WATER MANAGEMENT, LIVESTOCK AND THE OPIUM ECONOMY

Baseline Survey

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About the Afghanistan Research and Evaluation Unit

The Afghanistan Research and Evaluation Unit (AREU) is an independent research organisation that conducts and facilitates action-oriented research and learning that informs and influences policy and practice. AREU also actively promotes a culture of research and learning by strengthening analytical capacity in Afghanistan and by creating opportunities for analysis and debate. Fundamental to AREU's vision is that its work should improve Afghan lives.

AREU was established by the assistance community working in Afghanistan and has a board of directors with representation from donors, UN and multilateral organisations agencies and non-governmental organisations (NGOs).

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1. Introduction

1.1 Background

The applied thematic research project "Water Management, Livestock and the Opium Economy" is funded through a contract awarded to AREU by the EC, effective for 36 months from May 2005.

The principal objective of the project is to:

> *...enhance the sustainability of Afghan rural livelihoods by providing policymakers with clear and accurate information on the use, management and role of natural resources (with specific focus on water, livestock and opium) within the agricultural economy.*

The research is expected to provide evidence-based recommendations for improving the effectiveness of agricultural policy and rural programming — addressing the recognised lack of understanding about the ways in which rural livelihoods are constructed and respond to change.

The project takes a farm systems approach, viewing farmer decisions about the use of individual resources as closely linked to the availability and management of other resources, while recognising that the farm (and rural livelihood) system as a whole is inextricably bound to the broader economy.

1.2 Project methodology

This research project seeks to understand natural resource management strategies within the context of relevant risks, constraints and opportunities, and its focus is necessarily on several closely linked areas:

- natural resource availability and condition (including social and political systems of access);
- management actions (farmer decisions, strategies of resource use and their practical results); and
- externalities (economic incentives and constraints, opportunity costs, government policy and the operation of markets).

Research activities should combine the collection of environmental, agricultural and socioeconomic data with more in-depth explorations of farmer decision-making, and the structures and institutions that support this. As a key site for decision-making about natural resources is the household, and as household livelihood security may be utilised as an indicator of the effectiveness (and sustainability) of farming systems, the household is an important level of analysis in this study.[1]

The project is structured around longitudinal monitoring of 220 farming households in twenty primary research sites in four provinces, although complementary studies will also be undertaken in other areas. These sites were selected to demonstrate a wide range of natural resource use and socioeconomic conditions. During the course of the study data will be collected longitudinally — through thematic studies undertaken by specialist consultants[2] and by seasonal (three-monthly) monitoring of

[1] For the purposes of this study, the household has been defined as a socioeconomic unit which is normally (but not always) co-resident and that centrally pools and reallocates all resources (incomes, assets and labour) — and so normally eats together.

[2] Project consultants have been appointed to research social and technical aspects of water management and irrigation, livestock management, land tenure and the opium economy.

on-farm activities, natural resource use and socioeconomic indicators. Complementary studies and physical measurements will also be undertaken. This programme of research is designed so that each of the datasets will be mutually complementary and integrated using a specially developed project database.

This approach is expected to provide insight into how natural resources are used through the seasonal calendar and how farmers' management of particular resources relate to other elements within farm systems and livelihoods. The data collected through monitoring and thematic studies will contribute to the empirical basis for interpretation and analysis.

The monitoring sample groups will not be statistically significant outside of their local populations: not only was a statistically significant sample beyond the resources of the project, but the approach of cross-sectional research at a national scale was judged unlikely to produce the level of understanding necessary to achieve the project's objectives. The primary research sites are instead to be used as multiple case studies from which inferences and insights may be drawn.

1.3 Primary research site selection

This project's contract stipulates that primary research activities are focused on the provinces of Nangarhar, Ghazni, Herat and Kunduz. These selections were made on the basis of covering four of the five major river basins as well as a diversity of biophysical, social and economic conditions. For practical reasons site selections were restricted to areas where the project's partner NGOs, German Agro Action (GAA) and the Danish Committee for Aid to Afghan Refugees (DACAAR), were actually working.

Primary research sites (villages and their associated natural resources) were selected in collaboration with partner NGOs on the basis of eighteen categories of variables recorded during preliminary site inspection visits to the four provinces (see table 1). Each category was assigned one of three different values on the basis of observations and the reports of NGOs working at the sites. A simple site profile was completed for all possible sites.

Table 1. *Variables used in preliminary site selections*

Bio-geographical	Irrigation and Water	Livestock	Opium	Socioeconomic
landscape elevation	water source scale of system management position in system	species population production feed sources management	Area cultivated regularity importance	market access land holdings off-farm income wealth

Category values were entered into a spreadsheet and site selections were made on the basis of ensuring the overall widest distribution of these — to encompass as broad as possible variation in resource conditions and management practices. Applying this selection strategy produced a sample group of sites which were, in nearly all cases, broadly representative of the wide range of natural resource management conditions in Afghanistan.

1.4 Survey methodology

Primary research sites were selected according to the reported and observed indicators in aggregate. However, this indicated little in terms of household- and farm-level values and their distributions.

Because of the importance of household monitoring data to the overall research effort, it was necessary to ensure that the households selected for monitoring should be, as far as possible, representative of their broader communities — with respect to livelihoods and natural resources management. The need to select a sample of households consistent with the broader community profile was the primary reason for the baseline survey.

Table 2. *Baseline survey sampling strategy*

Province	Research site	Total households	Weighted sample	% site total
Ghazni	Zala Qala	100	16	16
	Pyada Rah	21	3	14
	Qala-i-Naw	354	55	15
	Turmai	123	19	15
	Chel Gunbad	42	7	17
Total		*640*	*100*	
Herat	Khalifa Rahmat	29	22	75
	Tunian	35	25	71
	Gawashk	28	20	71
	Ghorak	17	12	70
	Sir Zar	29	21	72
Total		*138*	*100*	
Nangarhar	Maruf China	160	19	12
	Sra Qala	100	12	14
	Khawaji	60	7	16
	Otarkhel	100	12	14
	Janikhel	425	50	10
Total		*845*	*100*	
Kunduz	Abdul Nazar	40	14	35
	Alam Bai	26	9	34
	Dana Haji	40	14	35
	Wakil Jangal	68	23	33
	Afghan Mazar	110	38	34
Total		*284*	*100*	
Total			**400**	

The distribution of samples at provincial level was calculated utilising the "probability proportional to size" (PPS) approach — the survey sample from each site is weighted according to overall distribution of households in the selected sites of that province. Using this approach, all households in each research site have an equal probability of selection. A total of 400 households were surveyed, distributed through the selected primary research sites in each of the four provinces. In all cases, the proportion of households from each primary research site surveyed was 10

percent or over (see table 2). This level of sampling should allow for adequate representation in constructing community profiles.

Sampling within primary research site communities was random; teams either compiled a list of households and selected at intervals from the list, or worked through villages sampling households from within *qala* (housing compounds) at pre-determined intervals.

Table 3. *Key to the village datasheets*

Land management	
Household land ownership	Land reported as property of the household, whether by legal or customary entitlement.
Household-worked land	Land under cultivation by household, irrespective of tenure status.
Uncultivated	Land owned but not under household cultivation, including land that is fallow, sharecopped or leased out, or under mortgage.
Sharecrop/rent	Land cultivated in addition to household property, that is, rented, sharecropped or acquired through a mortgage transaction.
Socioeconomic indicators	
Assets	A value calculated from reported and observed ownership of common domestic assets, including thermos, radio and mobile phone as indicators of "disposable income". While the values are in themselves arbitrary, their presence facilitates direct comparison between households and locations.
Nutrition	A value calculated from the reported incidence of consumption of a range of food (including meat, vegetables, bread, eggs and dairy products) over a specified week. The value is also arbitrary, but facilitates comparison and analysis.
Off-farm incomes	Number of sources of income to household irrespective of duration or type of work.
Value of external incomes	Estimated annual income in US dollars, calculated from a description of the labour (both temporary and permanent) activities of all members of the household. This value describes off-farm as well as non-farm incomes, but not farm income.
Cropping	
Summer cropping	Area reported under cultivation by responding households during the 2005 season.
Winter cropping	Area reported under cultivation by responding households during the 2005 season.
Water for cultivation	
Reported sufficiency of water	Encompasses water from all sources used for cultivation over the previous twelve months. Describes the extent to which water was adequate for crops under cultivation during each season. For unirrigated sites, describes the seasonal adequacy of the previous year's rainfall.

The survey datasheet consisted of four sections dealing with: general household information: a combination of socioeconomic indicators: land and water use: and livestock management. The datasheet was completed twice in each household — with the male (or female) head of household and with the senior female of the household. Interviews were held simultaneously and separately, so that data could be corroborated from two independent sources.

Prior to the commencement of fieldwork, meetings were convened with individual communities and their leaders, explaining the purpose and methods employed by the research and seeking community consent for the survey. This was universally given. The field research teams received a considerable amount of training before the

survey and, to ensure that high standards of interviewing were maintained, some of their time in the field was spent under the supervision of their respective NGO partner's research support officers. On completion of the survey, data was entered into spreadsheets. Queries emerging from the data were returned to the field team for clarification.

The purpose of this report is to provide an accessible summary and synthesis of the baseline data, to identify trends, to suggest initial interpretation of these findings and to highlight potential areas for further research within the Water Management, Livestock and the Opium Economy project.

2. Discussion of Findings

2.1 Diversity in farming systems

The baseline survey for the Water Management, Livestock and the Opium Economy project was undertaken to provide a sampling frame for household selection for monitoring. The principal objective of the survey was to establish the natural resource use and socioeconomic profiles of the research sites (see Appendix 1).

However, the diversity of resource conditions and the differences between farming systems in the primary research sites make direct comparisons and inferences across the entire dataset unproductive. Farm systems have therefore been organised according to a preliminary typology in order to facilitate comparisons. This may be revised, updated or discarded as additional data and observations are received, however the initial division of farm system types is described in table 4. The descriptive statistics from this categorisation are given in table 5.

Table 4. *Research sites by farm type*

System type	Research site	Total household sample
River valley sites	Wakil Jangal	41
	Dana Hajji	13
	Afghan Mazar	37
	Gawashk	20
	Tunian	25
	Chel Gunbad	7
	Turmai	19
	Qala-i-Naw	55
	Janikhel	35
Hillside sites	Ghorak	13
	Pyada Rah	3
	Zala Qala	22
	Khawaji	13
	Otarkhel	20
	Sra Qala	20
	Maruf China	22
Rainfed sites	Abdul Nazar	9
	Alam Bai	7
	Khalifa Rahmat	22
	Sir Zar	20

River valley sites: These are sites where land is irrigated by water conveyed by a system of canals from a permanent (albeit fluctuating flow) source. Water distribution is facilitated by permanent structures and established institutional mechanisms. These lands are generally in densely populated and cultivated river valleys where irrigated land resources are limited. The baseline survey included river valley sites in all four provinces.

Hillside sites: Sites in this category are generally found at higher elevations than irrigated land that is along the major river valleys. Land is commonly irrigated by variable-flow springs, *karez*, or small (sometimes seasonal) washes and surface flows. Irrigated cultivation at these sites is generally constrained by water availability and there are not usually specialist community institutions for the manage-

ment of water. Due to limitations on the availability water for irrigation, farmers may supplement irrigated cultivation in hillside areas with rainfed arable cultivation.

Rainfed sites: Considerable overlap exists between limited or seasonal irrigated sites and rainfed cultivation sites. These latter sites are identified where farming is principally oriented towards rainfed cultivation, with only minor or supplementary irrigated components. Rainfed sites are typically located on hills or plains with low population densities, and where land resources are generally less scarce than in cultivated river valleys.

Table 5. *Comparison between farm systems*

	Water suffic-iency	Crop divers-ity (# crop)	Culti-vated area (*jerib*)	Sheep, goats	Cows	Human nutri-tion	Assets	Number of incomes	Income values ($)
Canal irrigated (n=252)									
Mean	246.94	7.77	8.95	3.58	1.69	78.64	3.64	1.86	1183.89
Std. dev.	64.18	3.96	11.94	9.10	1.63	23.38	2.91	1.22	1555.91
Limited irrigation (n=106)									
Mean	164.357	5.71	3.28	5.86	0.577	85.66	2.11	1.57	926.00
Std. dev.	33.98	1.70	4.61	9.69	1.03	21.94	2.47	1.01	1027.12
Rainfed (n=58)									
Mean	156	3.75	17.92	14.36	2.34	61	1.74	2	488.87
Std. dev.	28.74	0.5	15.63	17.03	2.43	17.23	3.37	1.135	523.70
ANOVA (P value)	0.003	0.086	0.123	0.255	0.018	0.31	0.069	0.27	0.00131

The data in table 5 summarises the differences observed between farm systems. Where land is irrigated by canal from major perennial water sources, farmers report higher levels of water sufficiency than at hillside sites, and these sites in turn receive a more adequate water supply than unirrigated rainfed lands. Low standard deviations from the mean suggest relative homogeneity in values within each category.

