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Annex 1. Description of project sites

Sogd Province, Tajikstan

Angora goat production in Tajikistan: decline of cooperative farms and emergence of private farms

There are approximately 200,000 Angora goats in Northern Tajikistan, produced by households (approx. 38%), private farmers (approx. 42%) and by the cooperatives (approx. 20%). Each of the three institutions represents a unique production system. The cooperatives were established on the basis of state farms and are involved in different types of agricultural production including cotton, grains and also livestock. They are operated by local bureaucrats and farm managers many of whom worked for the state farms during Soviet or early post-Soviet period. This group of officials and managers wants to retain control over assets inherited from the state farm system (land, livestock, technology, labor). Managing the so-called cooperatives gives them the opportunity to maintain control, extract rent and continue agricultural production at some level. The cooperatives also offer some employment to the rural population that has no resources to engage in private farming.

Regarding Angora goat production, the cooperatives still own the largest flocks of purebred Angora goats about 2,000-8,000 heads. They continue to follow Soviet-style breeding technology including production of breeding bucks, yearly evaluation of the entire breeding flock, tagging and registration of breeding animals and artificial insemination. They also sort and bail mohair after shearing according to the old Soviet classing system. By following the Soviet practices, the cooperatives contribute to preserving purebred Angora goat production in Tajikistan. However, they clearly are transitional organizations that suffer from diffuse property rights, poor market incentives, unstable management and frequent predation on their assets. As a result their assets are gradually dwindling – their land is being privatized, their livestock is being sold or bartered, their Soviet technology is not being replaced, and their number of workers is decreasing each year. The majority of cooperatives will eventually be dissolved or privatized which means that the future of Angora goat production depends on private producers.

The gradual dissolution of large Angora goat flocks owned by the cooperatives is paralleled by the emergence of private Angora goat farmers. Most of the private farmers originally worked as shepherds for the state farms and many continue to work for the cooperatives. They own Angora goats and graze them together with the cooperative goats. Although most of them would prefer to work independently, they rely on the cooperatives for access to rangelands, which is a key resource needed for goat production. The largest proportion of rangeland is still owned by the cooperatives and its privatization is an extremely complicated process that requires high bribes or personal ties to the authorities. As a result, most private farmers have only “unofficial” or “informal” access to rangelands and sheep pens, which is often tied to their former or current affiliation with the cooperatives. In order to secure their future in goat farming, the farmers will need to formalize their right of access to rangelands and set up a system of range management.

The flocks of private farmers are currently much smaller than those owned by the cooperative farms: between 100 to 600 animals or even smaller.

Farmer Suiumboi uses rangelands without formal rights to the land, Taboshar, April 2010

The final and most numerous group of Angora goat producers are households that own 5 - 20 Angora goats each. Households give their animals to farmers to graze and pay them per head or graze their goats around the village in a communal flock. Household producers generally do not follow any breeding strategy and have the fewest resources invested in Angora goat production. Due to an unorganized breeding of different types of goats in village flocks, it is likely that the number of Angora crosses will keep increasing and eventually purebred Angoras will be rare or nonexistent in household flocks.

Household flocks of Angora goats include a large percentage of crossbred animals, Takeli village, October 2009

Opportunities and challenges for private Angora goat producers

The cooperative farms do not have a long-term future in Angora goat production and village households lack the capacity to produce purebred Angoras in community flocks where breeding happens randomly. Therefore, the future of Angora goat production in Tajikistan depends on effective development of private Angora goat farms. Whether private farmers develop competitive Angora goat production depends on their incentives to invest in producing quality Angora goats versus other livestock such as sheep or meat goats. Farmers' capacities and incentives to raise Angoras will be shaped by governmental policies and changes in mohair markets. Governmental policies that affect Angora goat breeders include legislation on rangelands and development of extension services for Angora goat producers, specifically support in breeding and improved access to breeding animals and know-how. Secondly, farmers' decisions will be influenced by changes in mohair prices and markets. Such changes can also be shaped by governmental policies. For example, governmental support of mohair exporters or local processors can influence mohair prices and stimulate farmers' interest in mohair production.

Based on the research conducted by the project, Tajik farmers who have access to rangelands and experience in producing Angora goats are well positioned to profit from producing quality goats and mohair – they have cheap land to graze their goats all year (albeit their land tenure still need to be formalized), access to cheap family labor and relatively easy access to local mohair markets. The Tajik Angora goats are well adapted to the local conditions and mohair production is profitable. If the local mohair market is vibrant, farmers can earn US$ 10 per goat just in mohair sales. For example, in the fall of 2010 a farmer who had 100 quality goats could earn US$ 6.7 per 1 kg of mohair. Given that each goat produces about 1.5 kg of mohair, 100 goats yielded around US$ 1,000 in revenue, which is a substantial income for a Tajik rural family. Even during a stagnant mohair market, 100 goats can bring about US$ 500 from mohair. At the same time the production cost of Angora goats is minimal. The project calculated that one goat costs about US$ 18.50 to produce. The goat gives not only US$ 10 in mohair, but also a kid that is worth at the minimum US$ 15 in the fall, and milk (for 3 months) that is worth US$ 4 = US$ 29 total. Based on estimates by some producers, the profit from one Angora goat is about US$ 10, which confirms the project calculations.

Farmer with quality Angora goats makes about US$ 10 profit from each goat, Asht region, 2010

Although Angora goat production is profitable, there are several obstacles that need to be resolved to develop favorable and sustainable conditions for private producers. Firstly, **access to rangelands** is available only to some farmers and even in those cases their legal right to rangelands is uncertain. Governmental assistance is necessary to secure farmers' rights to rangelands. Secondly, the government needs to develop a reasonable framework regarding range management and taxation of land and livestock. This is challenging given the interest in collecting rents and lack of accountability of governmental officials.

Even after securing access to rangelands, a farmer may choose to produce local crossbred goats to be used for meat production as opposed to Angora goats that are bred primarily for fiber. Although "meat goats" or "Jaidaras" bring much less or no income from fiber and only about 20% higher income from meat (while Angora goats bring income from fiber for 5-6 years and income from meat when slaughtered), Jaidara goats do not require careful breeding and selection for fiber production. Every crossbred goat regardless of its productivity is considered a "local meat goat" and the production of such goats is easier and cheaper especially in terms of time invested in breeding. A producer of "Jaidara" goats can essentially produce crossbred goats without selection. Production of Angora goats requires selection and preparation of breeding bucks and careful management of the entire flock based on multiple criteria. This is more demanding in terms of time and effort and requires not only a level of care and dedication on the part of the farmer, but also professional assistance in the form of extension support.

All countries with developed mohair production provide good extension services and mohair marketing support to producers. South African, American or Australian producers are organized into associations and have access to a sector-wide support system that includes extension, breeding and marketing services. Tajik farmers, with the exception of those who collaborate with the IFAD/ICARDA project, receive no such support. They are isolated, unorganized and uniformed about global markets and effective production practices. They rely on their individual knowledge and experience but most of them do not receive any assistance from researchers, extension specialists, policy-makers and market experts. Although most farmers do have a good knowledge of basic animal husbandry, they do not have scientific knowledge of breeding principles and often have little experience in selecting breeding animals. This is because Angora goat breeding (just as breeding of all other "Soviet" livestock) was the responsibility of state-funded Livestock Institutes and state breeding farms. Currently the state farms (or their descendants the cooperatives) are in decline and Livestock Institutes continue to operate with very limited funding. The Institute scientists are only learning how to work with private producers and private producers are only beginning to understand that they need professional assistance to improve breeding and livestock productivity.

Given that the Tajik government has little experience in developing institutions and services for private producers, assistance of research for development organizations such as ICARDA is essential in building up extension support for the newly emerging private farmers. In the current project ICARDA collaborates with Angora goat breeding scientists and private Angora goat producers to develop a breeding program that can preserve and improve Angora goat production in Tajikistan. Without such support Tajik farmers would not succeed in breeding quality Angora goats and the opportunity to earn revenues from mohair export and processing would be lost, together with the Tajik Angora goat breed.

The IFAD/ICARDA project supports Angora goat scientists Dr. Matazim Kosimov and Farhod Kosimov in their work with private farmers, October 2009

A breeding program that leads to improvements in fiber quality can also help to expand the market for Tajik mohair. Currently, farmers have a limited access to mohair markets because Tajikistan is an isolated country poorly linked to global fiber trade. It mostly relies on regional markets (Russia and Uzbekistan) and on linkages with Turkey and China. The attractiveness of Tajik mohair is primarily its low price and high yield as opposed to high quality. Most Tajik mohair is sold to Russia and more recently to Turkey, and either processed into low price, utility knitwear or used to blend with other fibers. There is no good market for fine, kemp-free, mohair which is highly valued on the global market. A breeding program that improves fiber quality combined with efforts to link Tajik producers with a broader group of foreign buyers can lead to increased prices and revenues. The IFAD/ICARDA project works on improving goats and mohair quality as well as market linkages for producers. The following section outlines project activities in these areas.

Gorno-Badakhshan Province, Tajikistan

The overall population in the eight villages of the Askar Zamirov Dzhamoat is 2572 persons and 334 households. The villages are located around 40-65 km from Khorog in the mountains, along the road to Ishkashim, at approximately 2,500 - 3,000 meters above sea level. The annual precipitation in the area is only about 100 mm, primarily in the form of snow in winter. The village households practice subsistence livestock and crop production. They produce grains (wheat and barley), potatoes, beans, fruits (apples, pears, apricots) and vegetables (tomatoes, cucumbers, carrots, cabbage, onions, and peppers) primarily for family consumption. The amount of arable land in the dzhamoat is 133 hectares - only 0.05 hectares per person or 0.4 per household. Each family raises several goats and sheep (10-12 on average), 1-3 cows and poultry (primarily chicken). The maximum number of sheep and goats raised by a single household is 30, the smallest number is 5. The dzhamoat has 722 ha rangelands that are commonly owned.

Agricultural and livestock production in the area is constrained by the small amount of arable land and pastureland and by the relatively short growing season. Some villages located on the higher

mountain plateaus have poor access to water sources. The pressure on the scarce land resources suitable for livestock and crop production is very high and most families cannot produce enough food to ensure balanced nutrition. Only a small share of agricultural production is sold on local markets; most products are produced only for family consumption.

The economic challenges faced by the residents of the dzhamoat (and of Badakhshan in general) are exacerbated by the geographical isolation of the region and the lack of roads suitable for civil and commercial transport. The region is linked with Dushanbe by two mostly unpaved roads that are passable only by terrain vehicles. Only one road is usable in the winter period.

Livelihoods

The key source of income for the village households are remittances. Just about every household has one or two members who work in Russia for several years and send money home. They send approximately $100-150 per month especially during the spring, summer and fall season. In winter there is less work in construction and agriculture and less or no money to send. The $100-150 in remittances has to support a family of 7 or more persons and is often the only source of family income. The migrant workers are primarily men of working age (only about 1/6 are women). Younger men also leave their villages for the army and to study or work in Dushanbe or abroad. This means that the permanent village occupants who do the majority of work in agriculture and livestock production are primarily women, older men and children.

History of Cashmere Production

During the Soviet period, the 8 pilot villages were part of the "Badakhshan" kolkhoz which was formed in the 1930s. The kolkhoz was focused on livestock and crop production and started working on the development of cashmere goats in 1985. The objective was to develop a white Pamir cashmere goat by using Angora goats imported from northern Tajikistan, and the Gorno Altai cashmere goats imported from the Altai region of Russia. The Angora goats were used primarily to get the white color as the Altai cashmere goats are colored. The scientists who worked on this project brought over several hundred heads of each breed. All the animals had breeding certificates. (Unfortunately the certificates are no longer available – they were used up when there was no writing paper available in the governmental offices after the war.) Our team plans to conduct further research to identify the immediate origin of the imported Altai goats.

The goats were distributed to the state farms in each of the villages. The cashmere the goats produced was combed by women and sold to Orenburg (in Russia) where it was used to make the world-famous "Orenburg shawls" that sell for $200 and more. By 1991-1992 there were 4,500 of the new cashmere goats in the kolkhoz. Women who participated in combing the goats told us that the goats produced on average 500 grams of cashmere and some of the males produced as much as 1kg. Based on our discussions with shepherds who worked with these goats, the Altai goats adapted very well to the local conditions but the Angoras did not – they required additional feeding to do well. The Altai goats were large and good meat as well as cashmere producers – this corresponds to the descriptions of the Gorno Altai cashmere goat published by other sources. The shepherds claimed that the imported goats were even better "mountain climbers" than their local goats. Overall, the shepherds gave the Altai breed very high marks. They claimed that the kolkhoz became profitable mainly due to the cashmere production.

After the breakdown of the Soviet Union and the start of the civil war in Tajikistan the market linkages with Russia were broken and the kolkhoz lost its market for cashmere. In 1997 the kolkhoz was dissolved (to the disappointment of most of the shepherds) and the goats were divided between households. The households sold some of the cashmere goats to Afghanistan and from there the goats were supposedly sold to Pakistan. The remaining goats were bred to local meat goats.

Current Goat Production

According to governmental statistics, there are 3,786 goats and 2,524 sheep in the dzhamoat. Based on this data, the 334 households have on average 11 goats and 7 sheep each. (We plan to check on this statistics, it is possible that the actual numbers are smaller – the dzhamoats have an incentive to show larger numbers of animals to simulate growth.)

The visual assessment of the village flocks and sample collection show that the goat population in the villages is very diverse – there are various crosses of the cashmere and Angora goats as well as different types of native meat goats. Most of the goats produce many different types and volumes of cashmere. Clearly, the crosses of the Altai goats produce the largest volume of cashmere – 300 – 500 grams. Their cashmere is thick, long but not exceptionally fine (about 16-17 micron). Some villages have as many as 30% of the Altai crosses (these villages originally had a greater number of the Altai goats) but other villages have only 20% or less. The local meat goats represent about 60-70% of the flock and we estimate that they produce about 50 – 200g of fine cashmere. The volume and style of cashmere among the native goats seems highly variable – we will provide a detailed assessment after we examine the samples.

