cattle. Sheep remained in the stalls until early-May, when they were once again driven to the upland pastures, along with the goats.

* * *

In this chapter I have examined the salient features of the livestock component of the Hunzakut agro-pastoral production system. Hunzakut farmers, as we have seen, strived to make the best use of their available fodder resources by adjusting the size and composition of their herds, and by taking advantage of the physiological and behavioral characteristics
of the different ruminant species. I have also demonstrated how the Hunzakut authorities endeavored to coordinate farming and herding activities by means of the state-sponsored Odi ritual. Such ritual coordination enabled the people to meet the nutritional needs of their goats and sheep, as well as to conserve their upland grass resources.
CHAPTER VI
CROP-LIVESTOCK INTERACTIONS

Throughout this study I have stressed the determinative influence of material constraints on the traditional Hunzakut agro-pastoral production system, focusing on the state-sponsored calendrical rituals and other managerial controls through which the Hunzakut attempted to cope with these physical limitations. One of the principal constraints on agro-pastoral production in Hunza (aside from water and sunlight) was the insufficiency of natural sources of nitrogen in the local desert-like soils. In this penultimate chapter I shall demonstrate how Hunzakut farmers made good this deficiency through the skillful integration of the farming and herding components of their production system.

It is no easy task to maintain ruminant livestock in Hunza's energetically-closed oasis villages. The lack of significant natural forage resources beyond the boundaries of these settlements demanded that the Hunzakut look elsewhere for sources of fodder. The extreme shortage of arable land, however, prevented the farmers from simply opening up new tracts to cultivate fodder. They were thus compelled to devote a significant portion of their limited crop fields for fodder
production, striking a precarious balance between growing
grain for themselves (and to pay state taxes) and producing
feed for their livestock.

If we take as typical a 2 ha farm, we may say that the
farmer would allocate approximately 35% of his land for grain
and vegetables, nearly 45% exclusively for producing fodder,
and the remaining 20% for to multi-purpose cultigens that
provided food both for humans and livestock.

Land for grain was divided into two parts. Approximately
half the tracts would be planted to barley during the first
part of the year and to millets thereafter. The remaining half
would be under wheat to begin with, followed by buckwheats
(see Chapter 4). The grain supported the farmer's family,
while crop residues constituted a vital component of the
fodder for his livestock.

Land for vegetables comprised small plots located near
the farmer's house. These vegetable patches were planted to
carrots, onions, pumpkins, tomatoes, and pulses. The
vegetables were consumed by humans, while leaves and stalks
were fed to the animals.

Table 2 lists the area under cereal and vegetable
production and the relative yields from these crops for a
typical 2 ha farm. Using these figures, we may estimate that

1 I have chosen to use a 2 ha farm as an example because
agronomists familiar with the region have determined that, with a careful
double-cropping regime, an average household of about 7-8 members
working this amount of land could achieve self-sufficiency (cf. Saunders
1984:16).
Table 2. Area under cereal production and estimated outputs of grain and straw in a 2 ha farm

<table>
<thead>
<tr>
<th>Crop total</th>
<th>area under cultivation</th>
<th>kg grain</th>
<th>kg straw fodder</th>
</tr>
</thead>
<tbody>
<tr>
<td>barley&lt;sup&gt;1&lt;/sup&gt;</td>
<td>0.33ha</td>
<td>726</td>
<td>1,597</td>
</tr>
<tr>
<td>fresh stalks&lt;sup&gt;1a&lt;/sup&gt;</td>
<td></td>
<td></td>
<td>151</td>
</tr>
<tr>
<td>millet&lt;sup&gt;3&lt;/sup&gt;</td>
<td>0.33ha</td>
<td>645</td>
<td>1,293</td>
</tr>
<tr>
<td>wheat&lt;sup&gt;2&lt;/sup&gt;</td>
<td>0.33ha</td>
<td>594</td>
<td>1,425</td>
</tr>
<tr>
<td>fresh stalks&lt;sup&gt;3a&lt;/sup&gt;</td>
<td></td>
<td></td>
<td>151</td>
</tr>
<tr>
<td>buckwheat&lt;sup&gt;4&lt;/sup&gt;</td>
<td>0.33ha</td>
<td>400</td>
<td>415</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td>5,032</td>
</tr>
</tbody>
</table>

<sup>1</sup>Hordeum sativum: Estimates based on 2,200 kg/ha grain and 4,480 kg/straw outputs for this crop. Data based on field observations and informant reports. See also Whiteman (1985) and Saunders (1984).