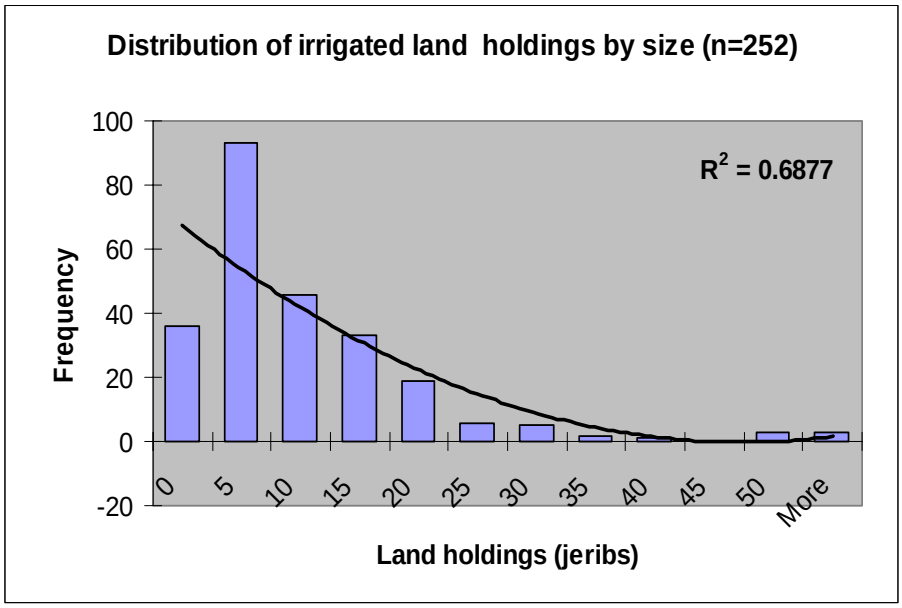
Crop diversity

The greatest crop diversity was recorded on irrigated farms in the river valleys, with less diversity recorded at sites dependent upon *karez*, springs or wash waters at higher elevations. The least diversity was found in rainfed farm systems. In fact, crop diversity increases with reported levels of water within farm systems. Across all farm systems, sufficiency of water correlates moderately with crop diversity (r=0.565). However, the strongest relationship was found in the water-scarce rainfed farm systems, where farmer reports of rainfall conditions were most closely related to crop diversity (r=0.649). This may indicate that water-scarce systems are proportionately more sensitive (in terms of cropping choices) to change in amounts of water (rainfall).

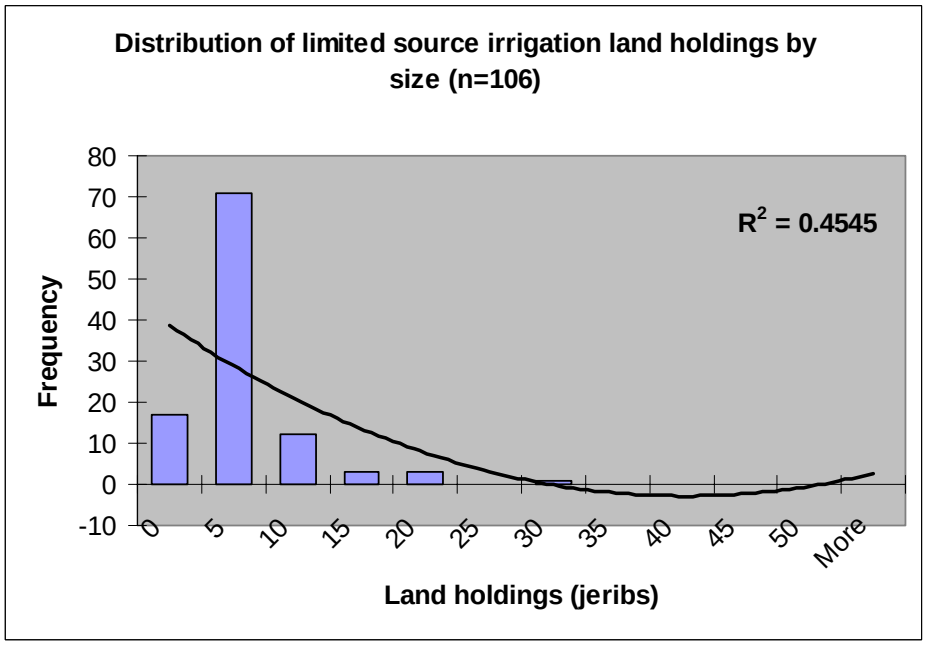
Cultivated land area

The data displays considerable differences in cultivated land area per household under different farm systems. While canal-irrigated land holdings are generally larger than those irrigated from hillside *karez*, springs or washes, mean rainfed land holdings were approximately double the size of those in the river valleys.

Differences in land holdings between various types of farms are emphasised by examining their frequency distributions. Canal-irrigated farmland holdings exhibit a relatively smooth and standard distribution, with modal values falling at 5—10 *jerib* and maximum values at over 50 *jerib*.

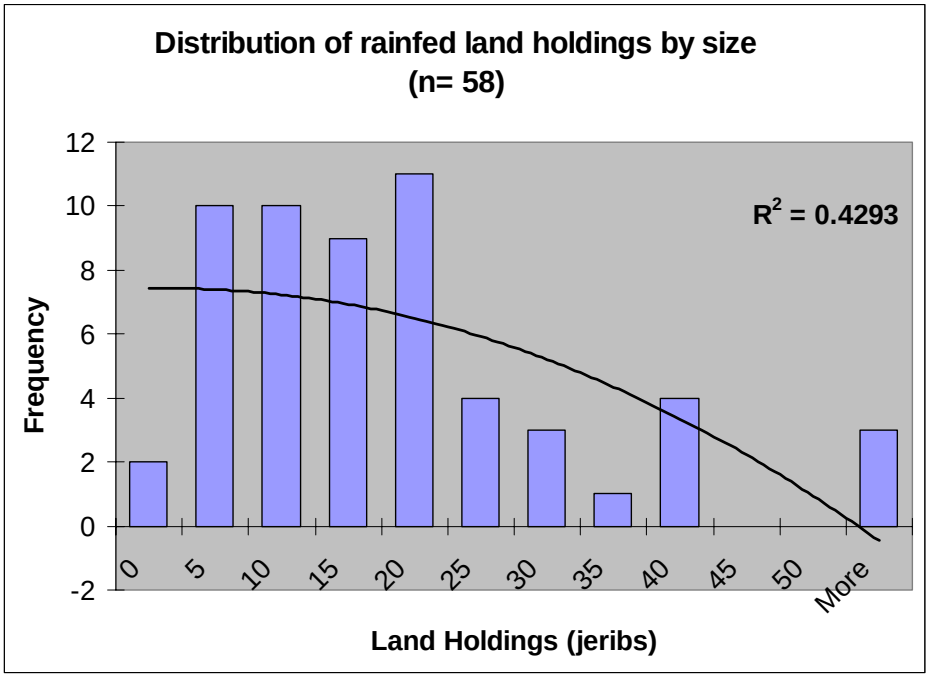


While the distribution of land holdings irrigated from *karez*, springs and washes displays a similar modal value of 5—10 *jerib*, the overall distribution of this category of holdings is notably more restricted, with a higher proportion of land holdings clustered around the modal area.



By contrast, the frequency distribution of rainfed land holdings by size exhibits a fairly consistent distribution of land holdings of 5—25 *jerib*, with frequencies only diminishing at less than 25 *jerib*. Even so, a considerable proportion of the sample lies beyond this level.

At this early stage of research it is not possible to fully explain or interpret these differences. However, the data seems consistent with the view that distributions of land holdings by size in all three farm systems are influenced by key resource constraints. In the case of canal-irrigated farm systems (although water scarcity may be a seasonal constraint in certain areas), land scarcity in the densely populated river valleys may be identified as a constraint — resulting in a classic distribution with the gently sloping tail. In elevated *karez*-, spring- and wash-irrigated farm lands, water availability similarly limits the extension of irrigated cultivation areas, but with a slightly different overall distribution (which may also be influenced by the inclusion of supplementary rainfed cultivation beyond the irrigated areas). The situation is different in rainfed farming systems where land or water is less of a determining constraint. The consistently large land holdings throughout the sample indicate a greater level of equity in access to land resources. Household cultivated area in rainfed systems correlates with adult males over the age of fifteen years (r=0.483). This relationship was weaker in households managing canal-irrigated lands (r=0.231), which is consistent with the view that labour availability may be a factor in limiting rainfed cultivation.



Livestock ownership

The data gathered on livestock ownership exhibits very different patterns of ownership and management, both by farm system type and by species. There is relatively little diversity in cow ownership, with a large proportion of households in the survey owning between one and three cows, regardless of farm system. This low population is consistent with the view that cows are principally owned to supply milk and dairy products for household consumption, and they are not generally managed as capital growth assets or income-generating assets. Across all households in the survey there was a weak positive correlation between ownership of cows and consumption of dairy products in the household diet (r=0.368).

The mean ownership of cows is highest in the rainfed cultivation research sites. This may reflect a generally greater involvement in livestock as an alternative to irrigated cultivation and a supplement to rainfed cultivation. Cereal crops such as

sorghum and barley or certain legumes are often grown for livestock in rainfed systems. At sites of irrigated cultivation, a relationship was evident between household cultivated area and cow ownership. This was marginally more pronounced for hillside *karez*- and spring-irrigated villages where water and land resources are more scarce (r=0.357, r=0.412).

As with cows, the largest holdings of ovicaprids are found in the rainfed farm system research sites. Unlike cows, herds are often much larger than would be expected for production of a purely domestic supply, which is consistent with the view that these stock are sometimes managed to generate income for farming households. The proximity to rangeland and extensive areas of post-harvest residue for grazing characteristic of rainfed systems are elements that may influence the prominence of livestock in this type of farming system.

The survey data was applied to test the common hypothesis that access to land is a prerequisite to livestock ownership. For the purpose of this test, livestock holdings were standardised into standard units (ovicaprid = 0.2 cow).

	Land (standard units)	**No land (standard units)**	
Mean	2.83	0.92	P value = 8.92
Std. dev.	3.255	1.35	

While there is a moderate relationship between land and livestock units across all farm systems, the difference in livestock ownership between land holding and landless households is not statistically significant. When species were tested individually, there was no significant difference in cattle ownership between land holders and landless respondents.

However, significant difference was found between landed and landless in ovicaprid ownership (P=0.0125). From the data available it is impossible to assess whether this difference can be attributed to the need for land to cultivate winter fodder, or simply that (wealthy) households with land tend to hold more ovicaprids as capital assets. Given the findings for cattle (which are even more fodder dependent than ovicaprids), it seems that the latter explanation should not be dismissed.

Household economy

There are considerable differences between farming systems with respect to human nutrition, gauged in terms of the diversity and quality of household food consumption. The highest values for consumption are found for hillside villages irrigated from *karez* springs and streams. Valley farms have the next best values for nutrition, while rainfed irrigated sites report considerably poorer diets. It worth noting that four of the seven sites in the hillside spring- or *karez*-irrigated category were in Nangarhar where unusually high levels of domestic food consumption were recorded. While this may reflect true consumption behaviour, this part of the data also raises the possibility of error or differences in the collection of data between provinces; it needs to be checked again. The hillside villages of Achin in Nangarhar have the smallest cultivated area per person of all surveyed sites and relatively low crop diversity, so unless diet is supplemented through income from sale of high-value crops (like opium), it seems unlikely that nutrition can be linked to farm production. If the Nangarhar sites are excised from the sample, overall values for nutrition in spring-, *karez*- and stream-irrigated hill villages fall well below those for canal-irrigated sites (mean 68.53, std. dev. 25.26).

The data indicates that household nutrition at both canal-irrigated sites and spring- and *karez*-irrigated hill sites relates to crop diversity (canal-irrigated r=0.57, *karez*- and spring-irrigated r=0.647). Sites with sufficient supplies of water are able to cultivate vegetables and other food crops, and this is reflected in the quantity and quality of diet at the household level. By contrast, at rainfed sites, when cropping diversifies it is usually into barley, sorghum or legumes, and this does not have a perceptible impact on levels of human consumption behaviour. These sites primarily produce wheat which is consumed as bread, and households farming in this way exhibit a relatively poor quality diet.