In addition there are about 10-20% of Angora/Cashmere crosses (again, some villages have more of those than others). The "Cashgoras" produce a blend of guard hair, kemp, mohair and cashmere fibers. Some Cashgoras might be fine enough for our spinning purposes if combed and cleaned. Given the distribution of these different types of animals, we can make a rough estimate that the households could comb on average 170-200 grams of cashmere per goat. Women experienced in combing goats confirmed this estimate. If we use the lower estimate of 170g of cashmere per goat, theoretically the 3,786 goats could produce about 640kg of raw cashmere. Even if the women collect only 100-50kg of cashmere in the spring, it will be enough to start our spinning activity.

In addition to the Askar Zamirov Dzhamoat, the cashmere goats were also produced in the Kozede Dzhamoat (on the road to Iskhasim) – the kolkhoz "Badachshan" had farms in these two Dzhamoats. There are also 8 villages in the Kozede Dzhamoat that have flocks with a large percentage of cashmere crosses (30% or more). We collected samples from one of the flocks in this area. Project resources permitting, we plan to start working in this area as well. Provided that the distribution of cashmere goats is similar to the Askar Zamirov Dzhamoat, additional 640kg of cashmere could be collected in this region.

As noted earlier, the cashmere produced by the large variety of cashmere, angora and native meat goat crosses is very diverse. Such diversity would present a challenge for commercial processors who require a specific fiber standard. However, we do not expect that this diversity will negatively affect handspun yarn production – we can blend the different types of cashmere and make a very nice yarn, after conducting spinning and knitting tests of individual fleeces.

Animal Husbandry

Based on the governmental statistics, each household has about 11 goats, 7 sheep and 1-3 cows. The households graze their goats and sheep together on common pastures. All households that have animals in the communal flock take turns grazing. The grazing period is from March - April to mid December. At the end of December the animals are stalled until March - April and fed until the end of April. The fully stalled period usually lasts for four months. The animals are fed mostly hay. Those families that can afford it feed them concentrated feed as well. From July to the end of September the animals are grazed on summer mountain pastures. The villagers hire a shepherd who stays with the flock in the mountains and pay him 2-3 somoni per month per animal.

As mentioned earlier, the households do not practice any breeding selection (this was confirmed by all respondents). Most males are castrated before they go to the mountain pastures, primarily because many shepherds refuse to take the non-castrated animals. The males that are left to breed are not selected on any basis and most of them do not exhibit any superior qualities. In many cases the non-

castrated males we saw breeding were only 8 months old. There are no Altai bucks or crosses left for breeding. One farmer who worked with the Altai goats in the past told us that he had to slaughter the last "purebred" Altai male a year ago because he was too old.

The lack of investment in breeding symbolized the "tragedy of the commons" - given that all village animals graze together during the breeding season, it makes no sense for a single family to invest in producing superior breeding males unless other families do the same or at least agree to castrate all inferior males. Therefore, development of a breeding system at the community level is essential for improving the overall productivity of the village flocks.

Current Cashmere Market

In spite of the fact that the households produce goats without selection, the cashmere these goats produce has some value – each year traders from Kyrgyzstan come to the villages to buy all the goat fleeces (which are shorn in April) for 5-8 somoni/kg – about 1.5-2USD. The traders stay in the area for one month and buy all fleeces for a single price, without sorting, and take them to Osh, Kyrgyzstan. We suspect that they take the fleeces to the cashmere-dehairing plant that was recently set up in Osh, dehair it and resell it.

None of the goats are currently combed as there is no market for combed cashmere. Some families still have cashmere combs that were used during the area of the kolkhoz. Being resourceful, the women have been using the combs to dig up potatoes and the combs are no longer suitable for cashmere harvesting. Most importantly, however, the skills in cashmere harvesting have not been lost – especially the older women have a long practice in combing goats and can train other.

The Economics of Value-Added Cashmere Processing

Unlike other projects that focus primarily on improving cashmere for commercial processing, our project seeks to improve local cashmere specifically for small-scale, manual processing into handspun yarn and knitwear. This will allow the producers - poor rural women who lack other sources of income – to obtain much higher earnings than by selling the finest raw cashmere available. Handspun cashmere yarn sells for $40/per 200yards (about 75 grams) in yarn stores in the US and is coveted by knitters who use it to make luxury shawls, sweaters and other clothing. These types of products can be made and sold by the Pamiri women who are excellent spinners and knitters.

Based on the study of McGregor, Kerven and Toigonbaev (2009) the clean yield of 1kg of combed Kyrgyz cashmere was 66%. Assuming that the Tajik cashmere would have a similar yield, we expect that 1kg of combed cashmere could be processed into 660 grams of clean cashmere and into 600 grams of yarn. The yarn could be used to make (at the minimum) 4 scarves, 150 grams each, that could sell for $120 - $300 in the US or Europe, depending on the product quality and the market. If the scarves sold for the lowest estimated retail price of $120, the wholesale price would be $60. Depending on the cost of shipping, taxes, tariffs and other marketing expenses, the women could earn at least $30-40 per scarf - the project will guarantee fair trade wages for the women and will assist them to obtain a Fair Trade certificate for their products.

Based on our experiences with mohair processing in northern Tajikistan, an experienced knitter can make a 2 meters long scarf in 4-5 days while performing her regular housework. It takes about 7 days to make 1 kg (or 3,750 meters) of yarn under the same conditions, using a wooden spinning wheel. Based on these estimates, a woman could earn at the very minimum $120 by processing 1kg of combed cashmere into 600 grams of yarn and 4 shawls in one month. Such earnings would nearly equal to the amount of monthly remittances the families receives from Russia. Based on the quality of the products and access to luxury markets, the earnings could be much higher. For example, if the scarves sold for $200, the wholesale price would be $100 and the woman could earn at least $60 - 70 per scarf – doubling her monthly income to $240 or $280.

Based on our estimates of cashmere production in the pilot area (i.e. 170g of cashmere x 3,786 goats) about 640kg of combed cashmere could be produced in the pilot region. At 66% yield, this cashmere could be processed into 422kg of clean cashmere which could be processed into approximately 380kg of yarn. 380kg of yarn could be processed into 2,508 scarves that could be sold by the women for $30 - $60 each. In this case the women's direct earnings would be anywhere from $75,240 to $150,480.

Provided that a family had 11 purebred cashmere goats that produced 500 grams of cashmere each, the family could produce 5.5kg of combed cashmere, 3.63kg of clean cashmere, 3.27kg of yarn and 21 shawls for $647 (using the minimum estimates of $30 per scarf). This would provide an important contribution to the household income. If the scarf sold for a retail price of $240 – which is not inconceivable based on the prices of the Orenburg shawls, their earnings would double.

Cashmere is being woven into luxury Pashmina shawls in India and knitted into expensive scarves in Orenburg, Russia. This project wants to build on the capacity of the Pamiri women to spin and knit not only shawls but also sweaters, hats, socks and other clothing. We plan to produce not only standard shawls or scarves but a diverse palette of cashmere knitted products based on contemporary design and market demand. Therefore, the cashmere most useful for our purposes will be cashmere suitable for hand spinning and knitting.

Cashmere must be defined by the market place. The project plans to test different types of cashmere produced by different goats by spinning it into yarn and knitting swatches from the yarn. This will tell us which type of cashmere is most suitable for this type of processing and which types of goats should be used for breeding. We suspect that the cashmere produced by the Altai crosses might be well suited for spinning and knitting given that it is long, reasonably fine and high-yielding. The Altai goats produce large amounts of cashmere and in addition are good meat producers, tested in local conditions. However, cashmere style (or crimp) is also very important for spinning as it affects how the fibers hold together. Some of the native goats sampled seem to have cashmere with a fine style. Questions regarding the quality of different cashmere types will be best answered by the processing tests in the spring. The results of the spinning and knitting tests should give us a good indication as to which types of cashmere goats should be imported to the pilot region for breeding.

Naryn Province, Kyrgyzstan

The Naryn oblast is located about 350 km from Bishkek and 200 km from the Chinese border 2800 m asl. The city of Naryn is known as the coldest town in Kyrgyzstan. Winter lasts for 145-165 days and temperatures been known to fall to -40°C. The average annual temperature is -6°C and the average annual rainfall is 250-300 mm. The population of the town of Naryn is about 45,000, and there are about 260,000 inhabitants in the Naryn oblast. The majority of families in Naryn rely on production of livestock (sheep, goats, horses and cattle) for livelihood on wide areas of natural, mainly mountain rangelands. Crop production is limited due to the short growing season. Sheep production has been a major element of the lifestyle of rural people in Naryn and Kyrgyzstan in general.The Naryn oblast is one of the poorest and most isolated regions in Kyrgyzstan, with high unemployment and poverty. Rural women are mainly engaged in housekeeping and family. Among the unemployed women 84.8% are between 20 and 49 years old. The yearly per capita income is about $2,000.

Kyrgyzstan and Naryn are known for developed felting tradition. Felting has been one of the earliest techniques of making textiles and it has played an important role in the life of nomadic cultures of Central Asia. The yurts of Kyrgyz pastoralists were made out of felt and protected the families from winter cold and summer heat. Felting was traditionally done by women whose job it was to process animal fibers and make felt rugs and clothing for practical use and aesthetic enjoyment. For hundreds of years, Central Asian women made felt vests, hats, shoes and decorative rugs to carpet the yurts and cover their walls. The art of felting was passed from mothers to daughters and women who were the most skillful felt-makers were respected for their craftsmanship. Felting was widely used during the

pre-Soviet era when the Kyrgyz pastoralists migrated with their livestock and relied on animal products for livelihood. After the Soviets annexed Kyrgyzstan and set up centrally planned agriculture women began to work on state farms and rely on mass produced consumer goods as opposed to handicrafts made within the household. This led to the decline of felt-making and other traditional arts and crafts. After the fall of the Soviet Union felting found a new role as a source of women's income. The high unemployment and the low productivity of subsistence farming that followed the market transition in Kyrgyzstan forced some rural families into poverty and many into a difficult financial situation. In their search for additional sources of income, some Kyrgyz women began to rediscover felt-making, realizing that felt products are desired on the local and the tourist market. The combination of a well-preserved felt-making tradition, pressures to find means of support and the new market opportunities inspired the development of small, women-led businesses that produce a variety of felt handicrafts for the local market and for export. Felt-making groups formed in the countryside and also in the capital city of Bishkek. The groups produce a wide variety of handicrafts and the diversity of their production is increasing each year. The products are sold on the local market mostly to tourists and some are also exported.

The assortment of products made by the different groups reflects the diversity in cultural capital and market signals the artisans rely on. For example, the remote Naryn region is known for its felt rugs or shyrdaks and is relatively isolated from outside markets. The artisans gravitate towards the use of traditional colors and patterns and towards the production of practical items for the home. Their felt products reflect the cultural capital of their region that has been passed on from generation to generation. Some of groups which it trying to work for export are changing the colors and the design of their rugs to suit the needs of the western market.

Many Kyrgyz felting groups, especially those in remote areas, face the challenge of finding markets for their handicrafts and obtaining market information that would help them to develop new products. The Central Asian market for felt products is relatively small and already saturated. The tourist market is also small and most tourists visit only during the summer months. In order to successfully market their products, the Kyrgyz felt-makers need to establish linkages to these developed and highly competitive western markets. They need to learn about the nature of the marketing process and understand the tastes and preferences of western consumers.

Gaining access to the American or European markets poses a considerable challenge for women in remote mountain villages who rarely leave their homes. Although some city-based felt-making groups have internet access and are successfully exproting their production online, the majority of rural groups in remote villages need assistance in developing linkages to markets and in designing new products that would satisfy western consumers. The objective of the ICARDA team is to work with such groups in the Naryn region and increase their capacity to produce and market felt handicrafts that can successfully sell on American and European markets and increase their incomes. The ICARDA research project team (Asanbek Ajibekov, Svetlana Balalaeva, Liba Brent and Zura Rasalieva) visited four felting groups in Lahol, Min-Bulak, At Bashi and Acha-Kaindy village during the initial visit to the Naryn region in November 2009.

Project Sites and Felting Groups

1. Lahol village, Naryn Rayon, Naryn Oblast

The Lahol village is one of the most isolated villages of the Naryn Oblasts. The village is located 320 km from Bishkek and 40 km from the route Bishkek-Naryn in the Kara Khudzhur valley, 2800 meters above sea level. Approximately 250 families live in the village. The main source of income/livelihood is livestock production – sheep, horses and cattle. The sheep produced in Lachol are primarily fat tails and also some Tian Shian and other crosses. (In the Lachol village crossbred semi-fine wool sold for .88 cents in 2009.) Women traditionally make felt rugs *shyrdaks* and other felt products, mainly for their houses, and sometimes for sale. The women make felts using local semi-fine and coarse wool, processing it by hand. The women use Turkish dyes, which are brought from Naryn and Bishkek. They never received any trainings in felting and know only the traditional felting technique *ala-kiiz*.

The products made by the women are typical, traditional felt carpets – thick, coarse and heavy, with traditional Kyrgyz ornaments in bright colors and high contrast. The export market for felts of this design and quality is very limited. The geographical/social isolation of the Lahol group will make it more challenging for them to succeed in producing felt for export. The felting project will be important for the Lahol women not only in terms of increasing their capacity to produce quality, marketable felts, but also as a way to gain access to new social networks and collaborate with felters from other villages.