<sup>1a</sup>Based on field measurements: 458 kg/ha obtained by thinning crops.

<sup>2</sup>Panicum miliaceum and Setaria italica: Estimates based on 1,960 kg/ha grain and 3,920 kg/straw outputs for this crop. Data based on field observations and informant reports. See also Whiteman (1985) and Saunders (1984).

<sup>3</sup>Triticum aestivum: Estimates based on 2,200 kg/ha grain and 4,480 kg/straw outputs for this crop. Data based on field observations and informant reports. See also Whiteman (1985) and Saunders (1984).

<sup>3a</sup>Based on field measurements: 458 kg/ha obtained by thinning crops.

<sup>4</sup>Fagopyrum esculentum and <i>F. tataricum</i>: Estimates based on 1,200 kg/ha grain and 1,260 kg/straw outputs for this crop. Data based on field observations and informant reports. See also Whiteman (1985), Saunders (1984).

The farmer with 0.66 ha under barley-millets and wheat-buckwheats, would have been able to obtain 1,800 kg of cereal for human consumption and 5,032 kg of straw for fodder.

These crops would have removed approximately 218 kg of nitrogen from the farmer's fields (Table 3). The farmer would have had to make good this loss in order to obtain a harvest sufficient to meet the needs of his household.
Table 3. Estimated nitrogen requirement of the various crops on a 2ha farm

<table>
<thead>
<tr>
<th>Crop</th>
<th>N kg/ha</th>
<th>area under cultivation</th>
<th>required N</th>
</tr>
</thead>
<tbody>
<tr>
<td>barley</td>
<td>200</td>
<td>0.33ha</td>
<td>66 kg</td>
</tr>
<tr>
<td>wheat</td>
<td>200</td>
<td>0.33ha</td>
<td>66 kg</td>
</tr>
<tr>
<td>millet</td>
<td>100</td>
<td>0.33ha</td>
<td>33 kg</td>
</tr>
<tr>
<td>buckwheat</td>
<td>100</td>
<td>0.33ha</td>
<td>33 kg</td>
</tr>
<tr>
<td>vegetables</td>
<td>200</td>
<td>0.10ha</td>
<td>20 kg</td>
</tr>
</tbody>
</table>

TOTAL 218

Source: Tivy (1990:63-71)

The farmer relied on the manure produced by his ruminant livestock to maintain the fertility of his fields,² while straw from his crops constituted an important source of animal feed. (Vegetable residues comprised only a negligible part of the fodder supplies.) His fields, however, did not produce sufficient crop residues to sustain herds large enough to provide the required amounts of manure fertilizer. For example, nine oxen, or 50 goats, would be needed to produce enough manure to fertilize the cereal component of a 2 ha farm. But to feed this number of animals on crop residues alone would require anywhere between 13,000 to 19,000 kg of straw. A 0.66 ha of land under cereals could only provide a

² By converting the straw into manure and applying it to the fields, rather than simply plowing in the stubble and straw, farmers can return nitrogen to the soil in a form readily available for the crops (cf. Cooke 1986:105-106). This is because microorganisms in the stomach of ruminants aid in the decomposition of these materials, making the nitrogen they contain readily available (cf. Russell 1973:538-539; Smith 1952:3-4).
maximum yield of 5,032 kg of straw, enough to feed two cows or 19 goats. Planting more land to cereals was not an option, since this would only have exacerbated the imbalance, as even greater amounts of manure would have been needed as fertilizer.

In order to make up his shortfall of fodder, the farmer had to adjust his land use and cropping patterns. He also had to carefully regulate the number and types of ruminant species he maintained.

With respect to land use and cropping patterns, Hunzakut farmers typically planted only a third of their fields to cereals and vegetables, as we have seen, allocating the remaining two-thirds to fodder crops (Pl. XXII), such as lucerne, grass, fodder trees, and multi-purpose cultigens (like fruit and nut trees, which contributed to the farmer's food supplies and provided leaves for the livestock). Estimated outputs of these cultigens are provided in Table 4.
Plate XXII. Fodder collection and production: clockwise from top left, grass from tog; leaves from fodder trees; cut lucerne drying in front of wheat field (Photos M. Sidky)
Table 4. Estimated outputs from various fodder sources