Household assets (non-essential items like radios, thermoses and mobile phones) were utilised as indicators of disposable income. The baseline survey indicated that the highest level of assets were in river valley villages. If the Nangarhar nutritional data is excluded, the basic pattern of assets ownership (highest values for canal-irrigated sites and lowest for rainfed sites) replicates that of household nutrition. However, there are many factors that could skew the distribution of assets in households of different farming systems. It is probable that in settled valley areas assets will be more accessible to households (due to the proximity of markets) and those households would be more likely to have access to electricity and other enabling factors. However, there seems no reason to doubt that the greatest concentration of assets (as indicators of disposable incomes and wealth) is found in the farming villages of river valleys.

It is notable that the incidence of waged employment among household members was most frequently reported among remote rainfed farming communities. However, as the question about "employment" did not specify duration or remuneration, this could reflect seasonal engagement in waged agricultural activities like harvesting (labour demand is high in extensive rainfed lands). More telling is the estimated levels of income, which identify households in river valleys as having the highest external incomes, and stream- or *karez*-irrigated hill sites as having next highest. Remote rainfed farming households have by far the lowest external incomes. This ranking is consistent with data describing the distribution of household assets and also (if the Nangarhar data are excluded), nutrition.

Summary

Overall, the data from the baseline survey suggests that village research sites in the canal-irrigated river valleys receive the most water for irrigation purposes and have the most diverse crop systems. Although access to land may be limited by population density, and lack of access to pastures may constrain ovicaprid ownership, households at these sites also have the best access to employment, and overall this is reflected in the highest levels of household incomes, assets and nutrition.

Hillside research sites irrigated from springs, *karez* and streams may be constrained in irrigated cultivation by limited water availability. Households farming in this way have the most limited access to land — possibly because there is insufficient water to irrigate larger areas. However, because they have access to some irrigation water, they exhibit higher crop diversity than rainfed farm systems. Also, because of access to adjacent pastures and the possibility of rainfed farming on the hillsides, farmers of this type generally have more ovicaprids than households in the valleys, although (with less irrigated area for fodder cultivation) generally fewer cows. Off-farm incomes (and thus asset holdings) are generally lower on the hillsides than in the valleys.

Rainfed farm systems are characterised by the largest areas of land under cultivation. However, it seems probable that returns from farming of this type are limited and so this does not translate in any discernable indicator of household wellbeing other than livestock ownership. Overall, remote rainfed farming sites appear to be the poorest and most marginal of the communities covered by this baseline survey.

2.2 Nomadic pastoralists

The baseline survey includes data from two small communities of nomadic pastoralists, the Khomarikhel and Kutubkhel (n=25). Unlike the primary research sites, a rigorous selection process was not used to identify these groups. The logistical challenges associated with interviewing migratory communities meant that a primary consideration in the selection of these two groups was their accessibility throughout the year to research teams.

Table 6. *Characteristics of nomadic households studied*

	Ovicaprids	Ovicaprids/ person	Cows	Nutrition	Assets	Cash income ($)
Khomarikhel (n=15)						
Mean	44.4	9.79	1.13	80.06	1.13	351.33
Std. dev.	36.19	9.26	0.99	16.82	0.99	344.67
Kutubkhel (n=10)						
Mean	48.1	6.37	0.4	79.8	1.90	458.1
Std. dev.	47.22	5.82	1.26	21.91	1.64	690.44
ANOVA (P values)	0.82	0.309	0.117	0.467	0.884	0.612
Aggregate (n=25)						
Mean	45.88	8.08	0.84	82.12	1.96	394
Std. dev.	40.04	11.05	1.14	16.51	1.6	490

There is some overall evidence for differences between the two study groups, however if α is set at 0.05 and equal variances are assumed, these were not statistically significant.

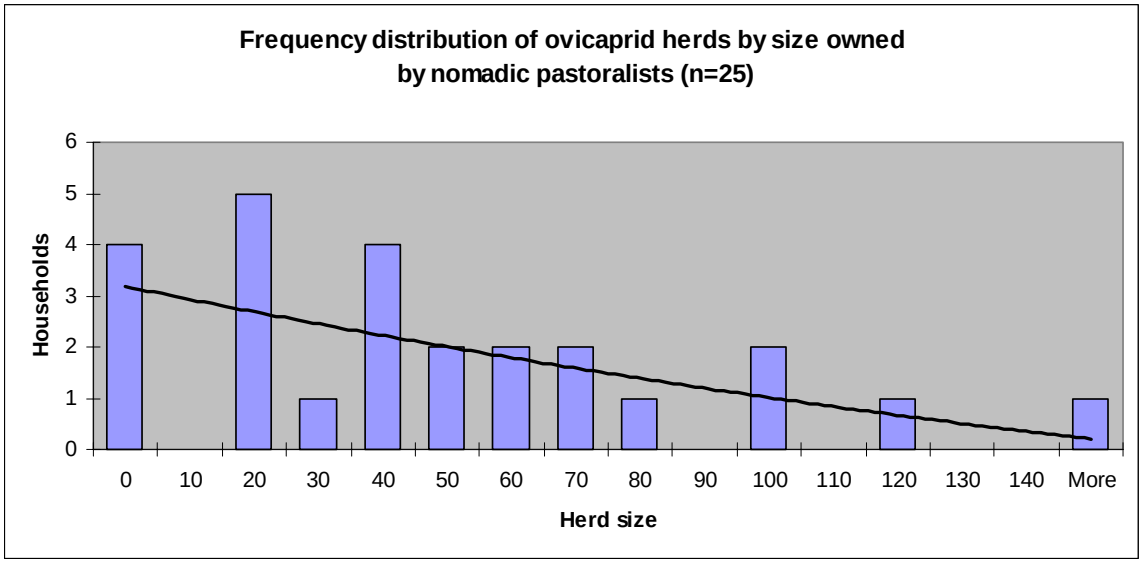
The data suggest that the Kutub group are marginally wealthier than the Khomari group. A few households in both groups reported ownership of small areas of land and property at their winter residence sites, which raises the possibility of additional rents or sharecropping arrangements to supplement the cash incomes recorded by the survey. Most of the Khomari households reported ownership of camels, with a mean ownership of 1.8 animals (std. dev. 1.37), while the Kutub are largely dependent on donkeys for transport. While both groups have similar mean holdings of ovicaprids, the Khomarikhel possess a higher ratio of small ruminants to humans. As with camels, the Khomari report a higher incidence of cow ownership, one that is comparable to the mean for sedentary farmers. Since the Khomari group have generally lower cash incomes than the Kutub, this evidence combines to indicate an overall greater reliance on livestock and a more pastorally based livelihood.

There appears to be very little difference between the reported quality and quantity of foods consumed by the households in the two nomad groups. Household nutrition values are probably composites of the ratio of livestock to humans and levels of external incomes.

However, compared with other farm systems described in this report, it is interesting to note that the sampled households of nomadic pastoralists exhibit some of the highest levels of nutrition of all the surveyed sites (table 5). By contrast, nomads seem to possess fewer assets than most sedentary farming households (not surprising given their need for mobility), and report much lower cash incomes from off-farm employment. Indeed, incomes reported by nomads are even lower than those recorded at rainfed primary research sites (the most vulnerable of sedentary of farming systems).

The apparent high level of nutrition recorded for nomad communities is probably related to the way in which this information was collected (scoring consumption of meat and dairy products more highly than vegetables and grains). Pastoralists often have a higher proportion of meat and dairy in their diet than cultivators, but this does not necessarily indicate food security: pastoralists do not regularly slaughter healthy animals for food. Perversely, high levels of meat consumption may be an indication of high levels of livestock illness or mortality, and therefore food insecurity. Further research is clearly required to ascertain the relative vulnerability of migratory pastoralists.

As a general observation, current levels of stocking (at about 8 small ruminants per person), is below the levels normally associated even with subsistence production (11–15 small ruminants per person). This is probably because pastoralists were surveyed during a period of restocking and recovery from drought, and it confirms that herders cannot be solely dependent upon livestock for their livelihoods. With currently available data it cannot yet be ascertained whether this will change as herds are restocked.



2.3 Provincial diversity

As a consequence of the diversity of farming systems encountered, there is limited value in making comparisons between agricultural data at the provincial level. The baseline survey does, however, allow some tentative comparisons to be made between socioeconomic data at the provincial level. Findings suggest the highest levels of consumption and nutrition occur at the Nangarhar research sites, with the lowest in the Herat research sites. Asset ownership is fairly consistently low provincially, with the higher values in Ghazni and Kunduz. The greatest number of external

incomes is in Kunduz, although many of these are low-value incomes for women undertaking weaving. The highest levels of cash incomes are found in Ghazni.

One of the problems of comparing data provincially is that the research sites were not selected to be provincially comparable. For example, although Ghazni apparently has the highest cash incomes, the five research sites in the Ghazni sample include three river valley villages and two *karez*-irrigated hillside villages. In Herat (which had the lowest overall cash incomes), two river valley villages were selected — one hillside spring-irrigated village and two rainfed cultivation sites. As covered in the discussion of research site diversity, this combination of site types skew the mean towards low income, nutrition and associated socioeconomic indicators.

For meaningful comparisons between provinces, future research will need to carefully identify comparable research populations within the main monitoring sample, and use these as a basis for comparison.

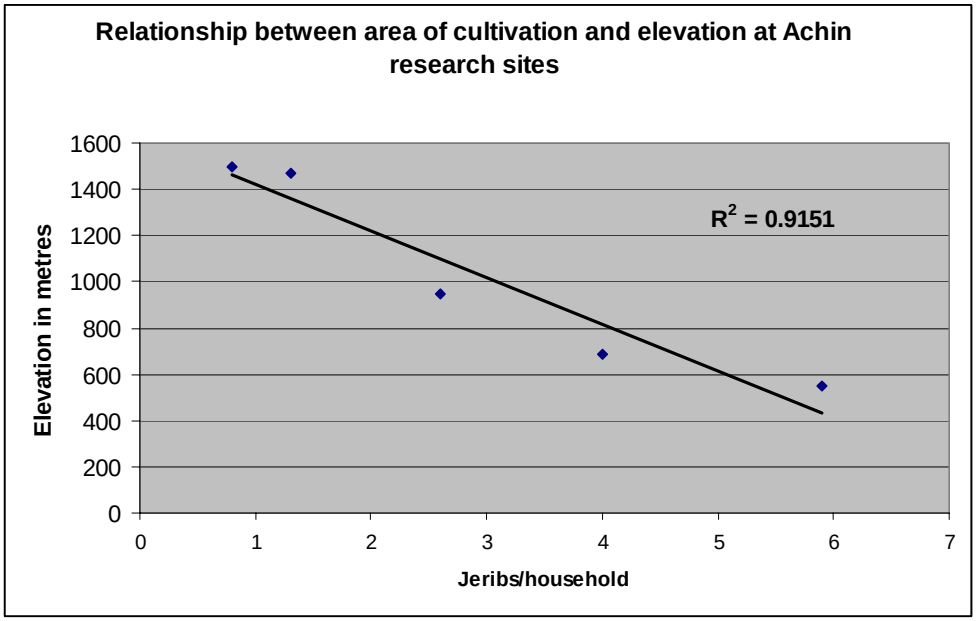
2.4 Opium

Of the provinces selected for this research project, only in Nangarhar is there commercial-scale cultivation of opium poppy. Poppy cultivation was also recorded among the Turkman villages of Qala-i-Zal district, Kunduz province, but this was in small areas for domestic consumption and not supplied to markets.

The baseline survey was undertaken in Nangarhar during October and November 2005, shortly before planting for the 2005—06 poppy season. The data gathered describes the situation in Achin the previous season, during which a ban resulted in major reductions in cultivation throughout the district.

Exploration of data pertaining to these sites reveals a number of pertinent facts. There is an extremely strong negative correlation (r=—0.956) between elevation and household cultivated land area. While this association is initially striking, the extent of cultivation is more likely to be determined by access to water and useable land area at each site (r=0.472).

At the time of the survey, opium poppy cultivation at the Nangarhar research sites ranged from 0—36 percent of cultivated area. The only research site in Nangarhar where no poppy cultivation was recorded was Janikhel, a large canal-irrigated village on the Nangarhar canal in the Kabul River valley. Janikhel has one of the highest values for water sufficiency in the entire baseline survey, with a relatively large cultivated area per household, good crop diversity and high values for household nutrition and assets.