Farms are medium size, and all are involved in sheep production keeping different breeds including fine wool, semi-fine wool, semi-coarse wool and coarse wool. Sheep are mainly maintained on rangelands except during the coldest winter period; there are sufficient winter, fall, spring and summer rangelands. Lakhol village, farms are provided by forage only for winter period and have sufficient. Sheep shearing takes place in May to June. No wool grading by quality is done as no specialists are available and wool is sold as a wholesale to middlemen. Semi-fine crossbred wool is sold for 30-35 Kyrgyz Som, while semi-coarse wool for 5 Som per kg. Remaining wool is used for felting, shirdaks, ala-kiyiz, jer-toshok and other products. The average wool production of Tien-Shan sheep is 2.7-3.1 kg, that of the fat-tailed sheep about 1.6-2.1 kg. The Tian-Shan sheep have homogeneous, crossbred white wool with luster and large crimp, uniform fiber length and diameter. Grease is mainly white. Fiber fineness of rams' wool meets the 50^{th} quality standard with a fiber length of 13 cm that of ewes and young females is of $58\text{-}56^{th}$ quality and a fiber length of 12.4 and 14.2 cm, respectively. Such wool can be used for production of valuable felt products.

The project worked with five sheep farmers in Lakhol:
Farmer Gulmira Usupbaeva keeps 120 sheep including 110 Tien-Shan semi-fine wool sheep and 10 fat-tailed sheep. Her Tien-Shan sheep are in good condition, size and liveweight of rams and ewes meet the requirements for the desirable type.
Rakhat Kasymaliev keeps around 80 sheep including 50 Tien-Shan sheep with wool corresponding to crossbred wool by type and traits (fiber length and diameter, crimp and luster).
Nurlan Akunov rears mainly Kyrgyz fat-tailed sheep. Out of his 50 sheep, only 10 are Tien-Shan. From two shearings of Kyrgyz fat-tailed ewes, a farmer can get 1.8-2.0 kg of semi-coarse wool to be used for felt products.
Myrzabek Asanaliev has both Tien-Shan semi-fine wool (25 sheep) and fat-tailed (25 sheep) animals.
Yrys Sydykov keeps Tien-Shan sheep. His animals are in a good condition, and meet the breed standard.

2. Min-Bulak village, Naryn Rayon, Naryn Oblast
The Min-Bulak village is located 30 km from Naryn city and 320 km from Bishkek. As in Lahol, most village families rely on livestock production for livelihood and there are very few other sources of employment. In this village a group called "Uz Nuraim" of 10 women was selected for participation in the project. The Min-Bulak village is closer to the regional center Naryn and the residents have more opportunities to travel and find access to markets, information and other resources. The group has skills in producing shyrdaks, ala-kiiz, felt souvenirs, and products made from chii (local straw). The artisans have experience in participating in seminars, for example organized by UNDP. They also took part in craft fairs in Naryn city and Bishkek.

The group has a good creative potential. For example, they produce a small folding yurt as a souvenir, which is interesting and easy to transport. Most of their shyrdaks have traditional colors – green, blue and red - but they also use natural colors, which are favored by western buyers. Given the group's experience in felting and in exhibiting and marketing products locally, the women could be trained to produce export products within 1-2 years.

The farms are small size. Thus, the project worked with a group of five farmers that were interested to improve their flocks and agreed to share improved rams:
Amantur Musaev has 20 sheep including 17 fat-tailed.

Omurtur Ismadiyarov; almost all of his 30 sheep are Tien-Shan semi-fine wool sheep.
Saktur Musaev: keeps around 20 sheep, out of which 16 are Kyrgyz fat-tailed sheep.
Tabaldy Asanov also has a mixed flock of 25 sheep including 10 black fat-tailed sheep.
Esentur Musaev keeps 25 typical fine wool sheep; the wool is mainly of 64 and 60th quality grade, grease is white, fiber length is 7 cm.

3. At-Bashi village, At-Bashi Rayon, Naryn Oblast
The village is a regional centre with relatively developed infrastructure, but no internet access. It is located 45 km from Naryn city and about 400 km from Bishkek. The village is well known for its artisans, producing felt shyrdaks; there are several craft NGO-s and cooperatives in the village. In this village the project selected for participation the Public Foundation "Ak-Bairak" with 15 women from socially vulnerable groups.

The Public Foundation "Ak-Bairak" was established in March 1999 with the aim to provide assistance to the families of disabled children through involvement of their parents in felt handicrafts production. The PF "Ak-Bairak" has two rooms in a kindergarten: one room is for disabled children, and another room is used as a workshop where the mothers work on felt handicraft production. Many of the mothers bring up their children alone, without husbands. The composition of parents changes as their children grow up and leave the center. At present time 7 women work at the workshop, and 8 women work at home. The group includes a professional seamstress with university education, Kasmira Asanbaeva, who has designing skills and is enthusiastic about innovative design and felting techniques. Her training and skills will be helpful in designing new products.

The group is supported by different projects, in particular by the "AUB-Charity" Foundation which previously funded training in wool processing and felt production for the group. The main products of the group are: shyrdaks, chair-mats, cushions, tuch-kiiz, and souvenirs. The products are sold during a tourist season in Tash-Rabat and Issyk-Kul area. However, none of the products are of export quality. Similar to the other two groups, this group also needs training in design, in new product development, in dying felt and in changing color schemes to suit western demand. We estimate that the group will require 1-2 years of training to reach export standards for products such as felt seat mats and shyrdaks.

In At Bashi the project explored links with two large farmers keeping fine wool as a potential source for felt products
Monolbay Manapbaeva's flock consists of 1,000 sheep, 500 fine wool and 500 fat-tailed sheep. Due to non-systematic mating and insufficient feeding of animals, part of his ewes have heterogeneous fleece and fiber fineness. Average wool production of fine wool is 3.6-3.7 kg, and that of semi-coarse wool 1.5-2.0 kg. The fine wool is sold to middlemen and at the local market for 58-60 Som per kg.
Farmer Aala Manapbaev owns 300 fine wool and 60 fat-tailed sheep. In general, the flock is typical for Kyrgyz fine wool breed; Australian Merinos were used in the past to improve the flock. Due to lacking support for systematic breeding some animals show deviations by type, and wool quality, e.g. inclined crimp not typical for Merino wool. Average wool productivity of fine wool is around 3.0 kg, and that of semi-coarse wool 1.5 kg. The farmer sells his fine wool to middlemen for 58-60 Som per kg.

4. Acha-Kaindy village, At-Bashi Rayon, Naryn Oblast
A famous Kyrgyz artisan-felter Janyl Alibekova lives in this village. She produces exquisite shyrdaks using quality raw materials and high-level technique. Her shyrdaks are very popular - representatives of Embassies, international specialists working in Kyrgyzstan and tourists travel here to buy her shyrdaks. Janyl showed us her new products and shyrdaks which she currently makes on order from the Aga-Khan Foundation Office in Naryn. Janyl works on her own, with some assistance from her family members.

A group of artisans "Cheber Koldor" (Skilful Hands) in this village was selected for participation in the project. The group includes 15 women felters, mostly pensioners and unemployed women. The

group members have some experience in marketing shyrdaks to tourists who visit Naryn in the summer but their products are also not of export quality. The team plans to arrange for the group to collaborate with and learn from Ms. Alibekova. The group will also receive training in design, improved felting techniques and in using natural wool colors and dying felt.

Kerman Province, Iran

The project will be implemented near Baft city (latitude 29°17'N and longitude 56°36'E) in the southeast of Kerman province, 2270 meters above sea level. The annual precipitation for this region varies from 180 mm to 320 mm. The climate is hot and relatively dry, with temperatures ranging from -10 °C in winter to +35 °C in summer. City of Baft is about 12030 square kilometers located in east southern of Iran and in west southern of Kerman province; situated between Bardsir city in the north to Jirouft and Bam cities in the east, to Hormozgan province in the south and to Sirjan city in the west. Climate is made up of two distinct weather patterns; in the north and center it is mountainous and in the south the weather is of semi desert land type. Baft is the center of the Raeini Cashmere goat production, with 850,000 heads of cashmere goats produced in the region. The Iranian farmers do not sort cashmere in terms of fineness and color and are not organized to take advantage of collaborative marketing strategies and economies of scale. Iranian farmers sell produced cashmere to local dealers at a much lower price than the price exported or sold at some markets in countries in the region. They sell unsorted cashmere for low prices and lack direct market linkages. Similar to Southern Tajikistan, women in the region work with cashmere and wool but do not have access to export markets. The project's goal will be to work with producers and women processors to improve breeding, fiber quality, marketing infrastructure and market access. It plans to introduce harvesting, sorting and grading methods that were successfully applied by major cashmere producers such as Mongolia. It will also work to develop collaborative ties between Cashmere producers in Southern Tajikistan and Iran and encourage synergistic effects of the two projects.

Raeini Cashmere goats with an average live weight of 35 kg for males and 30 kg for females produce 250-500 g of cashmere with 19-21 micrometer fiber diameter and a staple length of 31 to 40 mm. Cashmere fibre color is mainly white but it is also found in a range of different colors. The goats are kept in small farms and by nomads. Goats are most frequently mated in late June/July and kidding takes place end November till January; shearing will be done in late April/early May (Table 1).

Table 1. Main features of goat management in Iran

	Winter			**Spring**			**Summer**			**Autumn**		
	Jan	**Feb**	**Mar**	**Apr**	**May**	**June**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Mating [1]						**	**					
Pregnancy							***	***	***	***	***	***
Kidding	***										**	***
Lactating	***	***	***	***	***							***
Shearing				***	***				**			
Grazing	*	**	***	***	***	***	***	***	***	***	*	*
Stubble feeding	***	***									***	***
Concentrate feeding	*	*					**				**	**

*- Less frequent; **- Frequent; *** Most frequent; 1- Buck is mixed in the flock all year round

Nomad and semi-nomad farms are the target groups in this project. Nomads migrate to the south in autumn and winter (Persian Gulf area) and return back to Kerman province in spring and summer (Table 2).

Table 2. Migration of Nomads with animals in different seasons and months of year.

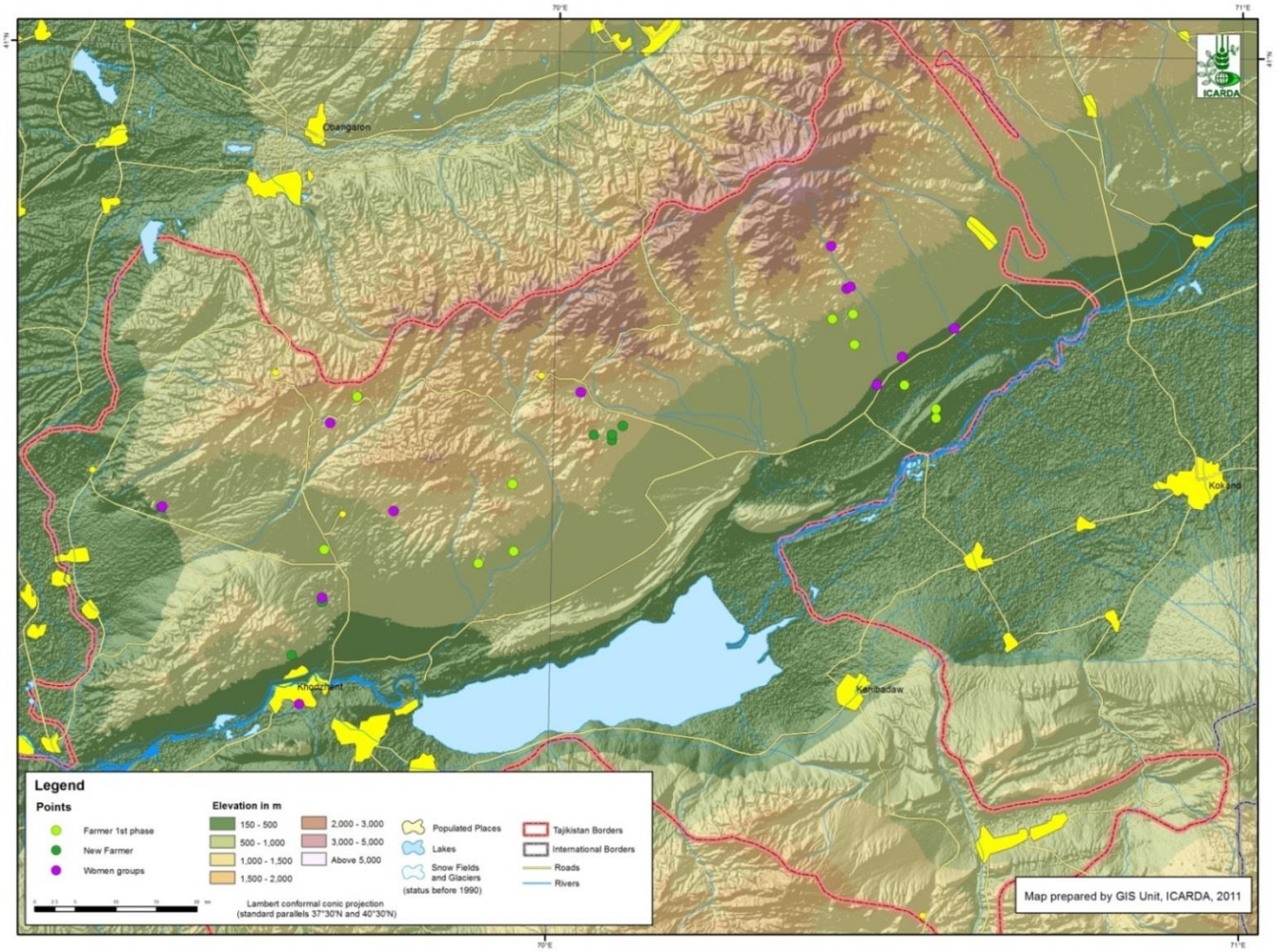
Activity	**Season/Month**											
	J	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Grazing around Baft city/Kerman province					x	x	x	x	x	x		
Migrating to Persian gulf provinces	x	x	x	x							x	x

All family members are involved in raising goats; men do the shepherding, shearing and feeding the goats and the women are involved in milking and dehairing. Traditionally raw cashmere (cashmere + hair) is sheared using double blade knives, fiber is stored in plastic bags and kept at the farms. Cashmere is sold as bulk fleece at the site to local dealers at a price much lower than the international markets (in 2009 7 USD/kg fleece).