<table>
<thead>
<tr>
<th>Source</th>
<th>output kg/ha</th>
<th>total ha under cult.</th>
<th>kg output 2ha farm</th>
</tr>
</thead>
<tbody>
<tr>
<td>lucerne</td>
<td>7,000</td>
<td>0.66</td>
<td>4,620</td>
</tr>
<tr>
<td>grass</td>
<td>3,000</td>
<td>0.30</td>
<td>900</td>
</tr>
<tr>
<td>vegetables</td>
<td>600</td>
<td>0.10</td>
<td>60</td>
</tr>
<tr>
<td>fodder</td>
<td>variable*</td>
<td></td>
<td>2,940*</td>
</tr>
<tr>
<td>trees</td>
<td></td>
<td></td>
<td>1,680</td>
</tr>
<tr>
<td>fruit</td>
<td>600</td>
<td>0.26</td>
<td>1,000*</td>
</tr>
<tr>
<td>trees</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td><strong>11,200</strong></td>
</tr>
</tbody>
</table>

Data based on field estimates of fodder and leaf harvests.

*Fodder trees are usually dispersed along the edges of field, foot paths, and irrigation ditches.

*One-third of a total of 84 fodder trees cropped each year, with yields of 35 kg/trees.

Mature and dead leaves from all 84 trees, at rate of 20 kg/trees.

Mature leaves from 50 fruit trees, collected after fruiting season at 20 kg/tree.

As to the size and composition of his livestock herds, the Hunzakut farmer had to match the number and species he kept with the various fodder and forage resources available to him. Thus, according to my informants, a farmer with 2 ha of land would have maintained approximately 3 cows, 20 goats, and 10 sheep.

Each cow requires roughly 6 kg of fodder per day. Thus three animals would require about 6,600 kg a year. Cattle, as we have seen in Chapter 5, did not take part in the annual transhumance cycle, but remained in the villages all year round. Here they subsisted almost entirely on farm-grown fodder.
Goats and sheep require about 2 kg of fodder per day, and the 30 animals would have required 21,900 kg for the year. These animals, in contrast to cattle, could be taken to the upland pastures for part of the year, where they subsisted on the natural vegetation. For the remainder of the year the goats and sheep were kept in the villages. The farmer had to stall-feed his goats only for about 136 days in winter and could send them to browse on the desert-steppe zones outside the villages for about 76 days.\(^3\) The 20 goats on a 2 ha farm would thus have required about 5,440 kg of fodder (2 kg per animal/day). Sheep, by contrast, are unable to forage on the desert-steppe zones and had to be stall-fed for a total of about 212 days, during which time they consumed some 4,240 kg of fodder (like goats, approximately 2 kg per animal/day).

Using natural vegetation to support their goats and sheep for part of the year allowed Hunzakut farmers to conserve the fodder supplies they produced on their farms. The state-imposed pastoral timetable (discussed in Chapter 5), which set the dates for the removal of small livestock from the villages in spring and for their return in autumn, may be seen as an important part of an overall fodder-conserving strategy.

A farmer with a herd of 3 cows, 20 goats, and 10 sheep would have needed approximately 16,250 kg of fodder. By meticulously collecting the cereal straw, lucerne, grass, and

\(^3\) I have attempted to match the different periods of the Hunzakut pastoral calendar to the 365 days of the year. Hunzakut farmers themselves did not follow such a precise timetable.
tree leaves\textsuperscript{4} produced on his farm he could just about maintain these animals (see Tables 2 and 3). In so far as fodder production and collection were integral parts of the state-controlled agricultural and pastoral cycles, we may say that efficient fodder accumulation was as much dependent on state coordination as was food production.

One of the most crucial by-products of animal husbandry for the Hunzakut was manure for fertilizer. Taking the example of a farmer with 2 ha of land, 3 cows, 20 goats, and 10 sheep, we may calculate that the total weight of the manure produced by his livestock was 5,360 kg. The three cows would each have produced about 2.9 kg of manure a day, or nearly 3,200 kg for the three animals in a year. Nearly all of this was recovered and applied to the fields. With a 2.4\% nitrogen content (Makhijani and Poole 1985:108-109), the cow manure provided 76 kg of nitrogen, 39\% of the total that the farmer needed to return to his fields.

The farmer's 20 goats could produce approximately 0.30 kg of manure per animal per day. Altogether they would produce about 816 kg of manure during the 136 days when they were stall-fed. Again the owner was able to recover all of this and add it to his soils. The goats produced an additional 1,374 kg during the 230 days or so they spent outside the villages.