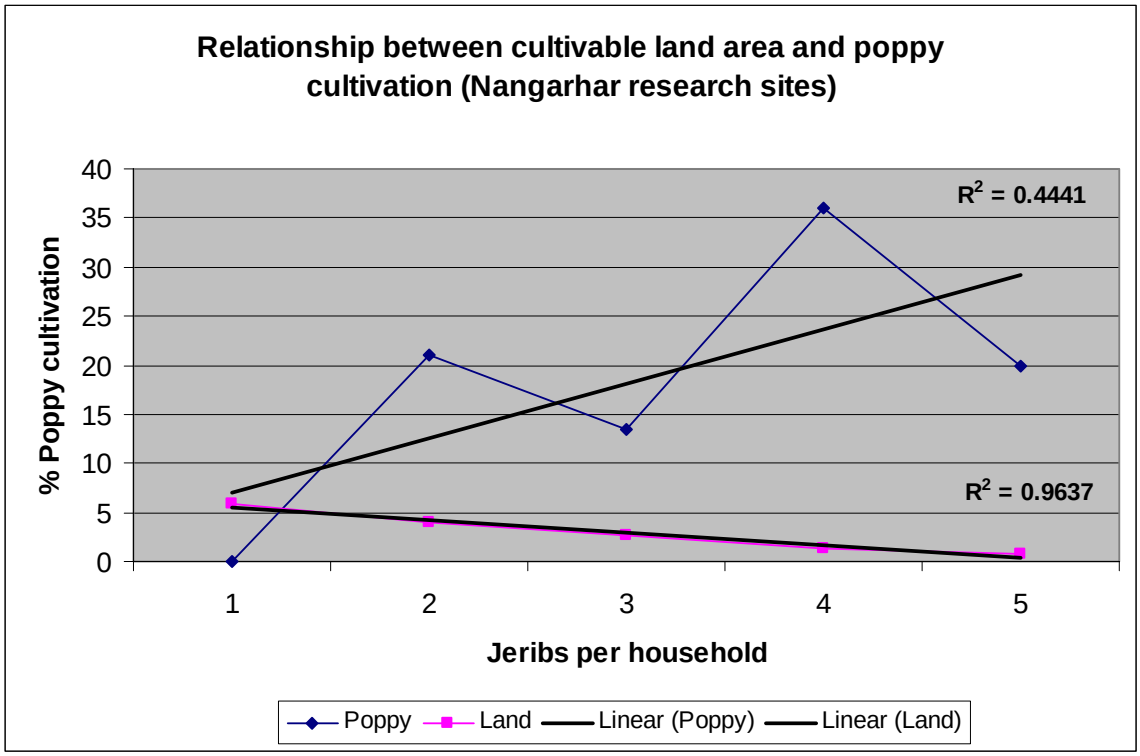
All other research sites in Nangarhar are irrigated by *karez*, springs or streams, and progression up the hillside corresponds with diminishing cultivated areas. Otarkhel, one of the higher villages, has the smallest cultivated area per capita of all the baseline survey sites. Where water is increasingly scarce, crop diversity diminishes (r=0.537). Human diet (linked to crop diversity) and assets, as indicators of disposable income, are also lowest in the upper villages.

Table 7. *Comparison between Nangarhar research sites*

Research site	Water Suff-iciency	*Jerib* per house-hold	Culti-vated land per person	Crop diversity	Poppy (%)	Assets	Nutrition
Janikhel	359	5.9	0.41	9	0	2.5	97
Maruf China	105	4.2	0.31	7	16.6	2.25	91
Sra Qala	162	1.9	0.17	8	13.5	2.9	96
Otarkhel	210	1.15	0.01	6	36	2.1	95
Khawaji	198.5	0.8	0.064	6	20	1.07	89

A strong negative correlation is evident across Nangarhar research sites between mean cultivated land area and poppy cultivation (r=0.759). This is even more pronounced when poppy is plotted against cultivated area per person (r=>–0.8).

The relationship between poppy cultivation and livestock is more complex. There is a very strong inverse relationship between cows and poppy cultivation, perhaps suggesting competition over land resources for fodder production. In contrast, there is a mild correlation between ovicaprid ownership and poppy cultivation, possibly indicating that poppy incomes enable farmers to support these capital growth assets. The data is consistent with reports of widespread sales of small ruminants in response to the loss of poppy incomes.



This evidence seems consistent with the view that poppy cultivation (at the time of the survey) was strongly related to local resource scarcity, and was prevalent among the more socioeconomically vulnerable communities of Nangarhar. In drawing deeper meaning from the baseline data, other factors must be appreciated — most importantly, anecdotal and documentary evidence suggests that major reductions have occurred in poppy cultivation on the upper slopes in Achin district. Therefore, the current distribution of poppy cultivation cannot be considered typical. This must be recognised when relating patterns of poppy cultivation to factors such as household assets and livestock.

A possible hypothesis, which will require future study, is that when the poppy ban was enforced, all but the most resource-poor households moved away from the crop. It may be that the resource poverty currently associated with opium cultivation was not always a feature of the farm system, nor will it necessarily continue to be.

It is also important to recall that progressive resource scarcity moving up the hillside also equates to physical distance from the populated Kabul River valley — and therefore from the attention of enforcement agencies. This may be the one real comparative advantage of remote hillside cultivation.

While poppy cultivation in Achin district is strongly linked with resource scarcity, socioeconomic indicators do not indicate corresponding levels of household vulnerability relative to data from other provinces. This may in part be due to the incomes from poppy cultivation, and the causal aspects of this relationship require further investigation.

2.5 Problems with and limitations of the data

This baseline survey was intended as a preliminary profiling exercise, and its efficacy reflects this. A number of problems and limitations of the data and survey process need to be acknowledged:

- The baseline dataset does not include any production data or evaluation of agricultural inputs or outputs. It simply describes asset conditions and access to resources. As such it is a purely "static" picture of agricultural holdings without reference to how these are actually used.
- There exist clear anomalies in the data which may partly be due to differences in the working styles and strengths of the provincial research teams; the clearest example of this may be the high values for household nutrition collected for Nangarhar. These initial findings collected through the baseline survey need to be tempered by long term longitudinal study. As further team training is given , we can expect the quality of data collecting to standardise between the four field research teams
- The strength of data of the type collected through the baseline survey (and that will continue to be collected through ongoing seasonal monitoring) lies in the extent to which it can be integrated with other more nuanced and exploratory data sets. Even more sophisticated quantitative datasets (such as those to be collected through monitoring) are only useful in that they provide corroborating or comparative material for more inferential studies. The full value of this baseline dataset will only be realised if an effective articulation can be achieved between it and the results of other research undertaken as part of this project. This issue is essentially one of project management, and it is expected that the establishment of the project database (designed to accommodate and integrate all project data), will assist in making the project data easily accessible and comparable.
- The capacity of the baseline data to inform about poppy cultivation and livelihoods is extremely limited, given the lack of comparative scope between areas. Owing to the selection of provinces in the original research proposal, the baseline survey only covers a few villages in Nangarhar where poppy is cultivated commercially. These are also characterised by similar farming systems (with some differences as discussed). Furthermore, as the baseline dataset has demonstrated, the sites in Nangarhar seem to exhibit some unusual values compared to other sites, which also serves to limit the extent to which general conclusions and inferences can be drawn.
- By virtue of its design objectives, this research exercise has been primarily descriptive, identifying relationships as they appear to exist in the dataset. The data collected during the course of this survey cannot adequately explain why these relationships exist, nor establish their causal aspects. This task will be an important element of this project's ongoing research.

3. Conclusions

This baseline survey for AREU's "Water Management, Livestock and the Opium Economy" project was designed as a data-gathering exercise to establish research site profiles, rather than as an analytical exercise to address key research problems. However, given the volume of thematic data gathered, this data provides useful insights into the farming systems under investigation, and it has raised some further important questions.

The research has identified considerable diversity in Afghan farming systems, specifically inequities in the distribution of natural resources, how these resources are used in cultivation and livestock husbandry, and the socioeconomic conditions associated with different systems. As well as highlighting diversity, however, the baseline data also reveals patterns and similarities in the same systems — although at this early stage of research these are advanced with caution.

While the data suggests that some relationships appear to be universal (for example, higher values for supply of irrigation water or rainfall result in increased crop diversity, and crop diversity is in turn associated with household nutrition), other relationships appear to be specific to particular farming systems or natural resource contexts. While none of these relationships or associations are yet understood, it should at least be recognised that interventions in one type of farm system may not necessarily have the same effect as in another.

With the cultivation of illicit crops a major rural development and governance issue in Afghanistan, poppy constitutes a crop of particular significance to this research project. The baseline survey identifies a possible link between natural resources scarcity and the cultivation of poppy (as a high-value, relatively low water-using cash crop). If this hypothesis is found consistent with emerging facts, it would suggest that improvements in natural resources management could play a role in reducing dependency on poppy. This assumption was central to the design of this project, namely that opium cultivation is inextricably linked to natural resources access and other components of farm systems.

While the findings of the baseline survey remain preliminary, they set the agenda for substantive follow-up actions to ascertain their validity. These findings may have already gone some way towards identifying priorities for further research and programming to support vulnerable rural communities.

Appendix: Baseline Survey Data – Village Profiles

Nangarhar: Khawaji (n=13)

Land management	**Mean (*jerib*)**	**Std. dev.**
Cultivated land/person	0.064	
Household land ownership	0.8	0.8
Household worked land	0.8	0.8
Uncultivated land	0.1	0.05
Sharecrop/rent in	0.1	0.46

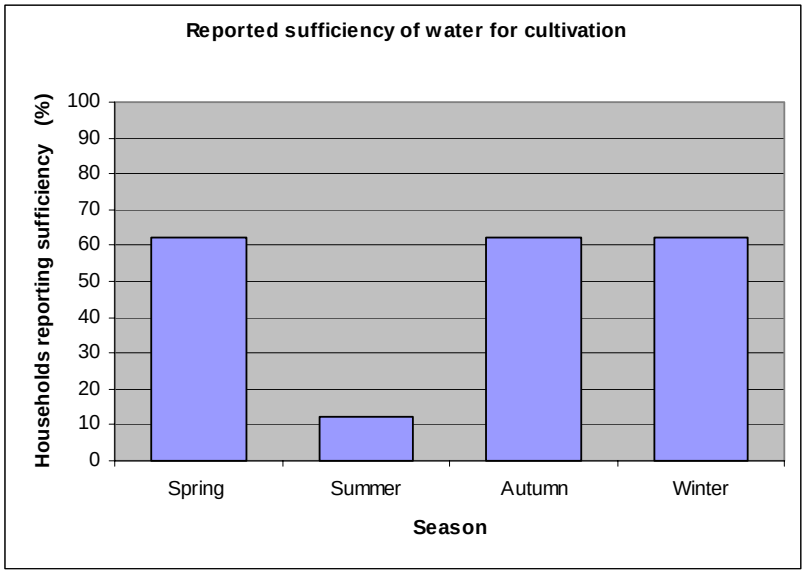
Summer cropping	**Total area**	**% cultivated area (*jerib*)**
Maize	7	70
Fodder	2	20
Vegetables	1	10
Total	*10*	*100*

Winter cropping	**Total area**	**% cultivated area (jerib)**
Wheat	7	70
Poppy	2	20
Fodder	1	10
Total	*10*	*100*

Livestock ownership	**Mean**	**Std. dev.**
Ovicaprids	0.846	0.77
Cattle	0.53	0.745
Donkeys	0.77	0.575

Importance of different ovicaprid feed sources	**Cultivated**	**Range**	**Purchase**
Most	37.5	25	50
Medium	0	62.5	25
Least	62.5	12.5	25

Household socioeconomic indicators	**Mean**	**Std. dev.**
Assets (weighted values)	1.07	0.957
Nutrition (weighted values)	89	14.34
No. off-farm incomes	1.6	0.83
Total value external income ($)	1141	575



Nangarhar: Otarkhel (n=20)

Land management	**Mean (*jerib*)**	**Std. dev.**
Cultivated land/person	0.01	
Household land ownership	1.15	1
Household worked land	1.3	0.965
Uncultivated land	0.1	0.35
Sharecrop/rent in	0.2	0.21

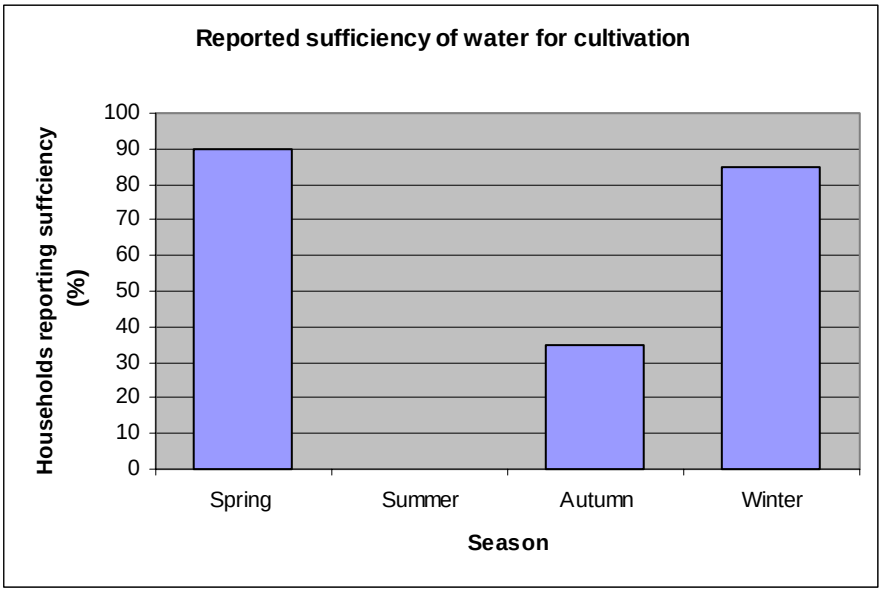
Summer cropping	**Total area**	**% cultivated area (*jerib*)**
Maize	18	83
Vegetables	3	14
Fodder	0.5	3
Total	*21.5*	*100*