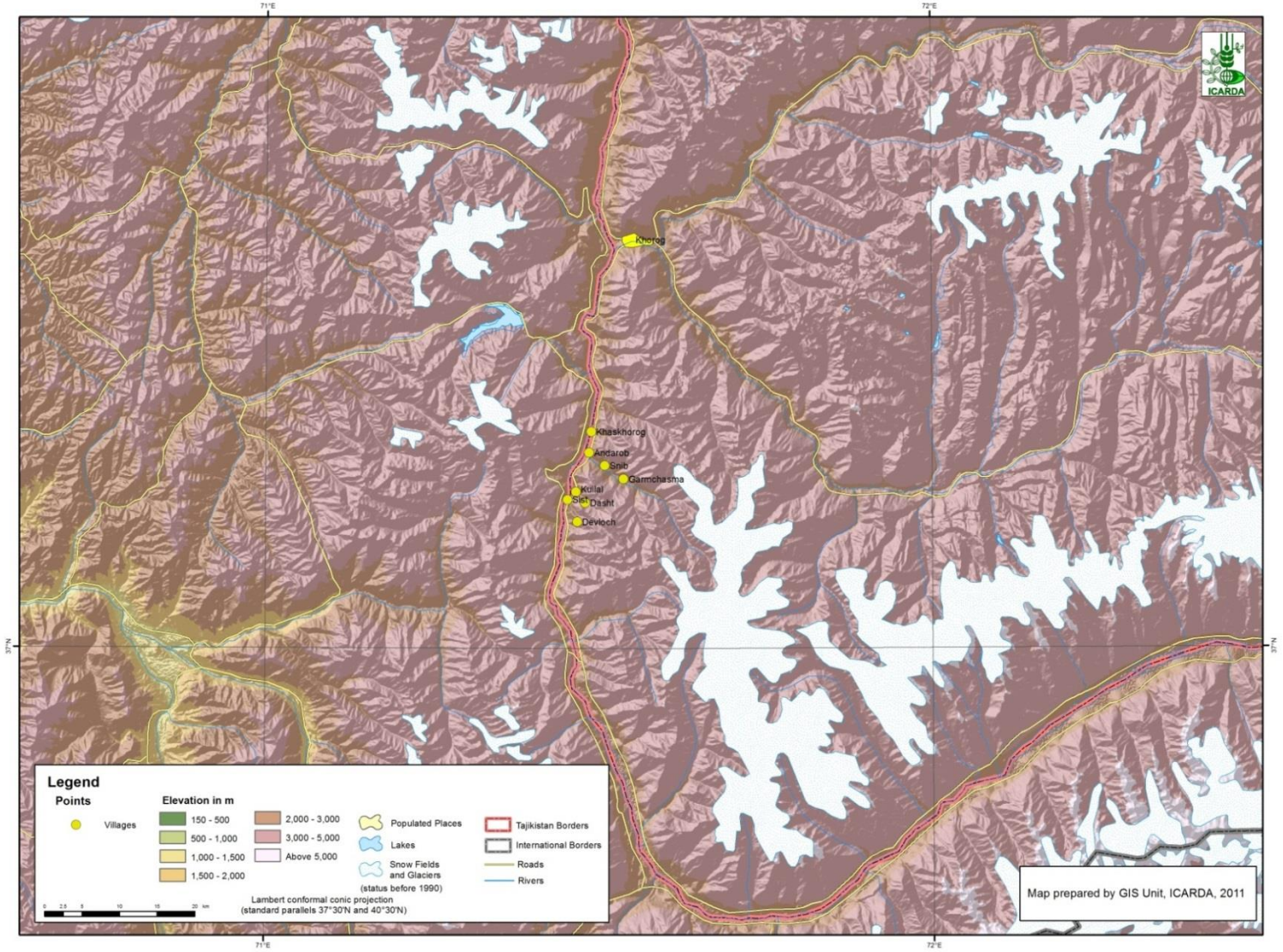
Raeini Cashmere goat breeding station in Baft

Iran has established some governmental breeding farms in different parts mainly to improve the genetic quality of cashmere goats. The main cashmere goat breeding center is located in Kerman province-Baft city. Its main objective is to produce superior males and distribute them among local goat farms. Baft Raeini breeding station has been established about 30 years ago and keeps 600 goats of which 300 heads are reproducing goats. Improved male goats from the station are distributed to local farms and to avoid inbreeding some superior male goats from local farms are introduced into the breeding station. Artificial insemination is used in the station and about 1000 goats of local farms are inseminated artificially using fresh semen from the breeding station. Major part of applied research can take place in this station with a close direct community level contact. Raeini goat breeding station would be a good center for developing a harvesting, sorting, breeding and marketing strategy in close communication with local farms. Training facilities at Baft breeding station can be used for workshops to train local cashmere producing farmers and women.

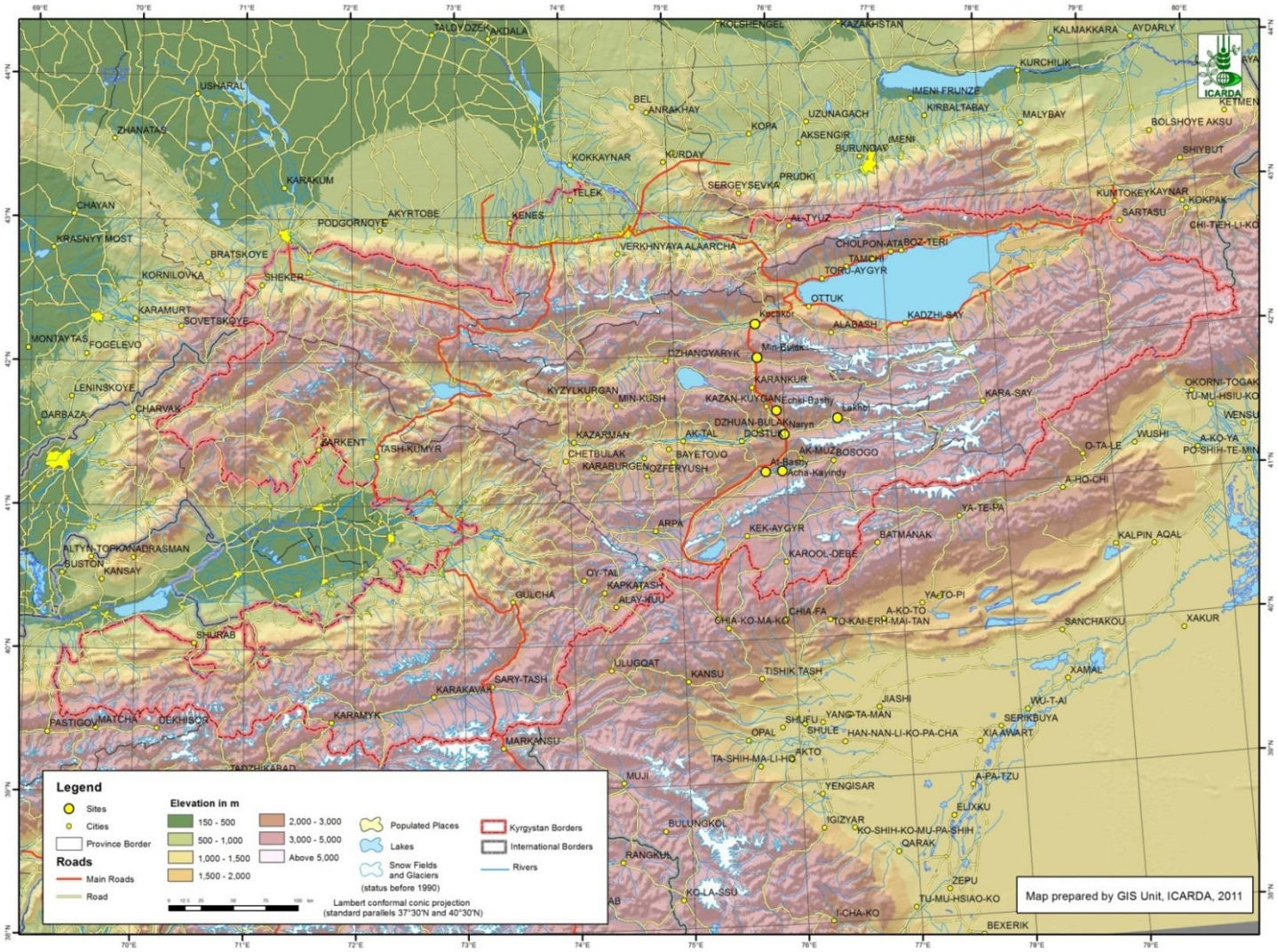
Maps of the project sites



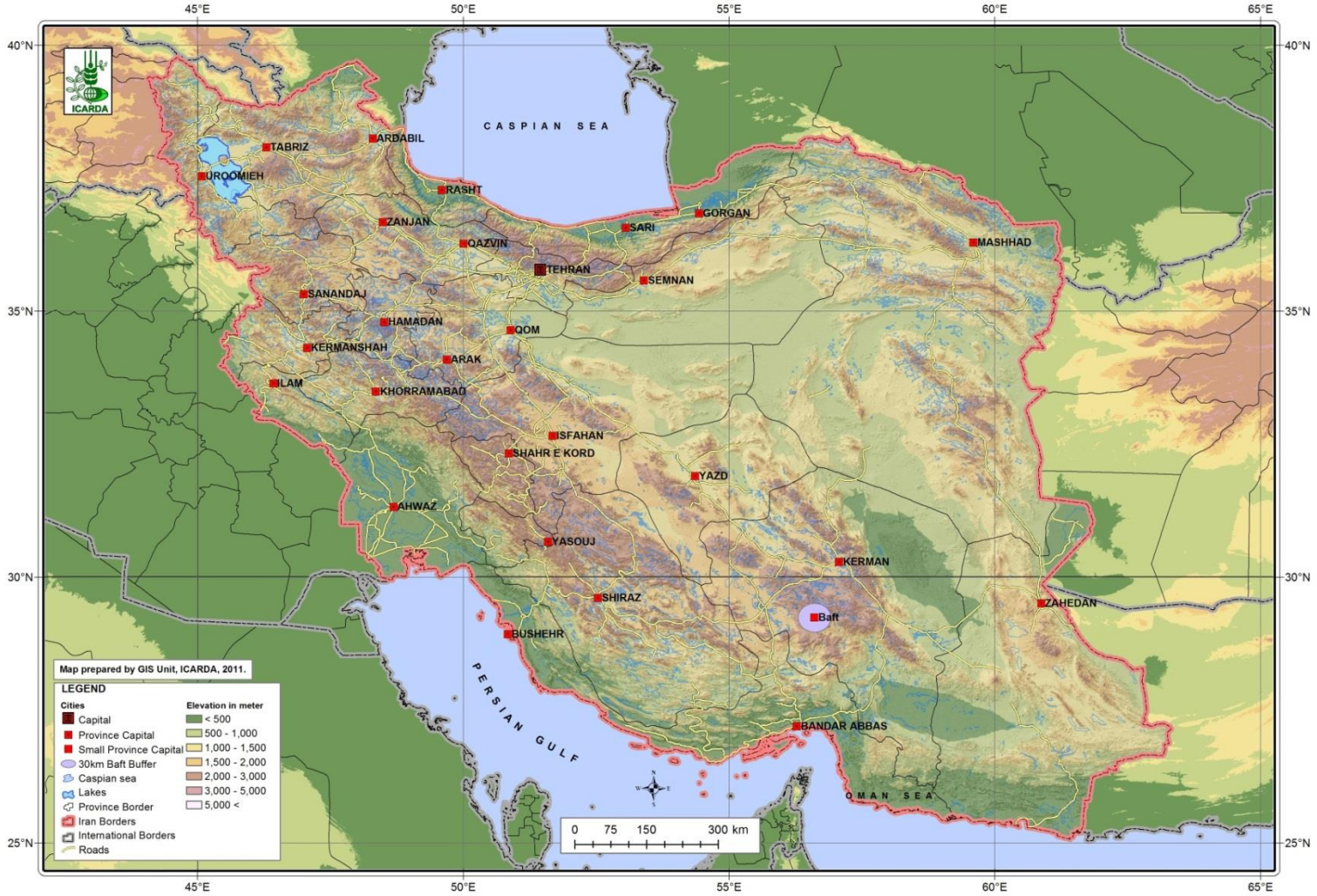
Map 1. Project site in Northern Tajikistan (individual goat farmers and women groups)



Map 2. Project site in Badakhstan, Southeastern Tajikistan (project villages)



Map 3. Project site in Naryn Province, Kyrgyzstan (project villages)



Map 4. Project site in Kerman Province, Iran (rangelands around Baft city)

Annex 2. Selection for fiber quality within the Tajik Angora flocks

The project team initiated the breeding programs in fall established two breeding nuclei for producing superior breeding animals with the most interested farmers that had at least some above average females (Table 1). Based on fiber fineness one nucleus was formed for black and one for white Mohair goats and the selected nucleus females were separated from their flocks and kept for the mating period by one of the nucleus farmers. Data were collected nucleus animals was initiated.