\textsuperscript{4} The nutritional value of leaves is uncertain (cf. Wilson 1977; Hopkins 1985; PAC Report 1989). Researchers tend to see leaves as a low-quality fodder, although little is known about those collected by Hunzakut farmers.
Only about 549 kg, or 40%, of this was recovered. In total, therefore, the goats produced approximately 1,370 kg of recoverable manure. With 4.1% N (ibid), this provided 56 kg of nitrogen, or about 29% of the total that the farmer needed to return to his fields.

The farmer's 10 sheep produced 0.3 kg of manure per animal per day, which amounted to a total of 636 kg of recoverable manure for the 212 days during which they were confined to the villages. During the 153 days or so on the upland pastures, they would have produced 459 kg of manure, of which 184 kg, or 40%, was recovered. Therefore, the sheep supplied the farmer with approximately 820 kg of recoverable manure. With the same estimated nitrogen value as goat manure (cf. Makhijani and Poole 1985:108-109; Benne et al. 1961), this constituted about 34 kg of the required nitrogen for the crops, or some 18% of the total returned to the fields. The total manure outputs for the various ruminant species are listed in Table 5.
Table 5. Estimated manure production capacity of Hunzakut ruminants (DM) and total outputs from livestock on a 2ha farm.

<table>
<thead>
<tr>
<th>Animal</th>
<th>kg/animal/day</th>
<th>kg/animal/year</th>
<th>kg/output/farm</th>
<th>%N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle</td>
<td>2.9</td>
<td>1058</td>
<td>3,175 kg (3 cows)</td>
<td>2.4</td>
</tr>
<tr>
<td>Goats</td>
<td>0.30</td>
<td>109</td>
<td>1,365 kg (20 goats)</td>
<td>4.1</td>
</tr>
<tr>
<td>Sheep</td>
<td>0.30</td>
<td>109</td>
<td>820 kg (10 sheep)</td>
<td>4.1</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td>5,360 kg</td>
<td></td>
</tr>
</tbody>
</table>

1 Based on field measurements of output of individual animals (DM), and estimates based on the number of packs of manure (30kg) collected from the farm's livestock and taken to the field.

2 Total recoverable manure.

3 Total recoverable manure.

4 See Makhijani and Poole (1985:108-109); Benne et al. (1961); Gotaas (1956); Stout (1990:246).

According to the estimates generated from the 2 ha, 3 cows, 20 goats, and 10 sheep farm, it appears that the Hunzakut farmer could obtain 5,360 kg of dung and 166 kg nitrogen from his livestock; a shortfall of approximately 52 kg.

The farmer made good most of this shortfall by applying human feces and urine to his fields. These were either taken to fields from the household latrine, or deposited directly by defecating and urinating household members. Such use of human wastes reflects the severe resource constraints associated with mountain oasis environments. It is a practice found
nowhere else in the region, except for Baltistan, where similar environmental conditions prevail.

If we take a typical Hunzakut household as comprising eight adult equivalents, the total solid wastes from excreta of household members would have been about 272 kg per year. With a 5% N value, far greater than manure produced by ruminant livestock (Stout et al. 1979:128; Fahm 1980:58), the total nitrogen from this source would have been 14 kg. Estimating that 80% of this could be recovered (Makhijani and Poole 1985:109-109; Snaydon and Elston 1976:55), the farmer would have obtained 11 kg of N. An adult could produce 18 kg of solids in the form of urine a year, thus eight adults would have produced 144 kg annually. With 15% nitrogen, of which an estimated 80% is recoverable, this could have amounted to 17 kg of nitrogen. According to my calculations, human feces and urine constituted about 14% of all the nitrogen that the farmer added to his fields.

The relative amounts of nitrogen from all such sources are presented in Table 6. These estimates suggest that Hunzakut farmers operated on a very tight nitrogen budget. Only by carefully coordinating the farming and herding components of their subsistence system, were they able to produce sufficient food for themselves and their livestock, as

---

6 This figure is based on studies elsewhere (cf. Gibb and Nielsen 1976:319-320; Stout 1990:246), not field measurements. I have used such data in order to obtain a rough estimate of the potential nitrogen from this source.
well as to maintain the fertility of their agricultural
fields.