Winter cropping	**Total area**	**% cultivated area (jerib)**
Wheat	14.5	56
Poppy	9.5	36
Fodder	2	8
Total	*26*	*100*

Livestock ownership	**Mean**	**Std. dev.**
Ovicaprids	2.9	1.09
Cattle	0.33	0.55
Donkeys	0.8	0.98

Importance of different ovicaprid feed sources	**Cultivated**	**Range**	**Purchase**
Most	66	35	0
Medium	23	47	30
Least	11	18	70

Household socioeconomic indicators	**Mean**	**Std. dev.**
Assets (weighted values)	2.1	2.45
Nutrition (weighted values)	95.1	16.97
No. off-farm incomes	1.1	1.2
Total value external income ($)	725	854



Nangarhar: Janikhel (n=35)

Land management	Mean (*jerib*)	Std. dev.
Cultivated land/person	0.41	
Household land ownership	5.2	8.68
Household worked land	5.9	8.9
Uncultivated land	0.1	0.32
Sharecrop/rent in	0.1	0.276

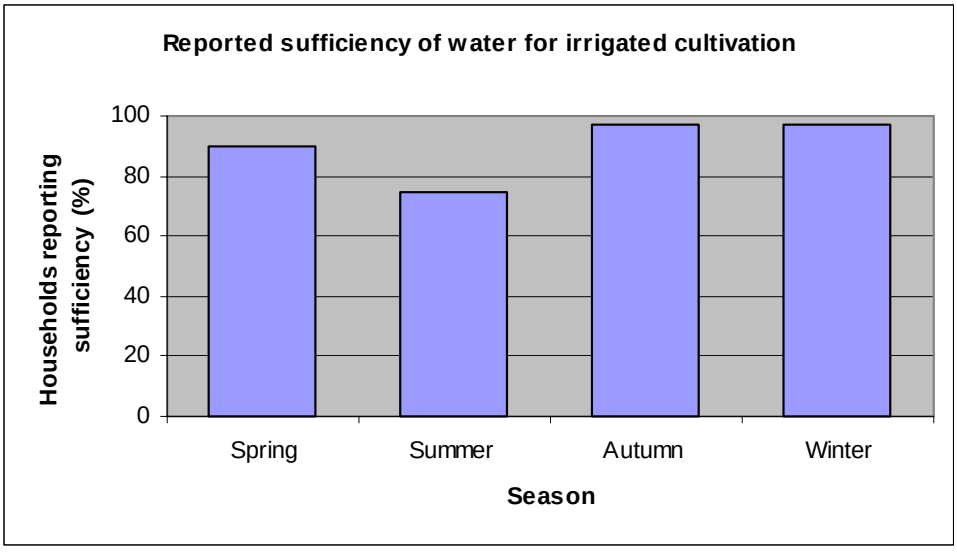
Summer cropping	**Total area**	**% cultivated area (*jerib*)**
Maize	85	58
Cotton	26	18
Maize	85	58
Fodder	26	18
Vegetables	15.5	10
Sugar	4	3
Total	*146.5*	*100*

Winter cropping	**Total area**	**% cultivated area (*jerib*)**
Wheat	204	97
Vegetables	3.5	1.5
Fodder	3.5	1.5
Total	*211*	*100*

Livestock ownership	**Mean**	**Std. dev.**
Ovicaprids	0.19	0.61
Cattle	1.08	1.25
Donkeys	0.5	0.69

Importance of different ovicaprid feed sources	**Cultivated**	**Range**	**Purchase**
Most	50	25	25
Medium	50	0	50
Least	0	75	25

Household socioeconomic indicators	**Mean**	**Std. dev.**
Assets (weighted values)	2.5	2.3
Nutrition (weighted values)	97	10.5
No. off-farm incomes	2.8	1.1
Total value external income ($)	1021	903



Nangarhar: Maruf China (n=22)

Land management	**Mean (*jerib*)**	**Std. dev.**
Cultivated land/person	0.31	
Household land ownership	4.2	2.8
Household worked land	4	4
Uncultivated land	0.9	1.8
Sharecrop/rent in	0.7	1.47

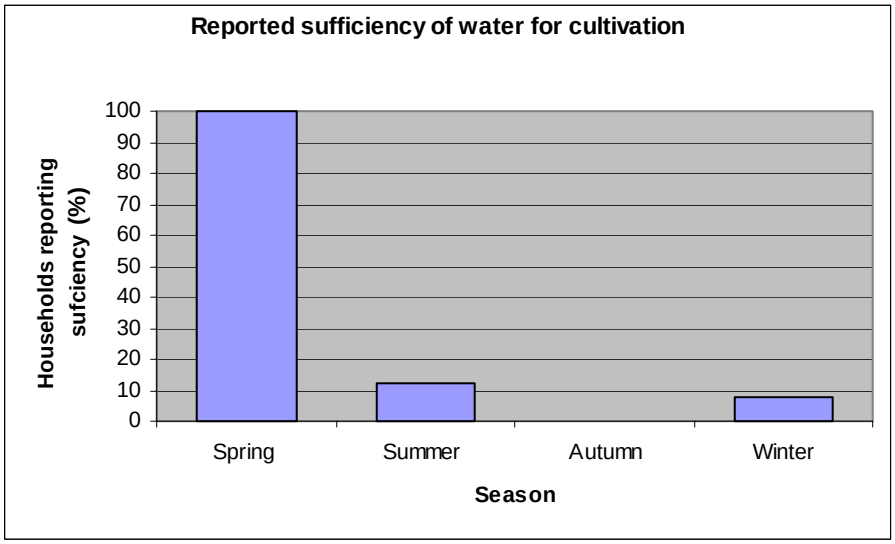
Summer cropping	**Total area**	**% cultivated area (*jerib*)**
Maize	35.5	50
Cotton	28.5	42
Fodder	3.5	5
Vegetables	2	3
Total	*67.5*	*100*

Winter cropping	**Total area**	**% cultivated area (*jerib*)**
Wheat	63	77
Poppy	16.5	21
Fodder	1.5	2
Total	*83*	*100*

Livestock ownership	**Mean**	**Std. dev.**
Ovicaprids	1.8	2.32
Cattle	0.68	1
Donkeys	0.36	0.56

Importance of different ovicaprid feed sources	**Cultivated**	**Range**	**Purchase**
Most	79	21	0
Medium	21	79	0
Least	0	0	100

Household socioeconomic indicators	**Mean**	**Std. dev.**
Assets (weighted values)	2.25	1.8
Nutrition (weighted values)	91	11.43
No. off-farm incomes	1.5	0.65
Total value external income ($)	671	665



Nangarhar: Sra Qala (n=20)

Land management	**Mean (*jerib*)**	**Std. dev.**
Cultivated land/person	0.17	
Household land ownership	1.9	1.35
Household worked land	2.6	1.87
Uncultivated land	0	0
Sharecrop/rent in	0.6	1.44

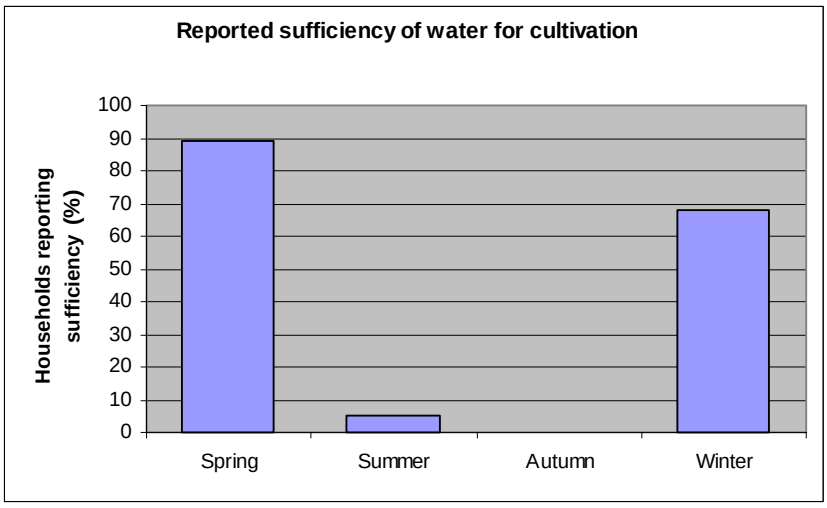
Summer cropping	**Total area**	**% cultivated area (*jerib*)**
Maize	35.5	75
Vegetables	6.5	14
Fodder	4.5	9
Cotton	1	2
Total	*47.5*	*100*

Winter cropping	**Total area**	**% cultivated area (*jerib*)**
Wheat	40	84
Poppy	6.5	13.5
Fodder	1	1.5
Vegetables	0.5	1
Total	*48*	*100*

Livestock ownership	**Mean**	**Std. dev.**
Ovicaprids	0.57	1.75
Cattle	1.09	1.2
Donkeys	0	0

Importance of different ovicaprid feed sources	**Cultivated**	**Range**	**Purchase**
Most	75	25	0
Medium	25	50	25
Least	0	29	71

Household socioeconomic indicators	**Mean**	**Std. dev.**
Assets (weighted values)	2.9	3.19
Nutrition (weighted values)	96	18.12
No. off-farm incomes	3.1	1.01
Total value external income ($)	1031	805



Ghazni: Zala Qala (n=15)

Land management	**Mean (*jerib*)**	**Std. dev.**
Cultivated land/person	0.46	
Household land ownership	8.26	9.04
Household worked land	6.03	6.72
Uncultivated land	2.76	5.62
Sharecrop/rent in	0.533	2.06

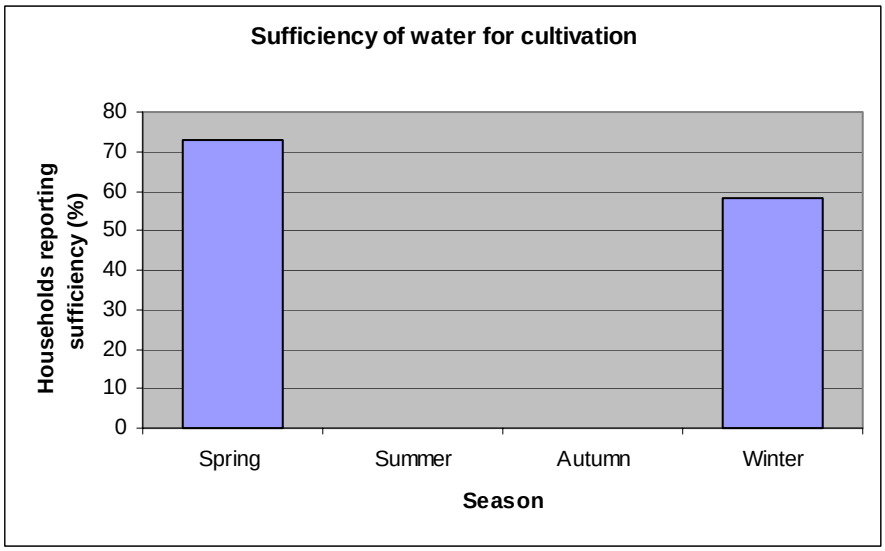
Summer cropping	**Total area**	**% cultivated area (*jerib*)**
Sorghum	55	85.5
Fruit	8.5	13
Vegetables	1	1.5
Total	*64.5*	*100*

Winter cropping	**Total area**	**% cultivated area (*jerib*)**
Wheat	14	58
Vegetables	7.75	32
Fodder	2.25	10
Total	*24*	*100*

Livestock ownership	**Mean**	**Std. dev.**
Ovicaprids	13.53	14.44
Cattle	0.33	0.899
Donkeys	0.071	0.258

Importance of different ovicaprid feed sources	**Cultivated**	**Range**	**Purchase**
Most	40	40	20
Medium	20	60	20
Least	40	0	60

Household socioeconomic indicators	**Mean**	**Std. dev.**
Assets (weighted values)	1.9	2.31
Nutrition (weighted values)	79.86	24.4
No. off-farm incomes	1.53	1.24
Total value external income ($)	1410	2571.54



Ghazni: Turmai (n=19)