Dr. Matazim Kosimov and Farhod Kosimov examining fiber of breeding bucks at a cooperative farm, October 2009

Altogether, 8 farmers with 776 animals participate in the joint mating. 75 of their best females were selected for the nuclei and mated separately with selected breeding males (Table 1). The animals were selected on the basis of fiber quality – fineness, low percentage of kemp and medulated fibers, fiber length and uniformity and volume of the fleece. The project team had difficulties finding breeding males with these characteristics especially for the white nucleus, as most white Angora bucks in Tajikistan have coarse fiber. In spring 2010, Matazim and Farhod Kosimov collected data on the nucleus kids born in March and April and held discussions with farmers about preliminary results of the breeding.

In addition two of the ten farmers, Usarboy Kholmatov and Khaydarali Khakimov, that live at remote sites and therefore could not be linked to the community nucleus flocks, formed black nucleus groups within their flocks that were mated separately from the main flock.

Table 1. Farmers from Asht district, their flock size and number of goats in the nucleus herds

Farmers	The number of goats as of Jan. 2010		Color of goats	Fiber sample	Shorn fiber (kg)
	total	nucleus			
Urunboev Tirkashali	145	30	White	30	1.51 ± 0.03
YoldoshevZokir	27	5	White	-	-
Turaev Makhmud	131	16	Dark	7	1.51 ± 0.03
Turaev Bozorboy	50	6	Dark		
Meliboev Okhunjon	185	6	Mixed	4	1.47 ± 0.05
Abdulloev Egamberdi	122	8	Dark	7	
Abdulloev Goibberdi	78	4	Dark	4	1.40 ± 0.04
Mirzoakhmedov Ikromali	65	5	Dark	3	
Khakimov Khaydarali	130	24	Dark	10	1.36 ± 0.04
Kholmatov Usarboy	180	37	Dark	27	1.35 ± 0.05
Total	**776**	**75**			

The results of visual assessment of the entire flocks of the eight farmers are shown in Table 2.

Table 2. Visual assessment of white and dark mohair goats

Farmer's name	No of animals		Live weight*			Body Condition*			Fleece weight**		
			+B	B	-B	+K	K	-K	+III	III	-III
White flocks											
Urunboev Tirkashali	N	115	61	37	17	65	38	12	20	72	23
	%	100	53.0	32.2	14. 8	56.5	33.0	10.4	17.4	62.6	20
Yoldoshev Zokir	N	27	11	11	5	6	16	5	5	18	4
	%	100	40.7	40.7	18.5	22.2	59.3	18.5	18.5	66.7	14.8
Black flocks											
Turaev Makhmud	N	128	25	72	31	25	85	18	26	81	21
	%	100	19.5	56.3	24.2	19.5	66.4	14.1	20.3	63.3	16.4
Turaev Bozorboy	N	42	5	25	12	7	28	7	11	23	8
	%	100	11.9	59.5	28.6	16.7	66.7	16.7	26.2	54.8	19.0
Abdulloev Egamberdi	N	138	35	85	18	29	81	28	20	101	17
	%	100	25.4	61.6	13.0	21.0	58.7	20.3	14.5	73.2	12.3
Meliboev Okhunjon	N	190	46	112	32	54	105	31	51	103	36
	%	100	24.2	58.9	16.8	28.4	55.3	16.3	26.8	54.2	18.9
Abdulloev Goibberdi	N	56	14	29	13	24	27	5	6	38	12
	%	100	25	51.8	23.2	42.9	48.2	8.9	10.7	67.9	21.4
Mirzoak. Ikromali	N	58	12	37	9	21	31	6	9	35	14
	%	100	20.7	63.8	15.5	36.2	53.4	10.3	15.5	60.3	24.1

*Liveweight and body condition were assessed in Oct. 2009, **fleece weight in March 2010

A first unexpected result was a much higher than average survival rate of the kids born from nucleus does compared to those outside the nucleus groups. The reason for this was that the mating in nuclei flocks was conducted during the optimal period from 22 October to 22 November. As a result the kidding period lasted only one month and started in March when mild temperatures and availability of feed provided good conditions for the does and the kids. Farmers who did not participate in the breeding program kept the bucks with their flocks from August to November. As the rangelands were in comparatively good conditions due to favorable rainfall in 2009, mating started early and was spread over a relatively long period. Consequently, the kidding season at those farms was much longer and started as early as January. Most farmers were unable to protect the kids born in January and February from the cold temperatures and to supply enough feed for the does. In addition the winter lasted longer than usual in 2010 and many farmers lost 30-50% of their kids while the nuclei farmers had a high kidding rate and a high kid survival rate.

Nucleus Farmer with Twin Kids, Asht district, May 2010.

A comparative assessment of liveweight and Mohair yield of the goats selected for the nucleus flocks and the remaining part of the flock (control) is shown in table 3.

Table 3. Comparison of does and bucks in the nucleus flock with the base flocks (8 flocks).

Indicators	White Goats		Dark Goats	
	Control	Nucleus	Control	Nucleus
Does, number	10	35	10	42
Liveweight, kg*	34.4 ±0.85	36.5±1.74	31.7±0.94	37.3±2.21
Fleece weight kg**	1.51 ±0.03	1.53±0.06	1.49±0.03	1.35±0.07
Bucks, number	2	2	2	2
Liveweight, kg*	39.5	43.0	42.5	46.0
Fleece weight, kg**	2.25	2.70	2.10	2.50

*Liveweight was recorded in October 2009; **fleece weight in March 2010

According to the eight farmers, their total mohair production was 1,187 kg of mohair, averaging 1.56 kg per goat per farm (Table 4).

Table 4. Total fleece weight produced and average fleece weight per head calculated in the shearing period of April 2010

Name	Total weight of mohair produced, kg	Average mohair production per head, kg
Urunboev Tirkashali	212	1.85
YoldoshevZokir	51	1.87
Turaev Makhmud	190	1.48
Turaev Bozorboy	62	1.41
Abdulloev Egamberdi	208	1.51
Meliboev Okhunjon	300	1.58
Abdulloev Goibberdi	85	1.35
Mirzoakhmedov Ikromali	79	1.40

The weight development of the kids born in March 2010 in the nucleus and base population is shown in table 5.

Table 5. Liveweight of kids born in March 2010 in the nucleus and control groups

Indicators		Birth weight		6 months liveweight	
		n	kg	n	kg
White	Nucleus	28	2.43 ±0.27	8	14.66 ±0.69
	Control	10	2.30 ±0.40	8	13.14 ±0.58
Dark	Nucleus	29	2.35 ±0.61	12	13.23 ±0.36
	Control	10	2.34 ±1.20	10	14.02 ±0.43

During shearing in spring 2010, 54 mohair samples were collected from goats in the nucleus groups for laboratory analysis to study mohair quality. During the spring visits before shearing, the project team also discussed the evaluation of goats with farmers and conducted trainings on selecting the best breeding animals. Farmers' attention was drawn to mohair quality and exterior of goats.

Table 6. Results of the individual assessment of adult goats before mating (October 2010)

Group	Sex	Assessment of the animal				
		Liveweight, kg	Natural fiber length, cm	Fineness (Bradford system)	Mohair production, kg	
					total	average
Nucleus	Bucks	52.2	21.5	48-46	70.8	2.95
	Does	29.8	18.2	56-48	820.0	1.55
Control	Bucks	44.5	19.0	56-48	65.0	2.10
	does	28.1	17.5	58-48	363.0	1.32
Difference, (exp – control)	Bucks	+7.7	+2.5	X	+5.8	+0.85
	does	+1.7	+0.7	X	+457	+0.23

Discussions were also conducted with key farmers from B. Gafurov district that participated in the earlier project (Turgunboy, Sulaymon, and Suyunboy) on further improving the genetics of their Angora goat flocks and preventing inbreeding. As a result, two young colored mohair bucks were procured for flocks of Suyunboy Mamarasulov. These bucks were selected from the nucleus breeding flock owned by Usarboy Kholmatov in Asht district. Assistance was provided for procurement of one white mohair buck for the farmer Turgunboy Madaliev from a famous farmer in the region. The farmers were also provided with recommendations regarding the selection of bucks and does for nuclei flocks, breeding, feeding and rearing. The team facilitated contacts between old and new nucleus farmers.

Annex 3. Crossbreeding Program in Northern Tajikistan

Comparison of Tajik and American Angora Mohair – price, production and processing

The project studied the relationship between price and quality of Tajik and American mohair. The results show that American mohair is on average twice as expensive as Tajik mohair on the international market. For example, while Tajik farmers earned on average $7-8 for 1 kg of mohair in 2011, American farmers earned $15/kg[1]. In addition, American goats produce more than twice as much mohair per year compared to Tajik Angora goats: the fleece weight of breeding does is 1.6-1.8 kg in Tajikistan and 2-3. 9kg Texas, USA, and the American Angora goats are sheared twice a year. This means that Tajik famers are losing substantial revenue by producing low quality goats.

The prices of Tajik and American mohair actually reflect the processing qualities of the two fibers. American mohair, which is largely kemp-free, finer and more homogeneous than Tajik mohair, is much cheaper to process into expensive, luxury yarns and textiles then cheap Tajik mohair. The project calculated that the production cost of 1 kg of luxury yarn would decrease even if the price of raw fiber increased by 100%, provided that the fiber was fine, uniform and kemp-free like the American mohair. In short, the cheap price of Tajik mohair does not outweigh the processing costs, given that it requires dehairing to eliminate kemp and short fibers. The dehairing process is expensive[2] and the yield of Tajik fleeces is low after dehairing. These calculations imply that not only Tajik farmers, but also women who earn income from fiber processing would benefit from improved mohair quality, even if the price of the improved fiber was much higher. In addition, greater numbers of goats with quality mohair would increase the supply of raw material available for processing and provide additional earning opportunities for spinners and knitters.

The project used multiple methods to assess the quality of Tajik mohair and the results of the assessment served as a basis for designing the new breeding program. The methods included collection and laboratory analysis of fiber data, visual assessment of goats and fleeces, and a comparative processing experiment using Tajik and American kid mohair. Laboratory tests and fiber analysis (using OFDA 4000) yielded information about fiber characteristics of Tajik mohair. The experiment in mohair processing clarified how specific deficiencies in fiber quality translate into additional costs and technological obstacles in processing. During the experiment, 5 kg of high quality American and 5 kg of high quality Tajik kid mohair was processed into yarn. The experiment had shown that nearly 100% of fibers in the American kid fleeces, which were kemp-free, fine and homogeneous, could be processed into luxury yarns and textiles that met the project export standard. The Tajik fleeces could not be processed into luxury yarn without manual dehairing which separates kemp fibers and short fibers from the rest of the fleece. As described in detail in a previous project report, dehairing increases the production cost of 1 kg of yarn by 1/5 (i.e. dehairing cost is 1/5 of the production cost). Moreover, dehairing considerably lowers the yield of fiber available for processing into expensive yarn. The yield of clean fiber that can be spun into luxury yarn after dehairing 1 kg of Tajik mohair is only about 300 grams. The remaining 700 grams has to be processed into cheap yarn for the Russian market. In comparison, 1 kg of American mohair yields about 900 grams of fiber suitable for processing into luxury yarn. The price of luxury

[1] The actual price advantage was even higher for American farmers, given that the clean yield of Tajik mohair is at least 15% higher than the yield of American mohair. That means that 1 kg of scoured Tajik mohair equals only 850 g of scoured American mohair.

[2] 1 kg of washed, quality Tajik mohair yields 300 g of high quality, clean fiber after dehairing. 1 kg of washed American mohair yields 900 g of high quality fiber, without dehairing. Dehairing 1 kg of Tajik mohair costs $11 (approximately 1/5 of the production cost of 1 kg of yarn)

yarn is 5-6 times as high as the price of cheap yarn sold to Russia. This means that a spinner can add much more value to a high quality fiber, and earn a much higher income.

Shearing Angora goat kids on a private farm, April 2011.

The comparative processing experiment confirmed that American mohair fleeces contain Angora goat hair of uniform length and fineness – i.e. are homogeneous. Tajik mohair fleeces contain a variety of fibers – hairs of different lengths, kemp and medulated fibers, short, cashmere-type down fibers and also dead and dry fibers. The heterogeneity of Tajik mohair creates multiple challenges during processing: kemp and medulated fibers increase coarseness and short and dead fibers cause shedding. Secondly, the majority of Tajik mohair is relatively coarse. The centralized purchase of kid mohair organized by the project in the spring 2011 confirmed that a bulk of Tajik kid mohair is coarser than American kid mohair and only about 1/5 of Tajik kid mohair clip is fine enough to be spun into fine yarn.

Strength and weaknesses of Tajik Mohair production

How to explain the prevalence of fiber deficiencies such as kemp in view of their costs to Tajik producers and processors? What do American producers have that allows them to keep improving their Angora flocks and mohair quality that is missing in Tajikistan? The simple answer is threefold: 1) strong linkages to global markets; 2) extension and scientific support; and 3) producer's associations and networks that help to coordinate breeding, marketing and other activities that support the sector.

Production of quality Angora goats and mohair cannot exist without good market linkages, extension & science, and producers' organization. In fact, Angora goat production in Tajikistan was also built on these types of support: during the Soviet period, Tajik Angora producers had access to

the Soviet market, received extensive scientific and extension support from the government, and were organized into state farms and cooperatives that collaborated on breeding and other activities. Currently, this support system is broken – Russia's mohair processing sector amounts to a fraction of its former size and its demand for mohair has decreased substantially. This means that Tajikistan needs to start developing linkages to other markets. Furthermore, extension and scientific support for Tajik mohair producers is minimal due the lack of governmental funding and ineffective relationship between the government and private farmers, including Angora goat farmers. Finally, private producers who are replacing state farms are isolated and unorganized, and grassroots-level organizations that serve rural communities and farmers are only developing. The Angora goat breeding tradition also present a problem: research had shown that the selection of Tajik Angora goats was driven by the requirements of Soviet textile industries that demanded strong mohair and did not consider the problem of kemp. As a result Tajik mohair has the deficiencies outlined above that make it less competitive on global markets.