Table 6. Estimated nitrogen obtained from all sources on a 2ha farm

<table>
<thead>
<tr>
<th>Source</th>
<th>Total kg excreta</th>
<th>Total kg/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle manure</td>
<td>3,175</td>
<td>76</td>
</tr>
<tr>
<td>Goats/sheep</td>
<td>2,185</td>
<td>90</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>1661</strong></td>
<td></td>
</tr>
<tr>
<td>Humans</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(solids)</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>(liquids)</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>28</strong></td>
<td></td>
</tr>
</tbody>
</table>

*This is a reasonable estimate. An alternative way of estimating the N content of manure is by using published data. The N value for farmyard manure is 3% (Gotaas 1956), giving a total of 161 kg for the 2 ha Hunzakut farm, which is very close to my own calculations.*


In this chapter I have demonstrated how Hunzakut farmers were able to adapt to the constraints imposed by a circumscribed oasis setting by skillfully integrating the farming and herding components of their production system (Fig. 9). The size and composition of Hunzakut livestock herds were regulated by the quantity and quality of the total supplies of fodder (primarily straw from cereals, lucerne, grass, and tree leaves) produced on limited amounts of arable lands. Herd size, in turn, determined the amount of manure (and therefore nitrogen) available for farming, and thus
Figure 9. The flow of nutrients and materials in a Hunzakut farm
governed agricultural productivity (including the amount of cereal straw produced).

The total output from the agricultural lands ultimately set limits on the numbers of livestock farmers could successfully maintain through the year. If an enterprising farmer ventured to expand his animal herd without increasing his existing fodder supplies -- by obtaining more arable land, or planting more of his grain fields to lucerne (which meant he had to settle for less food output for his household) -- he put his entire herd at risk.

On the other hand, the farmer had to have a sufficient amount of manure to avoid jeopardizing his harvest. Herd size and agricultural production were thus intricately linked, so that a change in either would affect both. This homeostatic relationship served to regulate the Hunzakut agro-pastoral production system by keeping the crucial variables of manure (N) and fodder within a range that ensured the stability, persistence, and productivity of the agro-ecosystem (cf. Sidky 1993d).

The homeostatic relationship I have just described was a structural property of the systemic articulation between the crop and livestock components of the Hunzakut agro-pastoral production system, a consequence of the distinctive arrangement of ecological, economic, social, and technological elements, which I have described in the previous several chapters.
In this study I have examined the relationships between ecology, canal-building, and the processes of state formation. Hunza represents a specific ethnographic instance, where the hydraulic potential of the natural environment, a certain degree of organizational power at the disposal of a ruling authority, and the decision to construct and maintain a large-scale irrigation system led to state formation.

The hydraulic system built by Silim Khan (and augmented by his two successors) had a decisive impact on the political evolution of Hunzakut society. The Mir's control over the water works, which gave him dominion over land and water -- the principal productive resources -- appears to have been the crucial factor that propelled Hunzakut society towards increased political complexity and centralization. With the hydraulic apparatus under his command, the Mir was able both to intensify agricultural production and to broaden his economic and political power base by establishing new villages throughout the Hunza Valley. He was thus able to acquire increased political authority, significant administrative and agro-managerial controls, and unprecedented wealth.
The Mir's new-found powers, in turn, enabled him to undertake further irrigation projects, establish additional new villages, and acquire strategic northern territories. By the end of Silim Khan's reign, all the essential administrative, sociopolitical, and economic attributes of the Hunza state had been instituted.

The political economy of the Hunza state -- the pattern of resource allocation and the manner in which production was organized and appropriated -- was the direct consequence of the hydraulic mode of production. Usufruct right to lands made arable through the hydraulic apparatus was a privilege granted by the Mir, and was contingent upon compliance by each grantee with the rules and obligations stipulated by the state. Access to the necessary means of production was granted by the state in return for payments, both in kind and in the form of rajaki labor. Through his taxation policies, the Mir set the goals and priorities for Hunza's agro-pastoral production.

The hydraulic apparatus also had a direct impact on the form and function of the Hunzakut agro-pastoral production system. By channeling water into the desert-steppe zones and modifying the natural landscape in other ways (such as the construction of terraces), the Hunzakut created habitats, or environs, suitable for human subsistence. These habitats, which I have called "oasis environments," presented
opportunities for, as well as setting limits on, agro-pastoral production.

I have interpreted traditional Hunzakut land-use patterns, food-production strategies, and aspects of labor organization as constituting adaptations to the ecological conditions associated with the oasis setting: limited arable lands, nitrogen deficient soils, the unavailability of outside nutrient subsidies, the necessity of maintaining ruminant livestock, and the scarcity of natural fodder and forage resources.