Land management	**Mean (*jerib*)**	**Std. dev.**
Cultivated land/person	0.25	
Household land ownership	2.52	3.27
Household worked land	2.45	2.34
Uncultivated land	0.925	2.26
Sharecrop/rent in	0.425	1.042

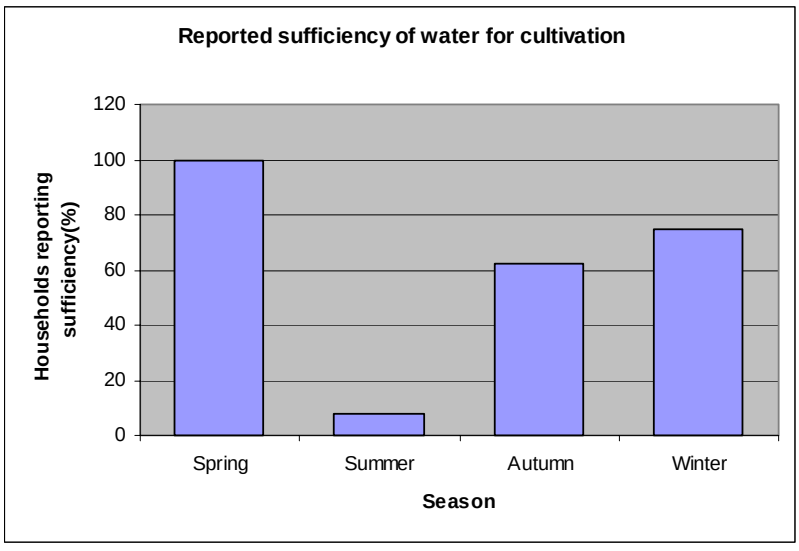
Summer cropping	**Total area**	**% cultivated area (*jerib*)**
Fruits	13.5	63
Rice	3	14
Fodder	4	18.5
Maize	1	4.5
Total	*21.5*	*100*

Winter cropping	**Total area**	**% cultivated area (*jerib*)**
Wheat	25.5	69
Vegetables	8	21.5
Fodder	3.5	9.5
Total	*37*	*100*

Livestock ownership	**Mean**	**Std. dev.**
Ovicaprids	0.7	1.592
Cattle	0.75	1.02
Donkeys	0.15	0.366

Importance of different ovicaprid feed sources	**Cultivated**	**Range**	**Purchase**
Most	50	25	25
Medium	50	50	25
Least	0	25	50

Household socioeconomic indicators	**Mean**	**Std. dev.**
Assets (weighted values)	4.75	2.63
Nutrition (weighted values)	81.05	16.99
No. off-farm incomes	1.75	1.07
Total value external income ($)	1073	1167.95



Ghazni: Chel Gunbad (n=7)

Land management	Mean (*jerib*)	Std. dev.
Cultivated land/person	0.543	
Household land ownership	2.714	2.884
Household worked land	5.357	4.317
Uncultivated land	0.14	0.37
Sharecrop/rent in	2.78	3.95

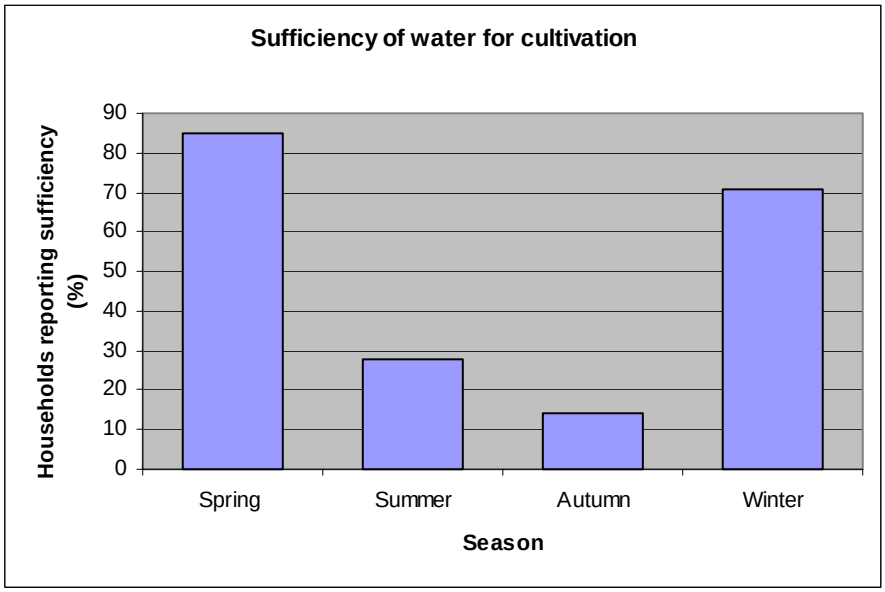
Summer cropping	**Total area**	**% cultivated area (*jerib*)**
Fruits	9	100
Total	*9*	*100*

Winter cropping	**Total area**	**% cultivated area (*jerib*)**
Wheat	10.5	38
Fodder	9.75	35
Vegetables	7.5	27
Total	*27.75*	*100*

Livestock ownership	**Mean**	**Std. dev.**
Ovicaprids	9.85	10.51
Cattle	2	1.73
Donkeys	0.57	0.53

Importance of different ovicaprid feed sources	**Cultivated**	**Range**	**Purchase**
Most	0	16	83
Medium	16	66	16
Least	83	16	0

Household socioeconomic indicators	**Mean**	**Std. dev.**
Assets (weighted values)	3.64	3.23
Nutrition (weighted values)	72.71	11.71
No. off-farm incomes	1.42	0.97
Total value external income ($)	749	629.084



Ghazni: Pyada Rah (n=3)

Land management	Mean (*jerib*)	Std. dev.
Cultivated land/person	0.86	
Household land ownership	13.66	22.81
Household worked land	15.33	14.502
Uncultivated land	8.33	14.43
Sharecrop/rent in	10	17.32

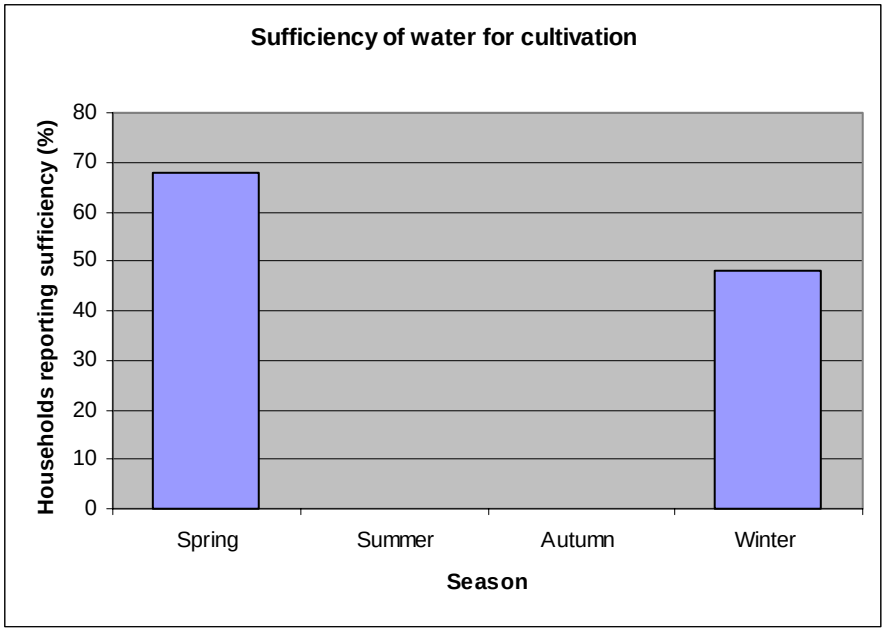
Summer cropping	Total area	% cultivated area (*jerib*)
Vegetables	0.5	100
Total	*0.5*	*100*

Winter cropping	Total area	% cultivated area (*jerib*)
Fodder	5.5	35.5
Wheat	5	32.25
Vegetables	5	32.25
Total	*15.5*	*100*

Livestock ownership	Mean	Std. dev.
Ovicaprids	11	9.64
Cattle	2.33	2.081
Donkeys	1	1

Importance of different ovicaprid feed sources	Cultivated	Range	Purchase
Most	0	0	100
Medium	100	0	0
Least	0	100	0

Household socioeconomic indicators	Mean	Std. dev.
Assets (weighted values)	6.33	4.64
Nutrition (weighted values)	81	13.52
No. off-farm incomes	1.66	1.154
Total value external income ($)	1832	1355.92



Ghazni: Qala-i-Naw (n=55)

Land management	**Mean (*jerib*)**	**Std. dev.**
Cultivated land/person	0.314	
Household land ownership	2.52	4.46
Household worked land	3.58	4.757
Uncultivated land	0.163	0.68
Sharecrop/rent in	1.23	0.678

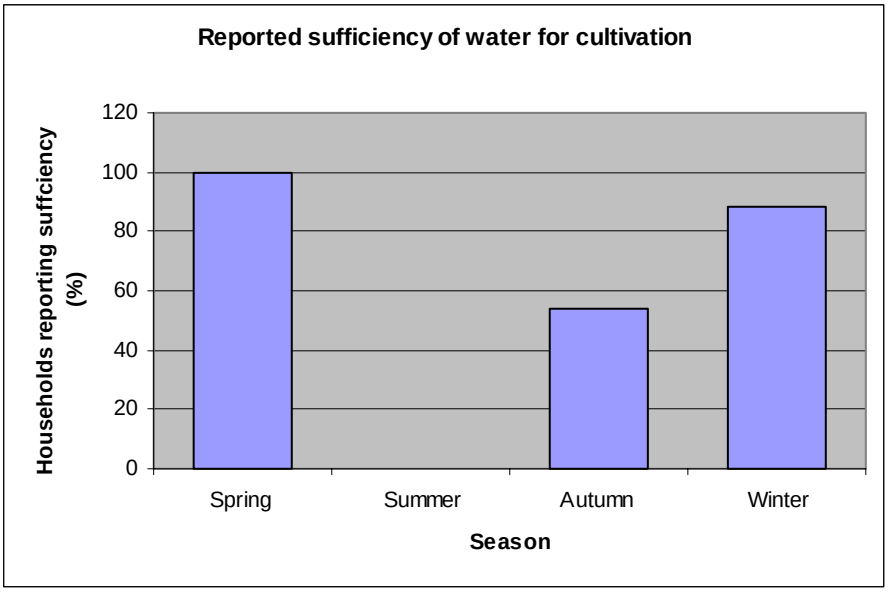
Summer cropping	**Total area**	**% cultivated area (*jerib*)**
Fruits	138.25	98.5
Maize	1	1
Fodder	0.5	0.5
Total	*139.75*	*100*

Winter cropping	**Total area**	**% cultivated area (*jerib*)**
Fodder	42.5	49.5
Vegetables	27	31.5
Wheat	16.5	19
Total	*86*	*100*

Livestock ownership	**Mean**	**Std. dev.**
Ovicaprids	1.07	2.92
Cattle	1.36	1.39
Donkeys	0.127	0.336

Importance of different ovicaprid feed sources	**Cultivated**	**Range**	**Purchase**
Most	58	17	25
Medium	42	42	16
Least	0	42	58

Household socioeconomic indicators	**Mean**	**Std. dev.**
Assets (weighted values)	4.02	2.8
Nutrition (weighted values)	75.14	18.97
No. off-farm incomes	1.85	0.989
Total value external income ($)	1667	1625.43



Herat: Tunyan (n=25)

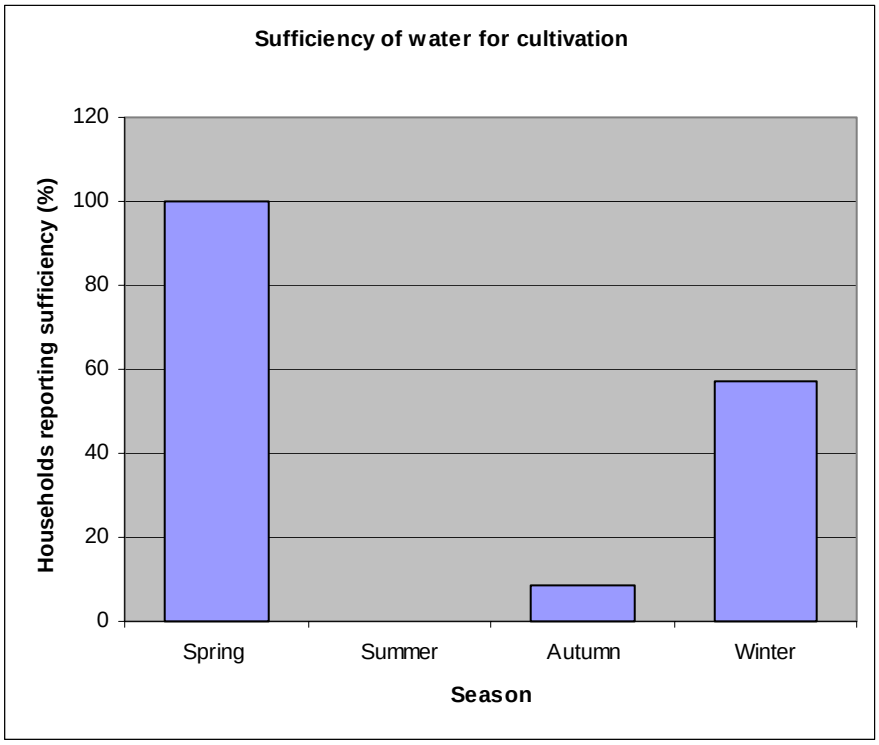
Land management	**Mean (*jerib*)**	**Std. dev.**
Cultivated land/person	0.86	
Household land ownership	11.44	18.15
Household worked land	6.24	8.064
Uncultivated land	5.8	10.59
Sharecrop/rent in	0.6	2.19