Tajik producers have limited means to eliminate such deficiencies without external assistance. While mohair producers in other countries focus on eliminating kemp and increasing fiber fineness, and are supported by sophisticated extension systems in their efforts to improve fiber quality, Tajik mohair producers are largely unaware of quality demands on global mohair markets and continue to operate in a limbo between the Soviet past and the market-driven presence. Many producers lack breeding strategy and market information and continue to supply low quality mohair to local traders who resell it for low prices to China, Turkey and Russia. It does not help that the Tajik government has yet to demonstrate the will and capacity for a meaningful intervention on behalf of the Angora goat sector. In addition to lacking market information and governmental support, Tajik producers do not have breeding animals with the desired fiber characteristics. Kemp free, homogeneous, fine-haired breeding bucks are very rare in Tajikistan and it would take a very long time to eliminate fiber deficiencies using local breeding stock only.

Tajik breeding bucks have coarse fleeces with kemp fibers, Haidarali farm, April 2011.

After outlining the multiple obstacles facing Tajik mohair producers, it is also important to analyze their competitive strengths that make the support of Tajik Angora goat sector a worthwhile cause. Firstly, Angora goat production in key mohair-producing countries such as South Africa, USA and Australia has been decreasing because of rising costs of inputs such as land and labor, and because mohair processing has moved from the USA and South Africa to China. Instead of being processed locally, American mohair is first exported to South Africa, where it is purchased by Chinese buyers together with South African mohair.

In Tajikistan, inputs necessary for Angora goat production are very cheap – labor costs are low, and the cost of pastureland suitable for Angora goat production is minimal given that the land is not suitable for agriculture or other livestock. Furthermore, Angora goat breeding has a long history in Tajikistan. There are around 200,000 – 250,000 Angora goats in the country, and the conditions for Angora goat production in the Asht and Gafurov region in Northern Tajikistan are excellent. Another advantage is that Tajikistan is the only country in Asia that produces mohair besides Turkey (which has low quality goats and fiber) and it borders China – the largest buyer and processor of mohair fiber. Russia, Turkey, China and India are all interested in Tajik mohair and active on the market.

Chinese buyers purchased large quantities of the lowest quality Tajik mohair for $4.30 per kg, April 2011.

Sales of mohair represent an important source of revenue for producers in Northern Tajikistan. For example, 200,000 goats can bring around $1,000,000 in revenue in fiber sales to a very poor region, if we calculate that each goat produces 1kg of mohair that is sold for $5. Based on interviews with Tajik mohair producers, Angora goat production is profitable and a single goat brings about $10 in profits. The profitability is the result of low production costs and relatively good prices for mohair especially during the last couple of years. Prices of mohair are expected to remain relatively high due to the fallen world supply and increasing prices of all natural fibers. Under these conditions,

improved mohair quality and prices could provide additional income for farmers and create earning opportunities for poor rural women many of whom currently process mohair for sale.

These are some of the main reasons why the ICARDA/IFAD project invested in developing a breeding program centered on introducing imported genetics of American Angora goats in Tajikistan. This program is expected to provide a new direction for the development of the Tajik mohair sector, speed up improvements in mohair quality and also promote development of other institutions that support Angora goat producers. For example, the import of frozen semen is linked with the project support for the Tajik Livestock Institute and its extension activities. Access to American genetics gives the Institute and its scientists a concrete means to improve the breeding stock and organize extension support. Scientists from the Institute are developing the breeding plan, organizing the insemination work and receiving training in using frozen semen. In the process they are strengthening linkages with private producers who show a great interest in participating in the new breeding program. The scientists are also promoting networks among producers and the formation of associations that could represent producers' interests vis-à-vis the government, and facilitate collaboration on mohair marketing, breeding, exhibitions of goats and fiber and other activities. The import of new genetics and support of the ICARDA/IFAD project is also increasing the awareness of the Tajik government in the importance of Angora goat production for farmers and women in northern Tajikistan. The introduction of new genetics thus serves not only the purpose of improving fiber quality, but is a catalyst for the reorganization of the Angora goat sector.

Dr. Matazim Kosimov showing an Asht farmer photos of American Angora goats, April 2011.

Performance of progeny born in 2012 (first AI) from Texan Angora bucks in Tajikistan

Studies on mohair quality showed that fiber diameter was 27.3 mic in 1-year old goats, 31.3 mic in 2-year old goats and continued to increase with age thereafter. Fiber diameter in white mohair was even higher than in mohair of other colors. Medullation was 1.22% with a maximum of 19.3%. Such mohair would be classified as crossbred in the international mohair market in fetch much lower prices than pure mohair.

Systematic breeding is key to improving mohair quality. To jump-start the breeding work an experiment was started by importing Angora goat semen from the United States to Tajikistan and collaborate with Tajik scientists and Angora goat producers on setting up a new breeding program linked to global market trends. Introduction of American genetics to Tajikistan is not new. The Tajik Angora goat breed was developed through crossing local fiber goats and Angora bucks that were imported to Russia and then to Tajikistan from the United States in the 1930s. The usage of American genetics will promote faster changes in fiber quality than selection from the local breeding stock of mostly coarse bucks with kempy fleeces. The new genes are expected to gradually eliminate kemp fibers, decrease fiber diameter and increase homogeneity and fleece weight of Tajik Angoras.

Selection of bucks (see photos below)

Eight top-rated Angora bucks for semen collection in 2010 were purchased at an auction in Sonora after completing a performance test at the Sonora Research Station administered by the Texas A&M University. The bucks were tested on a variety of characteristics including FD, kemp content, clean fleece weight (corrected to 180 days growth) and body weight. Eligible bucks had a maximum kemp content of 0.1%, med fiber content of 0.4% or less and with an overall test score of 110 or higher (Table 1). The team also selected one buck with a high clean fleece weight and two bucks with low FD. Care was taken to select bucks from at least four different breeders to ensure genetic variability.

Table 1. Key Characteristics of bucks purchased for semen collection

Id	Breeder	Straws	CFW (lbs)	FD (mic)	Med (%)	Kemp (%)	Index	Comment
9	Naumann	311	10.2	30.9	0.0	0.0	127.0	Low FD, high index, without med/kemp
19	Cerulean	225	13.1	34.4	0.3	0.2	156.7	Top index of the test
20	Cerulean	137	11.3	35.2	0.3	0.0	120.4	Good CFW, very low med/kemp
21	Cerulean	141	12.9	36.0	0.3	0.0	135.9	Good CFW, good index, very low med/kemp
23	Haby & Coates	371	11.0	32.6	0.0	0.1	112.8	Good CFW, very low med/kemp
25	Haby & Coates	12	11.2	35.4	0.0	0.0	124.6	Good CFW, good index, without med/kemp
45	Ross	289	9.1	30.3	0.3	0.1	115.5	Low FD
59	Speck	326	--	--	--	--	--	No data but visually excellent

The semen was collected at "American Genetics and Biologicals" in Bryan, Texas in the fall and winter 2010-2011. About 1,900 doses of semen were collected from the selected bucks and shipped to Tajikistan in October 2011.

Selection of farmers and flocks for artificial insemination

Farmers from the Asht and Gafurov regions that have the highest number of quality, white Angora goats in Tajikistan. The Asht region is a home to a state Angora goat breeding cooperative named "Dulana" that has approximately 8,000 Angora goats and is the main Angora goat breeding center in Northern Tajikistan. The farm is located at the foothills of the Kuraminsk mountain range, an area with excellent conditions for goat production. The cooperative goats are organized into flocks based on gender, age and overall ratings. Private farmers graze the Dulana flocks together with their own goats. The cooperative raises a flock of registered breeding bucks that are used during artificial insemination with fresh semen organized by the farm in October each year. It was decided to use the insemination facility of the Dulana cooperative to conduct the insemination with frozen semen in October 2011. The second insemination site selected is in the Gafurov region near the Takli village. This site also includes a cooperative named "Kushatov" with 8,200 Angora goats. The Kushatov farm has a similar arrangement with farmers who graze its goats together with their own goats.

Five private farmers affiliated with the two breeding farms were selected to collaborate on the insemination in 2011. Farmers were selected based on the quality of their flocks, their long-term capacity to develop Angora goat breeding, their interest in collaborating with local scientists on the insemination and the follow up breeding program, and also the distance between their flocks and the artificial insemination site. The following farmers were selected in Dulana: Nemat Rakhimkulov, Gafur Fozilov (Eshbay) and in Takli: Uktam Ibragimov, Ulugbek Beknazarov and Khaitkul Askarov.

Selection of females to be inseminated

Females were selected considering size, body condition and qualitative and quantitative indicators of mohair quality. A total of 258 does were selected for insemination out of 1,758 does evaluated in October 2011. The 258 does were identified with ear tags, tattoos and paint. The following objective was to organize artificial insemination at pilot sites and ensure that it was implemented by a trained specialist. The ovulation of the 258 selected females was synchronized using CIDR. Out of the 258 does 237 were finally inseminated between 24 and 30 October 2011. In addition, 37 goats from a governmental farm (the "supernucleus") were also inseminated. Table 2 summarizes the numbers of does presented by each farmer and the number eventually inseminated.

Table 2. List of farmers whose does were inseminated with imported semen

Name	Farmer's location	Color of goats	Number of goats	Number of inseminated does
Gafur Fozilov	Dulana	White	418	68
Nemat Rakhimkulov	Mullomir	White	576	76
Uktam Ibragimov	Takli	White	244	40
Ulugbek Beknazarov	Takli	White	285	38
Khaitkul Askarov	Takli	White	235	15
Total			1758	237

Prior to the insemination, the 237 does were measured and weighed. Goats in group II had the highest live weight (32.18 kg), height at the shoulder (55.07 cm) and straight body length (54.17

cm) and exceeded goats in group I by 5.56% (P<0.01), 0.09% and 0.35%, and group III by 18.7% (P<0.001), 0.67% and 4.02% (P<0.001), respectively (Table 3).

Table 3. Performance of does (n=237) inseminated by farmer and age group

Group	Farmer	N	Age, years	Live weight, kg	Height at the shoulder, cm	Straight body length, cm
I	Gafur Fozilov	1	2.5	29.00	57.00	53.00
	(Eshbay)	29	3.5	29.01 ±0.58	54.55 ±0.32	53.10 ±0.53
		31	4.5	30.77 ±0.55	54.70 ±0.37	53.87 ±0.45
		11	5.5	31.27 ±0.63	56.72 ±0.71	55.18 ±0.96
		4	6.5	33.37 ±0.68	56.50 ±1.19	58.25 ±0.85
II	Nemat	2	2.5	26.75	54.00	52.50
	Rakhimkulov	24	3.5	29.54 ±0.62	54.00 ±0.69	52.66 ±0.51
		16	4.5	32.75 ±0.84	55.18 ±0.85	55.00 ±0.86
		19	5.5	34.44 ±0.74	56.15 ±0.58	54.84 ±0.45
		7	6.5	35.35 ±1.20	55.85 ±0.98	56.14 ±1.16
III	Uktam Ibragimov/	26	2.5	24.72 ±0.60	53.22 ±0.57	50.55 ±0.45
	Ulugbek	22	3.5	25.34 ±0.48	54.45 ±0.61	51.59 ±0.43
	Beknazarov/	20	4.5	26.47 ±0.55	54.80 ±0.79	52.40 ±0.46
	Khaitkul Askarov	19	5.5	28.13 ±0.62	56.42 ±0.71	53.68 ±0.68
		6	6.5	27.83 ±0.72	55.83 ±0.91	52.83 ±0.74
Age 2.5		29		25.01 ±0.59	53.48 ±0.54	50.79 ±0.44
Age 3.5		75		28.10 ±0.38	54.34 ±0.30	52.52 ±0.29
Age 4.5		67		29.96 ±0.46	54.85 ±0.35	53.70 ±0.34
Age 5.5		49		31.28 ±0.56	56.38 ±0.38	54.46 ±0.38
Age 6.5		17		32.70 ±1.05	56.00 ±0.55	55.47 ±0.76
Group I		76		30.39 ±0.37	55.06 ±0.24	53.98 ±0.33
Group II		68		32.18 ±0.47	55.07 ±0.38	54.17 ±0.35
Group III		93		26.14 ±0.30	54.70 ±0.33	51.99 ±0.27

Fleece samples were taken from 81 out of the 237 inseminated does and analyzed in the Alrun fiber lab of Almaty, Kazakhstan. The average performance of these does for FD is 34.8 mic, SDFD 10.3 mic and CVFD 29.5%. No medullation was measured but the diameter frequency was available and its tail towards high diameters is an indicator of medullated fibers including kemp fibers (Fig. 1).