The traditional Hunzakut adaptive strategy for handling resource constraints was to rely upon the complementary interactions between the crop and livestock subsystems of their economy. Hunzakut farmers, as we have seen, had to treat their cereal crops in a dual-purpose fashion (both as a source of food for humans and fodder for livestock). They also had to offset fruit production with fodder-leaf production (through the number and types of trees they planted), and had to strike a balance between their needs for dairy products, animal flesh, hair, and wool, obtained from sheep and goats, and their requirements for manure and draft power, supplied by cattle.

In Chapters 4, 5, and 6 I described state agro-managerial controls and the form and function of the Hunzakut agricultural and pastoral production system. During the isolation of the past, when self-sufficiency was crucial for
survival, state management and coordination helped ensure the optimal used of seasonal conditions and the limited land and water supplies available for farming. Such management by the state also served to sustain intensive agricultural production.

Through the examination of historical, ethnographic, and ecological data, I have attempted to ascertain the specific circumstances contributing to increased political complexity and state formation in Hunza. Although factors such as warfare, population growth, and environmental and social circumscription were certainly important, as noted in Chapter 3, large-scale irrigation, I have argued, unquestionably played the principal role in this process.

While it would be imprudent to make broad generalizations solely on the basis of this particular ethohistorical case, nevertheless, in connection with the "hydraulic hypothesis," we may conclude that, as far as Hunza is concerned, large-scale irrigation did indeed contribute significantly towards increased political complexity and state formation.

More precisely, it may be stated that, a large-scale irrigation system under the direct control of a central authority can have significant political and socioeconomic consequences. This is because irrigation, which represents a strategy for the expansion and intensification of agricultural production, can serve as a potent source of wealth and political power.
BIBLIOGRAPHY

Adams, Robert McC.


Alder, G. J

Ali, Tahir


Akbar, Ahmed S.

Akbar, Ali

Bacot, Jacques, et al.
Bailey, Anne M.

Bailey, Anne M., and Josep R. Llobera, eds.


Banik, Allen, and Renée Taylor

Barth, Fredrik

Bayliss-Smith, T.P.

Benne, E. J., et al.

Bennett, John W.

Berger, Hermann
Berreman, Gerald  

Biddulph, J.  

Bielorai, H.  

Bielorai, H., et al.  

Bilham, R., et al.  

Bloch, Maurice  

Bodley, John H.  

Boserup, Ester  

Brady, Nyle C.  
Briggs, David J., and Frank Courtney  

Bronson, Bennet  

Brown, P., and A. Podolefsky  

Burnham, Philip  

Buddruss, Georg  

Butzer, Karl  

Carneiro, Robert L.  


<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Title</th>
<th>Publisher/Location</th>
</tr>
</thead>
</table>
Cohen, Ronald

Cohen, Ronald, and Elman Service, eds.

Cooke, G. W.

Cornick, Tully R., and Roger Kirkby

Coward, E. Walter, Jr., ed.

Crane, Robert I.

Crane, Robert I., et al., eds.

Curzon, G. N. (Marquess of Kedleston)

Devendra, C., and G. B. McLeroy  

Downing, Theodore E., and McGuire Gibson, eds.  

Drew, Frederic  

Duckham, A.N., and G.B. Masefield  

Dumond, Don E.  

Durand, A.  

Edmund, J.B., et al.  

Ellen, Roy  

Elliot, D.

Emerson, Richard M.

Fahm, Latte A.

FAO (Food and Agricultural Organisation, United Nations)


Fernea, Robert

Flannery, Kent

Fleming, Peter
Fox, Robin L.

Frisch, Rose E.

Fried, Morton H.

Friedman, Jonathan

Frissel, M.J.

Geertz, Clifford

Gibb, J.A.C., and V. C. Nielsen

Giles, D.

Gill, N.T., and K.C. Vear
Gordon, T. E.

Goswami, B. N.

Gotaas, Harold B.

Goudie, A. S., et al.,

Grey, Robert

Groetzbach, Erwin F.

Gross, Daniel

Guillet, David

Hall, Daniel
Hamid, S. Shahid


Harada, Naohiko, and Atsuko Miyoshi

Harris, Marvin


Hole, Frank

Holmes, W.
Hopkins, N.C.G.  