Winter cropping	**Total area**	**% cultivated area (*jerib*)**
Wheat	118.5	74
Barley	41.5	25
Total	*160*	*100*

Livestock ownership	**Mean**	**Std. dev.**
Ovicaprids	3	6.52
Cattle	0.8	1.1
Donkeys	0.84	0.687

Importance of different ovicaprid feed sources	**Cultivated**	**Range**	**Purchase**
Most	100	0	0
Medium	0	100	0
Least	0	0	100

Household socioeconomic indicators	**Mean**	**Std. dev.**
Assets (weighted values)	3.78	2.742
Nutrition (weighted values)	65.6	15.209
No. off-farm incomes	1.44	1.083
Total value external income ($)	733.88	565.45



Herat: Gawash (n=20)

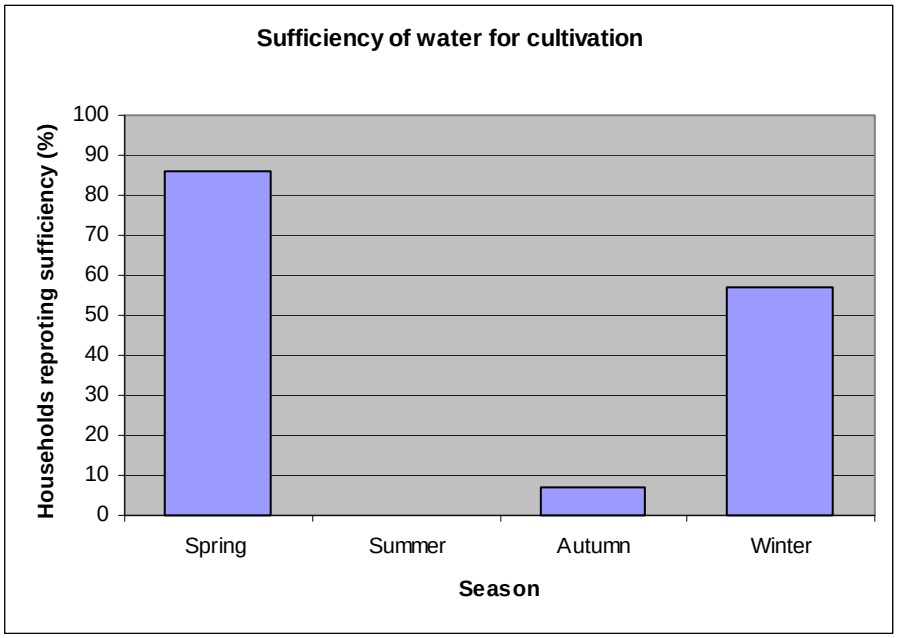
Land management	**Mean (*jerib*)**	**Std. dev.**
Cultivated land/person		
Household land ownership	12.65	24.389
Household worked land	14.95	19.77
Uncultivated land	3.7	8.34
Sharecrop/rent in	5.975	8.03

Winter cropping	**Total area**	**% cultivated area (*jerib*)**
Wheat	203.5	79
Barley	41.35	17
Pulses	7	2
Vegetable	3.15	1.5
Fodder	2	0.5
Total	*257*	*100*

Livestock ownership	**18.6**	**17.56**
Ovicaprids	1.55	1.394
Cattle	1	0.72
Donkeys	18.6	17.56

Importance of different ovicaprid feed sources	**Cultivated**	**Range**	**Purchase**
Most	94	12	0
Medium	6	88	0
Least	0	0	100

Household socioeconomic indicators	**Mean**	**Std. dev.**
Assets (weighted values)	2.75	2.908
Nutrition (weighted values)	48.7	9.9583
No. off-farm incomes	1.55	1.05
Total value external income ($)	396.65	484.32



Herat: Sir Zar (n=20)

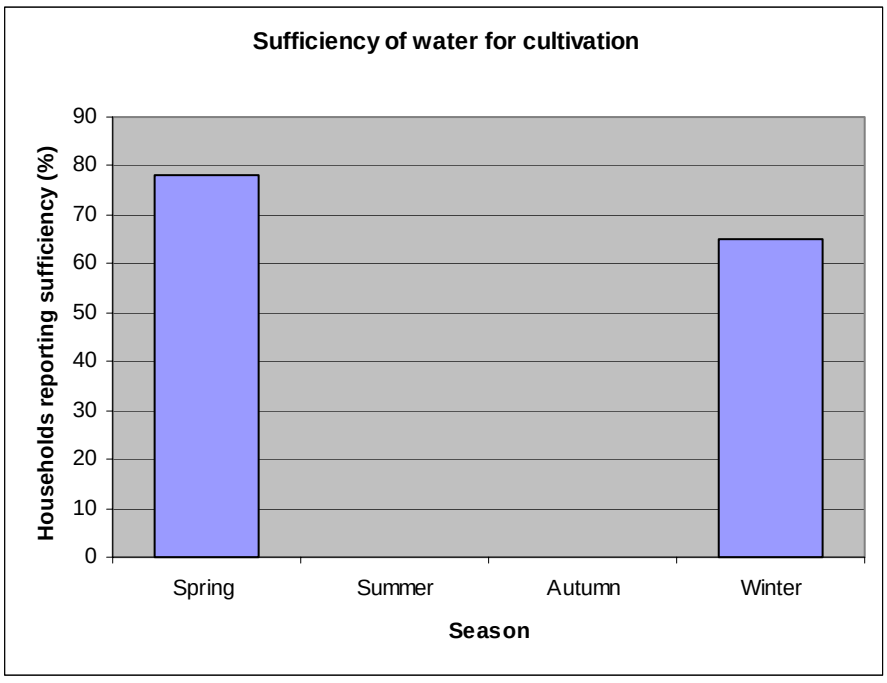
Land management	Mean (*jerib*)	Std. dev.
Cultivated land/person	2.218	
Household land ownership	14	10.94
Household worked land	15.75	10.15
Uncultivated land	0	0
Sharecrop/rent in	1.75	4.94

Winter cropping	Total area	% cultivated area (*jerib*)
Wheat	171	54
Pulses	46	16
Barley	55	17
Vegetables	43	13
Total	315	100

Livestock ownership	Mean	Std. dev.
Ovicaprids	18.85	19.57
Cattle	1.35	1.46
Donkeys	1.5	1.05

Importance of different ovicaprid feed sources	Cultivated	Range	Purchase
Most	83	17	0
Medium	17	83	0
Least	0	0	100

Household socioeconomic indicators	Mean	Std. dev.
Assets (weighted values)	0.725	0.6381
Nutrition (weighted values)	49.25	4.327
No. off-farm incomes	2.4	1.187
Total value external income ($)	659	437.22



Herat: Khalifa Rahmat (n=22)

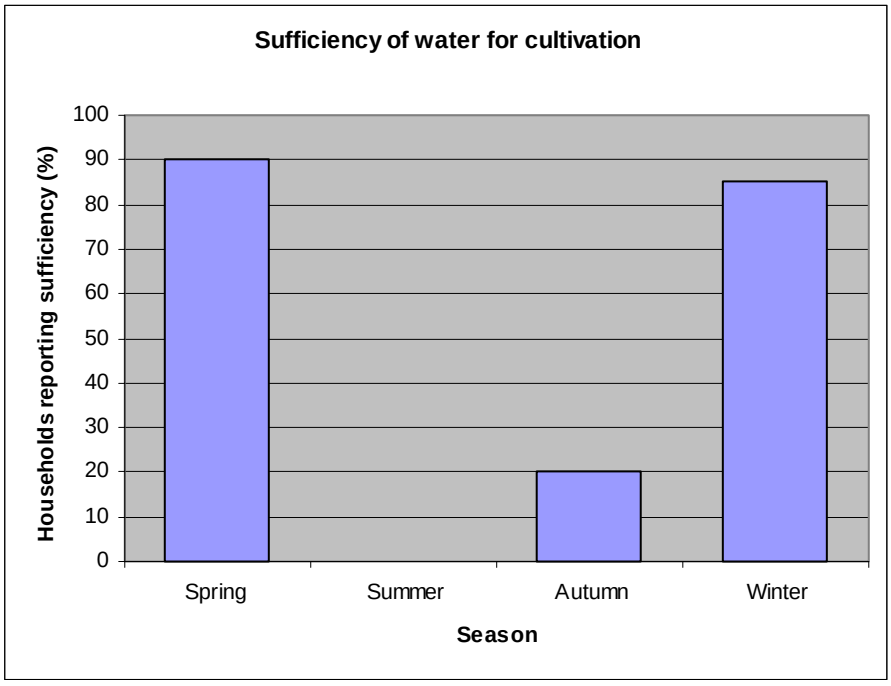
Land management	Mean (*jerib*)	Std. dev.
Cultivated land/person	1.118	
Household land ownership	8.113	8.698
Household worked land	12.47	9.88
Uncultivated land	1.909	7.05
Sharecrop/rent in	2.454	4.8

Winter cropping	**Total area**	**% cultivated area (*jerib*)**
Wheat	171	54
Barley	55	18
Pulses	46	15
Vegetables	43	13
Total	*315*	*100*

Livestock ownership	**Mean**	**Std. dev.**
Ovicaprids	17.27	17.95
Cattle	3.22	3.26
Donkeys	1.95	0.89

Importance of different ovicaprid feed sources	**Cultivated**	**Range**	**Purchase**
Most	68	36	0
Medium	31	63	0
Least	0	0	100

Household socioeconomic indicators	**Mean**	**Std. dev.**
Assets (weighted values)	2.636	5.226
Nutrition (weighted values)	57.27	9.21
No. off-farm incomes	1.727	1.07
Total value external income ($)	476.36	478.43



Herat: Ghorak (n=13)

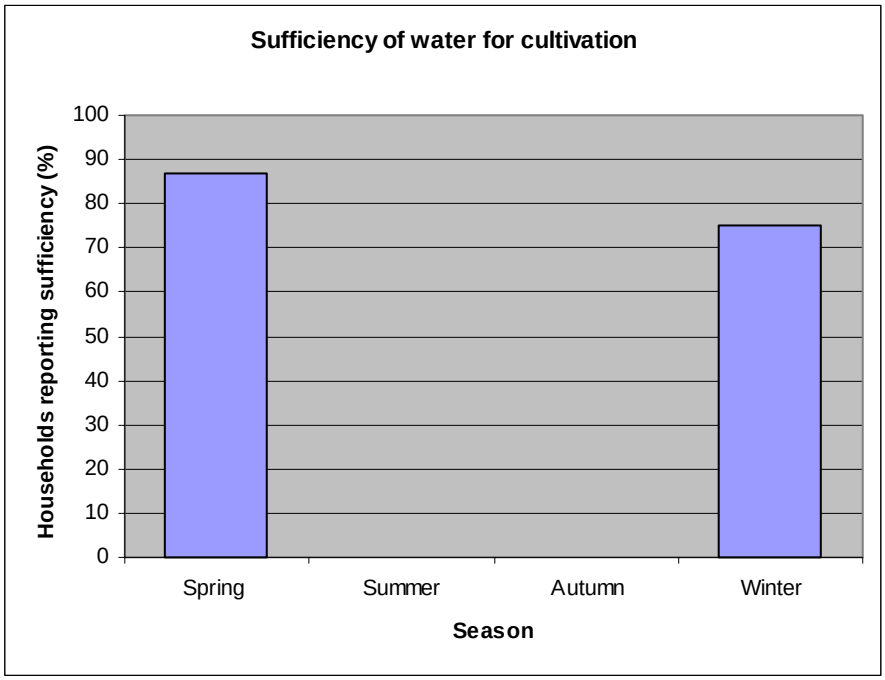
Land management	**Mean (*jerib*)**	**Std. dev.**
Cultivated land/person	0.57	
Household land ownership	6.92	12.45
Household worked land	3.07	3.32
Uncultivated land	4.307	9.595
Sharecrop/rent in	0.461	1.664