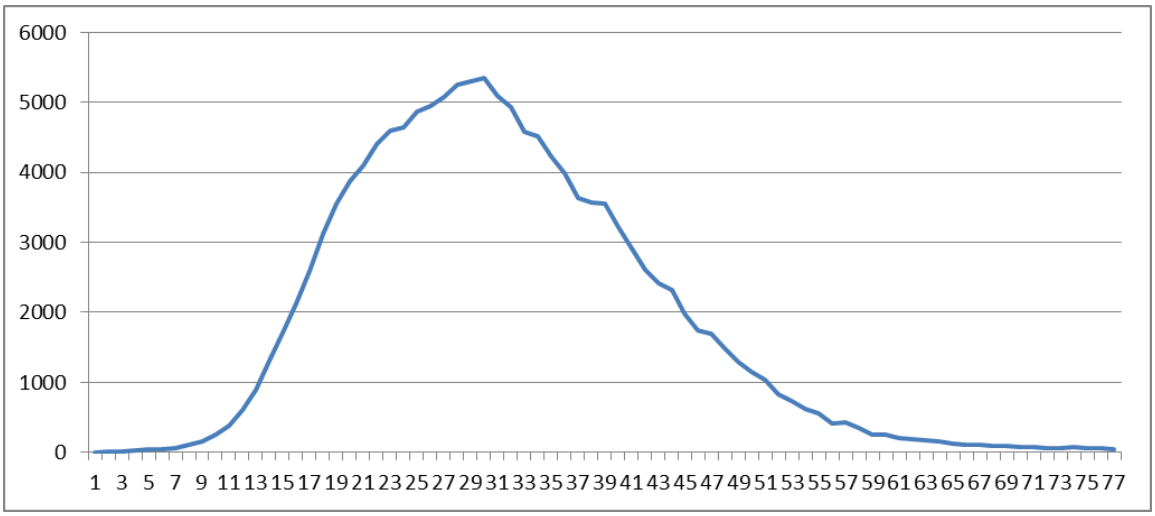


Fig. 1: Fiber diameter distribution in samples of inseminated does.

Insemination process

Artificial insemination using frozen goat semen was conducted for the first time in Tajikistan. During the Soviet period, Tajik Angora goat scientists used artificial insemination with fresh semen but not frozen semen. It was decided to invite an experienced inseminator to assist Tajik scientists with the insemination. After a preliminary visit to the pilot site to meet with Tajik scientists, prepare the insemination plan and assess local facilities and equipment needs. He arrived for a second visit to conduct the insemination. Insemination team members included specialists from the agricultural cooperatives, AI technicians and farmers participated during the introduction and training in the new method. A strict time schedule for synchronization and insemination was established (Table 5).

Table 5. Time schedule for synchronization and artificial insemination

Activity	Day	Time	Group 1	Group 2	Group 3
CIDR	0	8-10 AM	15/10/2011	16/10/2011	17/10/2011
PMSG + PGF2A	9	10-12 AM	24/10/2011	25/10/2011	26/10/2011
CIDR remove	11	10-11 AM	26/10/2011	27/10/2011	28/10/2011
Heat detection	12	15-17 PM	27/10/2011	28/10/2011	29/10/2011
AI	13	7- 10 AM	28/10/2011	29/10/2011	30/10/2011

Goats were inseminated 24 hours after synchronization. 10 days after insemination, the goats returned to their flocks of origin were they were joined with regular bucks and provided with 18 -25 kg of oats and minerals for successful wintering.

Data recording and fiber analyses

Kids born from inseminated does born between 21 of March and 2 of April 2012 (that is a minimum gestation length of 145 days and a maximum of 155 days) were accepted as Texan buck offspring. Birth weight, sex and birth type were recorded on Texan offspring and on other offspring born up to 22 of April (that is 20 days after last Texas born offspring). Further body weights were recorded at about 6 weeks, 6 months and 12 months of average age. At about 5-month of age visual assessment of fleece quality was performed and a fleece sample was taken and analyzed. At about 12-months of age goats were shorn, fleece weights recorded and samples taken for analyses. Visual assessment of fleece quality was based on evenness, softness, length and medullation. Goats were classed into inferior, average or superior.

Fiber samples were analyzed at the fiber laboratory of the National Institute for Agricultural Technology (INTA), Bariloche, Argentina. Greasy samples were divided in two subsamples. One subsample was analyzed with an OFDA 2000 instrument which yielded fiber diameter (FD, mic) its standard deviation (SD, mic) and coefficient of variation (CV, %). Comfort factor (CF, %), fiber curvature (Curv, Deg/mm) and fiber length (FL, mm) were also obtained from the OFDA. The second subsample was minicored at about 1 cm from the base and 1 cm from the tip of the staple. The resulting 2 mm long fiber snippets were analyzed with a projection microscope. On 300 snippets from each fraction (base and tip) medullated fibers were counted. Medullated fibers were classified as being med or kemp fibers. Med fibers (med, %) are those continuous or fragmented medullated fibers where the diameter of the medulla is less than 60% of the diameter of the fiber and kemp fibers (kemp, %) are those where the diameter of the medulla is 60% or more of the diameter of the fiber (ASTM D2698, 2001).

Statistical analyses

Med and kemp fiber percentages were transformed to the log scale as logx, such that logx=log(x+0.5), where x is the med or kemp percentage. A linear model with sex, farmer and genotype as fixed effects and age as a covariate were applied to all traits except birth weight, which was analyzed without the covariate. Sex effects were also removed from first shearing analyses since it was not significant. Least squares means were calculated with their standard errors. Statistic differences between genotypes were established at $P<0.05$.

Results

From the 237 inseminated does 26 offspring from Texan and 112 offspring from local bucks were obtained. A total of 7 Texan and 9 local bucks had offspring. Table 6 shows the distribution of measurements obtained from the offspring. Unfortunately not all sheared offspring were sampled, so that fiber traits were measured on 34 local and only 9 Texan offspring.

Table 6: Evaluated progeny (born in March-April 2012)

Sire ID	With birth weight	With fleece weight	With sample at 5 months	With sample at 12 months
Local (n=9)	112	110	8	34
19	4	2	1	1
20	4	3	0	2
21	5	5	3	4
23	1	1	1	1
45	1	1	0	0
59	1	1	0	0
9	10	10	0	1
Total Texan (n=7)	26	23	5	9

Least squares means are listed in Tables 7 to 10. Birth weights resulted higher in Texan kids but further body weights were similar between genotypes (Table 7).

Table 7: Early growth (born in March-April 2012)

Genotype	Birth weight (kg)	Weight at 6 weeks (kg)	Weight at 6 months (kg)	Weight at 12 months (kg)
Local	2.27	8.11	14.92	16.19
Texas	2.58**	8.08	13.84	15.85

** P<0.01.

At about 4-5 months of age fleece samples were collected and analyzed in the Bariloche Fiber Laboratory (Argentina) in July 2013. Results in Table 8 indicate a significant lower fiber diameter in Texan kids. Other differences tended to favor Texan kids but did not reach statistical difference. No difference between genotypes was found in medullation.

Table 8: Early fleece quality (sampling in August 2012)

Genotype	FD (mic)	SD (mic)	CV (%)	CF (%)	Curv (°/mm)	FL (mm)
Local	24.53	8.03	32.81	82.35	12.89	102.24
Texas	21.40*	6.72	31.26	92.61	13.71	114.30

	Base of fibers			Tip of fibers		
Genotype	Med (%)	Kemp (%)	Total (%)	Med (%)	Kemp (%)	Total (%)
Local	2.07	0.10	2.16	0.53	0.00	0.53
Texas	1.97	0.03	1.93	0.79	0.00	0.79

* P<0.05.

First fleece weight and staple length (measured with a ruler on the skin of the goat) were significantly higher in Texan buck offspring (Table 9). Interestingly visual fineness resulted not different.

Table 9: First shearing (March-April 2013)

Genotype	Fleece weight (kg)	Staple length (cm)	Visual Bradford fineness
Local	0.62	16.21	57.73
Texas	1.14**	20.39**	56.98

** P<0.01.

Measured fiber diameter in Texan offspring was finer than in Local offspring. Also Comfort Factor and Fiber Curvature were higher in Texan offspring. The large difference in medullation, in particular med fibers measured at the base of the fibers resulted not statistically different. Most probably, due to the low number of samples available in Texan offspring.

Table 10: First fleece quality (March-April 2013)

Genotype	FD (mic)	SD (mic)	CV (%)	CF (%)	Curv (°/mm)	FL (mm)
Local	27.4	8.1	29.6	67.9	13.2	158.2
Texas	22.5*	6.9	30.2	91.1*	16.4*	157.2

	Base of fibers			Tip of fibers		
Genotype	Med (%)	Kemp (%)	Total (%)	Med (%)	Kemp (%)	Total (%)
Local	3.17	0.31	3.48	0.20	0.02	0.22
Texas	1.38	0.14	1.52	0.74	0.00	0.74

* P<0.05.

Visual assessment of progeny resulted in a much higher percentage of "superior" animals born from Texas progeny (Fig. 2).

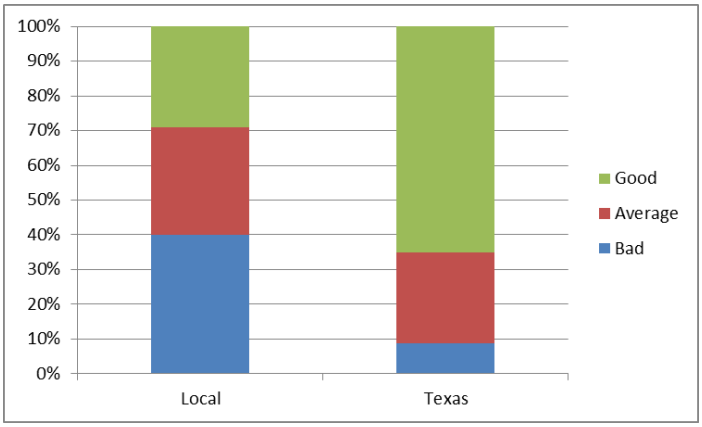


Fig. 2. Visual assessment of progeny

Discussion

Texas progeny resulted far better in terms of fleece weight, fiber diameter and visual appearance. A critical assessment relates to medullated fibers content for which the differences were also clearly favorable to the Texas crosses, although these results did not reach statistical significance. Considering the distribution, percentages were transformed to a logarithmic scale, but the transformed values did not improve sufficiently the statistical analyses. Therefore the small sample size probably explains best the lack of statistical significance. It was expected to obtain more than double the number of offspring and it was expected to collect samples from all crossbred progeny. Low semen fertility, probably due to loss of nitrogen during transport resulted in a small progeny crop. Logistical problems during shearing time prevented collection of all samples. Nevertheless the results available are clearly positive in improving Mohair quality in Tajik Angoras.

Past introduction of American Angoras originated present day Angoras in the country. There were further introductions but no information on their effects was found in the literature. Little information is available on the impact of Angora introduction and upgrading of local Angora populations in other countries as well. The effect of upgrading Turkish Angoras with American Angoras was reported by Gerstmayr et al. (1995). In their experiment a 30% increase in birth weight and an 11% increase in yearling fleece weight were observed, but negligible effects on older body weights, staple length and fiber diameter. Medullation was not measured. The conclusion of

this experiment was that upgrading with American Angoras was unexpectedly poor and it was considered questionable to invest in American Angoras to improve Turkish Angoras.
The discrepancy with our results might well be related to the particular imported animals used. The genetic quality of the American Angoras used in Turkey is not described in their experiment. In our case we know from central performance test results that we introduced amongst the best Angoras available and from several unrelated bucks.
South African Angoras were also introduced and tested in Turkey. In this case no body weight differences were found and fleece weight differences appeared at older ages in favor of the F1 (Günes et al., 2002). Again, medullation was not measured. South African Angoras were also tested in New Zealand (Newman and Paterson, 1999). Purebreds and crosses were sampled on different parts of the fleece. Med and kemp percentage was much lower in crossbreds (2.4 and 0.7%) than in New Zealand Angoras (6.2 and 2.8%), staple length was shorter in the New Zealand Angoras but fiber diameter was similar. In general traits were more uniform over the body of the animal in South African Angoras.
The import of semen resulted highly advantageous. Remaining semen should be used in multiplier flocks. Further research is needed to establish if heterosis effects were important and if there are unwanted side effects such as disease susceptibility or fitness reduction.

Procured bucks (test numbers). The last picture shows a buck purchased from a well-known breeder (Mr. Speck) that was added to those bought at Sonora auction

Annex 4. Developing the yarn product and a centralized yarn processing model in Northern Tajikistan

Research on markets for high value-added yarn

Research on yarn production in the pilot region

In 2009 – 2010 the project team conducted research on mohair processing and marketing in the Asht region in northern Tajikistan. The Asht region is one of the centers of Angora goat production and women in Asht have been spinning mohair yarn for sale for several decades. In some villages, as many as 20-25% of adult women spin and sell yarn throughout the year. The system of yarn production is the following – a spinner goes to a weekly mohair market and purchases one or two cheap mohair fleeces for ~25 somoni/kg ($5.20). She processes the fleeces into yarn within a week or two, brings the yarn to the market and sells it for 40 somoni/kg ($8.30), earning about 15 somoni for spinning 1kg of yarn ($3.12). It takes her two days to scour, card and spin the yarn – her daily earnings are about $1.56. The quality of the fiber and the yarn is low, and so are the woman's earnings. Local traders buy the yarn from spinners and use it to produce cheap, coarse socks or mittens for export to Russia.

Spinners selling yarn at the mohair market, Asht region

Exploring alternative markets for high value-added yarn

The project team searched for alternative, more lucrative markets for mohair yarn, including the US market for knitting yarns. Research on yarn sales in 2010 indicated that the US knitting yarn market was growing, with thousands of yarn stores across the US offering luxury wool, silk, mohair and cashmere yarns from many different countries that sold for high prices. Based on the prices of mohair knitting yarns sold in the USA, the project estimated that a Tajik spinner could produce and sell 1kg of high quality yarn for $50-70 as opposed to 1kg of low quality yarn for $10. However, the spinner would need quality kid

mohair fiber and the yarn would have to be evenly spun to compete with commercial, machine-spun yarns on the US market.