Hunt, Eva, and Robert C. Hunt  

Hunt, Robert C.  


Hunt, Robert C., and Eva Hunt  

Huttenback, Robert A.  

Imanishi, Kinji  

Jettmar, Karl  

Johnson, Frederick, ed.  
Johnson, Allen W., and T. Earle

Kappel, Wayne

Katz, Solomon H.

Keay, John

Kelly, William W.


Khan, Mohammad Aslam


Kon, S. K.
Knight, E. F.

Kreutzmann, Hermann J.
1986 *A Note on Yak-Keeping in Hunza (Northern Areas of Pakistan).* *Production Pastorale et Société* 19:99-106.


Langer, R. H. M., and G.D. Hill

Leach, E. R.


Leaf, Murray J.

Lees, Susan H.

Lees, Susan H., and Daniel Bates
Leitner, G. W.

Lewis, B.

Little, M. A., and G. E. B. Morren

Lorimer, David L. R.


1939  *The Dumaki Language: Outlines of the Speech of the Doma, or Bericho of Hunza*. Nijmegen: Dekkei & van de Vegt N.V.


Lorimer, Emily Overend

Macdonald, C.

MacNeish, Richard S.

Madelung, W.

Makhijani, Arjun, and A. Poole

Marx, Karl

McCarrison, Robert

McElroy, Ann, and P. K. Townsend

Mencher, J.
Mason, I. L.

Miller, Keith

Millon, René

Miner, R.J.
1971 Farm Animal-Waste Management. Ames: Iowa State University Agriculture and Home Economics Experiment Station NCR Publication 206.

Mitchell, William P.

Montgomerie, T. G.

Mons, Barbara
1958 High Road to Hunza. London: Faber and Faber.

Moore, O. K.

Moran, Emilio F.
<table>
<thead>
<tr>
<th>Year</th>
<th>Title</th>
<th>Author(s)</th>
</tr>
</thead>
</table>
Nevill, H.L.  

Netting, Robert McC.  


Odum, H.T.  

Ogino, K., et al.  

Orenstein, Henry  
PAC (Pakhribas Agricultural Centre)

Parkes, Peter


Parkin, Robert

Price, Larry W.

Paffen, K. H., et al.

Piddocke, S.

Potter, Jack M.

Poucha, Pavel

Pyke, M.
Qudratullah Beg, Haji  

Rajbhandary, H. B., and S. G. Shah  

Rappaport, Roy  


Rasul, Ghulam  

Redman, Charles L.  

Rhoades, Robert, and Stephen I. Thompson  

Ricciuti, E. R.  
1976  *Mountains Besieged.* International Wildlife 6(6):24-34.

Rodale, J.I.  
Rosman, Abraham, and Paula Rubel

Russell, E. Walter

Salter, P.G., and J. E. Goode

Sanders, W. T., and B. Price

Sanders, W. T., and Joseph Marino

Saunders, Frank G.

Schomberg, R.C.F
1935 Between the Oxus and the Indus. London: Martin Hopkinson Ltd.

1936 Unknown Karakoram. London: Martin Hopkinson Ltd.

Sedov, I.
1968 La Société Angkorienne et le Problème du MPA. La Pensée:71-84.

Service, Elman
Shahrani, M. Nazif  

Sheik, M.I., and A. Aleem  

Shimshi, D.  

Shor, Jean Bowie  

Sidky, H.  

Sidky, M. H.  


Smith, A. M.

Snaydon, R.W., and J. Elston

Spooner, Brian

Staley, John


Stein, R. A.

Stephens, Ian

Steward, Julian H.


Stout, B.A.


Syed, Anwar H.


Taylor, John G.


Thomas, David Hurst


Thomas, L., and T. Thomas

Thomas, R. Brook  

Thorne, G. N.  

Tichelman, F.  

Tivy, Joy  

Tobe, John  

Turner, Bryan S.  

Ulmen, G. L.  

Van Swindern, H.  

Vayda, A. P., et al.  
Webb, Malcolm

Webster, David

Weeks, Richard V., ed.

Wheeler, Geoffry

Whiteman, Peter T. S.


Wilkinson, J.M., and Barbara Stark

Wilson, A.D.
Winterhalder, Bruce, et al.

Winzeler, Robert L.

Witcombe, J. R.

Wittfogel, Karl A.


Wolf, Eric R., and Ángel Palerm  

Wright, Henry T.  

Yao, Augustine  

Younghusband, Sir Francis  