Winter cropping	**Total area**	**% cultivated area (*jerib*)**
Wheat	24	61
Barley	11	28
Legumes	3	1
Vegetables	1	0.5
Total	*39*	*100*

Livestock ownership	**Mean**	**Std. dev.**
Ovicaprids	15.23	13.3
Cattle	0	0
Donkeys	0.916	0.816

Importance of different ovicaprid feed sources	**Cultivated**	**Range**	**Purchase**
Most	55	45	0
Medium	45	55	5
Least	0	0	95

Household socioeconomic indicators	**Mean**	**Std. dev.**
Assets (weighted values)	0.961	1.107
Nutrition (weighted values)	48.46	6.88
No. off-farm incomes	2.15	0.8
Total value external income ($)	825.38	400.5



Kunduz: Alam Bai (n=7)

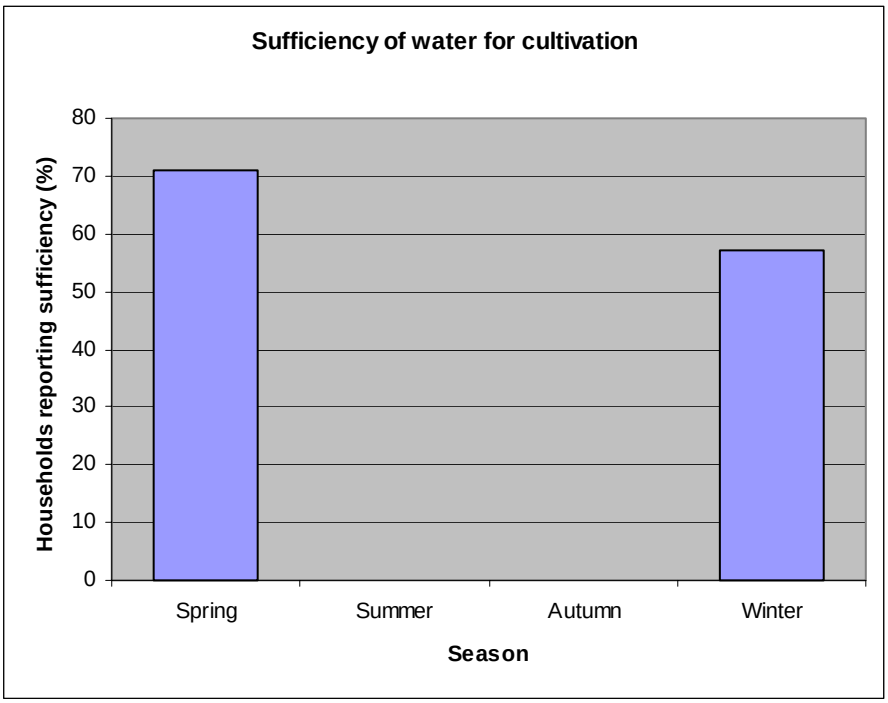
Land management	**Mean (*jerib*)**	**Std. dev.**
Cultivated land/person	2.61	
Household land ownership	15.85	20.35
Household worked land	23.57	27.3
Uncultivated land	0	0
Sharecrop/rent in	7.71	9.05

Winter cropping	**Total area**	**% cultivated area (*jerib*)**
Wheat	91	61
Melons	41	28
Barley	16	11
Total	*148*	*100*

Livestock ownership	**Mean**	**Std. dev.**
Ovicaprids	4.42	3.64
Cattle	2	1.73
Donkeys	1.57	0.53

Importance of different ovicaprid feed sources	**Cultivated**	**Range**	**Purchase**
Most	100	0	0
Medium	0	100	0
Least	0	0	100

Household socioeconomic indicators	**Mean**	**Std. dev.**
Assets (weighted values)	0.64	0.55
Nutrition (weighted values)	91.28	20.7
No. off-farm incomes	0.143	0.377
Total value external income ($)	85.71	226



Kunduz: Afghan Mazar (n=37)

Land management	**Mean (*jerib*)**	**Std. dev.**
Cultivated land/person	0.925	
Household land ownership	11.79	14.58
Household worked land	12.38	13.29
Uncultivated land	0.41	1.81
Sharecrop/rent in	1.01	2.7

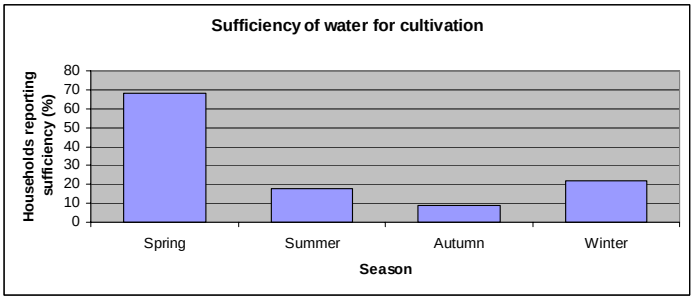
Summer cropping	**Total area**	**% cultivated area (*jerib*)**
Rice	119	29
Oil seed	125	30
Pea	107	27
Cotton	32.5	8
Maize	17.5	4.5
Fodder	2.5	0.5
Fruits	2	0.5
Vegetables	0.5	0.5
Total	*406*	*100*

Winter cropping	**Total area**	**% cultivated area (*jerib*)**
Wheat	329	81.5
Melons	36.5	10
Barley	22	7.5
Vegetables	15.5	0.5
Fodder	10	0.5
Total	*413*	*100*

Livestock ownership	**Mean**	**Std. dev.**
Ovicaprids	2.91	9.72
Cattle	1.86	1.53
Donkeys	0.51	0.69

Importance of different ovicaprid feed sources	**Cultivated**	**Range**	**Purchase**
Most	26	74	0
Medium	74	26	0
Least	0	0	100

Household socioeconomic indicators	**Mean**	**Std. dev.**
Assets (weighted values)	5.24	3.74
Nutrition (weighted values)	77.21	28.46
No. off-farm incomes	2.729	1.677
Total value external income ($)	1814.2	2412.9



Kunduz: Dana Haji (n=11)

Land management	**Mean (*jerib*)**	**Std. dev.**
Cultivated land/person	0.744	
Household land ownership	5.63	4.27
Household worked land	6.63	5.518
Uncultivated land	0.818	2.71
Sharecrop/rent in	1.818	3.156

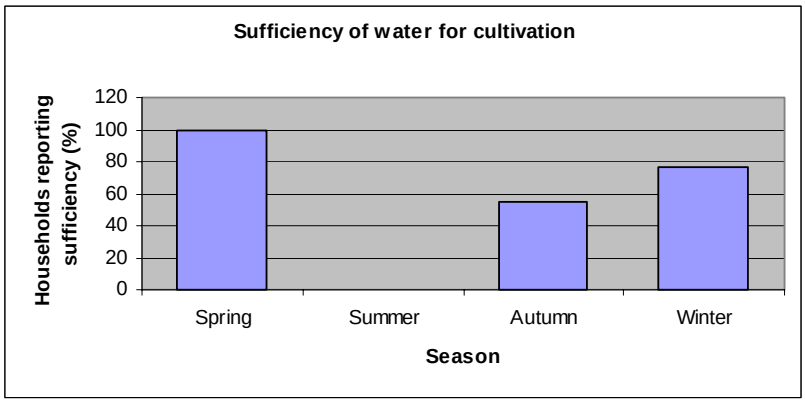
Summer cropping	**Total area**	**% cultivated area (*jerib*)**
Rice	40.5	61.5
Oil seed	8	12
Vegetables	8	12
Cotton	5	8.5
Maize	4	6
Fodder	0.5	0
Total	*66*	*100*

Winter cropping	**Total area**	**% cultivated area (*jerib*)**
Wheat	53.5	88.5
Vegetables	3	5
Fodder	2	3.5
Barley	1	1.5
Melon	1	1.5
Total	*60.5*	*100*

Livestock ownership	**Mean**	**Std. dev.**
Ovicaprids	1.81	1.66
Cattle	2.45	1.69
Donkeys	0.27	0.46

Importance of different ovicaprid feed sources	**Cultivated**	**Range**	**Purchase**
Most	75	25	0
Medium	25	75	0
Least	0	0	100

Household socioeconomic indicators	**Mean**	**Std. dev.**
Assets (weighted values)	2.77	1.915
Nutrition (weighted values)	75.45	20.43
No. off-farm incomes	2.181	0.98
Total value external income ($)	809.81	564.4



Kunduz: Abdul Nazar (n=9)

Land management	**Mean (*jerib*)**	**Std. dev.**
Cultivated land/person	2.79	
Household land ownership	17.66	11.68
Household worked land	30.77	18.71
Uncultivated land	0	0
Sharecrop/rent in	13.11	14.77

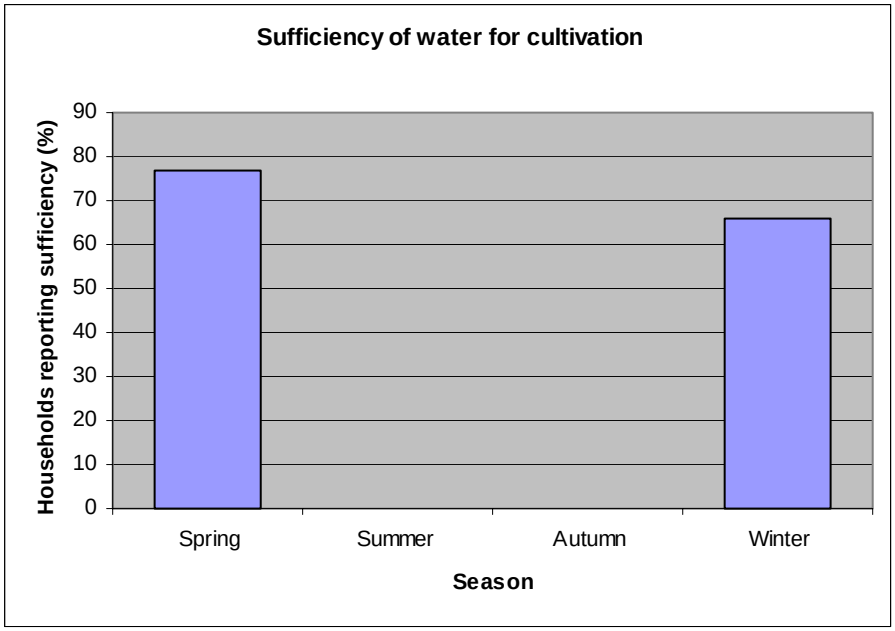
Summer cropping	**Total area**	**% cultivated area (*jerib*)**
Oil seed	20	100
Total	20	100

Winter cropping	**Total area**	**% cultivated area (*jerib*)**
Wheat	148	64.5
Melon	21.5	9.5
Barley	59.5	26
Total	*229*	*100*

Livestock ownership	**Mean**	**Std. dev.**
Ovicaprids	5	6.5
Cattle	2.66	1.5
Donkeys	2	0.7

Importance of different ovicaprid feed sources	**Cultivated**	**Range**	**Purchase**
Most	100	0	0
Medium	0	100	0
Least	0	0	100

Household socioeconomic indicators	**Mean**	**Std. dev.**
Assets (weighted values)	2.66	1.19
Nutrition (weighted values)	72.66	13.72
No. off-farm incomes	0.555	0.882
Total value external income ($)	453	802



Kunduz: Wakil Jangal (n=41)

Land management	**Mean (*jerib*)**	**Std. dev.**
Cultivated land/person	1.48	
Household land ownership	13.21	12.81
Household worked land	17.62	14.33
Uncultivated land	0.17	1.09
Sharecrop/rent in	4.57	8.52

Summer cropping	**Total area**	**% cultivated area (*jerib*)**
Oil seed	152	35
Pea	116.5	25.5
Cotton	74.5	18
Corn	73.5	17
Fodder	9.5	2
Vegetables	9	2
Rice	3.5	0.5
Total	*438.5*	*100*

Winter cropping	**Total area**	**% cultivated area (*jerib*)**
Wheat	449.5	76
Melons	54.5	9
Barley	52	9
Vegetables	23.5	4
Fodder	9.5	1.5
Poppy	1	0.5
Total	590	100

Livestock ownership	**Mean**	**Std. dev.**
Ovicaprids	4.17	9.3
Cattle	3.26	1.78
Donkeys	0.8	0.744

Importance of different ovicaprid feed sources	**Cultivated**	**Range**	**Purchase**
Most	22	61	5
Medium	77	22	0
Least	0	16	83

Household socioeconomic indicators	**Mean**	**Std. dev.**
Assets (weighted values)	2.768	2.32
Nutrition (weighted values)	91.41	24.88
No. off-farm incomes	1.073	1.23
Total value external income ($)	979.09	1817.6