Selecting a product to imitate & compete with

The project conducted a thorough research of luxury mohair knitting yarns sold in the United States and selected a 4-ply commercial mohair yarn the Tajik spinners could try to replicate using their small electric spinning machines or spindles. This 100% kid mohair yarn from Australia called "Wagtail yarn" (http://www.wagtailyarns.com.au/online-store/yarns.aspx) became a prototype for the production of 100% kid mohair yarn handspun in Tajikistan. The project planned to sell the new Tajik yarn at the same price point as the Australian yarn ($140 wholesale, $280 retail), and make sure it was of equal quality.

Wagtail Mohair, http://www.wagtailyarns.com.au/online-store/yarns.aspx

The product development process was challenging – the team searched for the most talented spinners in several villages and for the highest quality kid mohair fleeces on multiple farms to combine the best raw material and the highest spinning skills to produce yarn equal to or better than Wagtail yarn - fine, soft, lustrous and attractive to American knitters.

Tajik spinners with first samples of the new kid mohair yarn

The project coordinator took samples of yarns made by different spinners to a knitting store in Madison Wisconsin, USA and worked with a group of professional knitters to test the samples by knitting swatches and provide direct feedback to the spinners.

Wisconsin knitters test yarn samples made in Tajikistan by knitting swatches

Discovering deficiencies of Tajik mohair

The greatest technical challenge in producing competitive yarn comparable to the Australian Wagtail yarn was the quality of Tajik mohair. Tajik mohair fleeces were heterogeneous and included a relatively large percentage of kemp and medulated fibers[3]. This made the Tajik mohair yarn more scratchy and not as soft and lustrous as the Wagtail yarn. The only way to remedy this problem was to dehair the fleeces prior to spinning. The dehairing involved separating medulated fibers, kemp and down from the fleeces either by hand or by using a comb. The dehairing technology was developed by one of the spinners after all attempts at finding a sufficient supply of kemp-free fiber had failed.

Dehairing Tajik mohair with a comb

After a yearlong process of sample production and testing, the Tajik spinners started to produce yarn that could successfully compete on the US market and was comparable to the Australian yarn "Wagtail Yarn,"

[3] The deficiencies in the quality of Tajik mohair result from the lack of targeted breeding against kemp and medulated fiber. Targeted breeding against kemp is practiced by Angora goat producers in all major mohair-producing countries such as South Africa, Australia, USA and Argentina. These countries are closely linked to the global mohair market, their national breeding programs are responsive to market demand and quality standards, and breeders are well aware of the increasing demand for soft, fine fiber that can be knitted into luxury clothing. Tajikistan, on the other hand, has been traditionally linked to the Russian market that demands strong mohair used for brushed shawls and utilitarian knits that are used primarily for warmth, not fashion. In addition, breeding activities in Tajikistan have been undermined by the breakdown of the Soviet Union and the civil war that followed. More recently, private producers started to replace state Angora goat farms. However, unlike farmers in more developed countries, the Tajik producers lack governmental support in breeding, are poorly informed about changes and trends on the global fiber market and poorly connected to it. In fact, Tajik farmers started to learn about the value of fine, kemp-free fiber only thanks to the efforts of the ICARDA project.

only handspun. The yarn, made from manually dehaired fiber, was named “Mohair Magic.”

Tajik Mohair Magic yarn can successfully compete with Australian Wagtail mohair yarn

Comparing prices and quality of Tajik and American mohair

To fully understand the differences between Tajik and American mohair, the project organized a comparative processing experiment: it imported kid mohair fleeces from the Cerulean Farm in Oklahoma, USA to Tajikistan, and spun them into yarn. The American fleeces could be spun without dehairing into beautiful, lustrous yarn. The experiment clarified how much would Tajik producers benefit from breeding higher quality goats. The project team calculated that the processing groups would be able to purchase American-style mohair fiber for $20/kg and it would still be cheaper than buying Tajik kid mohair for $5 due to the dehairing cost and the waste. In other words, Tajik farmers could substantially increase their income by producing better goats and selling their fiber for $20/kg as opposed to $5/kg, and local spinners could process the improved mohair into quality yarn more cheaply and efficiently, even if they had to pay 4 times as much for it.

Kemp-free American kid mohair test-spun in Tajikistan

Test-marketing the new yarn

The next experiment was to test-market the new "Magic Mohair" yarn and assess market demand. During the second and third year, the project test-marketed the yarn in American yarn stores and at the Fair Trade Holiday Festival in Madison, Wisconsin. Samples of yarn were also exported to Wien, Austria. The yarn sold successfully, and received many compliments from customers. The project started receiving orders for larger quantities from small distributors and yarn stores. After confirming a solid demand for the new yarn at a wholesale price of $140/kg and a retail price of $280/kg, the project team began to develop a yarn production model that would allow the spinners to: 1) scale up production, 2) maintain quality standard, 3) decrease production cost, 4) fulfill export orders, 5) ensure fair wages for producers and as well as reasonable prices for distributors and customers.

Developing a centralized processing model to scale up yarn production

Experiment in working with individual spinners

During the second, third and fourth year, the project worked on developing a processing technology & business organization that would allow the women to produce the new yarn in a larger volume and consistent quality. Initially the project experimented with the simplest model - asking individual spinners who made yarn for the Russian market to produce "Magic Mohair" yarn of the desired quality for the American market, offering to pay $60/kg. Although the payment was very lucrative, the women could not successfully manage all processes required to produce the yarn: some could not find quality fiber, some did not invest enough effort into dehairing it, others did not wash the fiber or yarn correctly or could not spin it evenly. As a result most of the yarn the individual spinners offered for sale did not meet the required quality standard.

After trying to work with a number of individual spinners in several villages without satisfactory results, the project team concluded it needed to develop a more sophisticated production model that included a set of synchronized processing operations. Each operation had to follow clear technical and organizational guidelines to deliver quality output, which would be the input for the next processing step. The processing would start with the purchase of high quality raw fiber in a sufficient quantity. This fiber would then have to be dehaired, scoured, carded, spun and dyed according to standard by trained groups of women organized by a capable leader. Technological, organizational and pricing guidelines for all these processes would have to be developed.

Finding a group leader

Prior to forming a processing group, the project searched for a group leader. The team interviewed many spinners and tested their samples until it selected the most experienced spinner, Ms. Tuluikhon Abdulazizova from the Markhamat village, to become the group leader. The team then collaborated with Ms. Abdulazizova on forming the first processing group and developing all processing operations.

Ms. Tuluikhon Abdulazizova became the leader of the Markhamat spinning group

Developing Fiber Purchasing

The first step in developing the processing model was to set up a fiber purchasing system that would allow the team to buy a sufficient quantity of quality mohair during the spring shearing season. The project team received funds for mohair purchase from the ICARDA project, and worked actively on the weekly mohair market in Khodzhand in 2010 and 2011 to learn about fiber quality and prices, establish linkages with farmers and traders, and train mohair buyers. In the course of two seasons in the project team established quality standard and price for kid mohair suitable for processing, and trained farmers, traders and spinners how to select quality fleeces. The team promoted direct linkages between the processing group and the farmers and arranged for the group leader to visit farms and select and purchase

kid fleeces. The team also introduced advertising to draw producers' attention to the new market for kid mohair. This was the first time advertising has been used at the mohair market in Tajikistan.

The project team, the women processors and the farmers collaborated on improving the purchasing system in 2011-2013. The team identified farmers who produce the highest quality mohair and some of those farmers were trained to select kid fleeces for the project during shearing. Mohair traders who travel to different farms were also trained to collect finer, quality fleeces for the processing groups. The price for quality kid mohair has been set at $1-2 above the current market price for standard kid mohair ($6.25 – 7.30/kg) to motivate farmers to sell quality fleeces to the processing groups.

The purchasing system works well and the farmers, buyers and women processors have the capacity to collect up to one ton of quality mohair during the season. A ton of mohair can be processed into 700 – 750 kg of yarn and products and provides enough raw material for all processing groups established by the project to date. While developing the purchasing system in 2011-2013, the project team purchased close to one ton of mohair which is currently being processed into yarn. The fiber purchase has been financed by the ICARDA project. The new AKF project will help the groups develop financing for fiber purchase in 2014. Funds earned by the groups from yarn sales in 2013-2014 can be also used for this purpose.

Group leader helped select and purchase quality kid mohair from farmers

Dehairing

The next activity the project organized was dehairing. The team developed two methodologies for dehairing different types of mohair fleeces in collaboration with lead women processors. One method involves dehairing fiber by hand, the other using a comb.

The project team trained groups of women in both dehairing methods and established a price for each method. The women receive $11 for 1kg of fiber dehaired by hand and $14.60 for fiber dehaired using a comb. The team developed an organization for the dehairing that includes distributing raw fiber to the dehairers, collecting the fiber, checking quality, paying the dehairers and recording the transactions. In 2013 the main dehairing group located in the Markhamat village in Asht region included 12 women. Based on interview with the dehairers conducted in October 2012 and April 2013, the women were satisfied with the pay and considered the work easy. They could dehair fiber at home whenever convenient and the demand for the dehairing work among women in the villages was strong.

Dehairing using a comb

The project team took a lead in setting up the dehairing module, and then trained the group leader in managing the dehairing and placed the operation under her control. The leader now receives raw fiber from the project, distributes it to the dehairers, collects the dehaired material and pays the women. She keeps a record of the fiber distributed and collected and of payments to the dehairers. She receives 10%

surcharge for organizing the dehairing (i.e. adds 10% to the payment for the dehairing).
Although the dehairing system works relatively well it is an operation that substantially increases the cost of yarn production and makes it more complex and less efficient than it would be if the women had access to quality mohair. However, it is the only way to compensate for the deficiencies in mohair quality until the breeding improvements yield results and the Tajik mohair becomes more homogeneous and kemp-free.

Group leader packaging dehaired fiber collected from the dehairing team

Scouring

The following step in processing is scouring. Spinners in the pilot region were already experienced in scouring mohair fleeces and the technology was well developed: the women first wash the fiber in hot, soapy water in large, outdoor kettles normally used for cooking**.** Then they rinse the fiber in a stream that runs through the village. Although this method is suitable for washing a small volume of fiber, it is laborious and inefficient when washing larger quantities needed for the scaled-up processing. It is also hazardous for the women to try to wash fiber outdoors in winter.

Women rinse fiber in the stream

To develop a functional scouring system for a larger volume of fiber, the project would have to invest approximately $6,000 to purchase scouring equipment (large, old washing machines) and build a water supply pipe to the house of group leader. The project did not have funds for such an investment and the women have to scour large batches (10kg) of mohair the same way they scour small amounts of fiber. The women receive $2 for scouring 1kg of fiber and the scouring is organized and monitored by the group leader. It is essential to improve scouring in the future to lower cost, increase efficiency and make the process easier for the women.

Group leader with scoured fiber

Carding

The next step in fiber processing is carding. The carding technology for mohair was also developed – women brought washed mohair fleeces to one of several carding shops in the area and paid approximately $1 for carding 1k of fiber. To increase efficiency and control quality, the project helped purchase a used carding machine for the lead processing group in Markhamat village in 2012 for $2,000. The women are now able to card the fiber themselves as opposed to taking it to a carding place in another village. The carding machine was purchased half and half with project funds and with profits from yarn sample sales. Although the machine was used and requires frequent adjustments, the group leader is overall satisfied with its performance.

The group leader does most of the carding herself. She uses only scoured mohair, opens the locks by hand and slowly cards the loosened fibers. She cards 5 – 10 kg of fiber and blends it to create uniform raw material. She then distributes the fiber to spinners. The price for carding was set at $2 for 1kg of carded material.

Carding on an "Orlovchanka" carding machine

Spinning

From 2010 to 2013 the project team and the group leader collaborated on developing the yarn spinning technique and organizing a spinning group that could consistently and efficiently produce yarn according to standard. The standard yarn is 4 ply and very even. The weight is anywhere from lace to sport, depending on the skill and preference of the individual spinner.

The group leader has been in charge of working with the spinners – training them, monitoring quality, supplying them with processed fiber and paying them for the spinning. Spinners who want to work with the group can come to the home of Ms. Abdulazizova for training. They begin training using their own wool and once they achieve the desired standard they receive the dehaired, washed, carded fiber and start producing yarn for sale. Ms. Abdulazizova decides when a spinner is proficient enough to join the permanent group. Only about a third of the spinners successfully complete the training as not all women can develop the hand-eye coordination needed to spin high quality yarn. In spring 2013, 16 skilled spinners were part of the permanent spinning group and 20 spinners were being trained to spin fine yarn according to standard.

Trained spinner makes yarn for export to the US

The organization of the spinning group is the following: spinners receive 1kg of processed fiber and bring the yarn to Ms. Abdulazizova when all fiber is spun. The spinners are paid per meter of yarn and receive $31.25 for spinning 3750 meters of yarn which is approximately 1kg. Ms. Abdulazizova charges a 10% surcharge for organizing the spinning. Proficient spinners can produce over 300 grams of yarn per day, earning around $9.40. This is five times what they could earn producing low quality yarn for the Russian market. In addition they do not have to spend time selling their yarn or invest in buying raw fiber.

The spinners produce two types of yarn from two types of fiber – luxury, very even, fine yarn from dehaired mohair, and slightly coarse yarn from fiber that remains after dehairing. The undehaired yarn will be sold as sock yarn, and locally processed into socks for export. Spinners who produce the lower quality yarn are paid $21 per 3,750 meters of yarn. The project team works on developing a third type of yarn – a lace mohair yarn spun on a silk cord. This yarn will be excellent for knitting lace garments and is expected to find a good market. The silk cord for the yarn is imported from Uzbekistan.

The most challenging aspect of the spinning work is to maintain consistent yarn thickness and twist. Although most spinners have their own "signature" when it comes to weight and style, the group leader is responsible for monitoring that they maintain consistency and their skeins do not differ in thickness and twist. Even a slight difference between skeins that is barely noticeable can affect the quality of the knitted product. That is why all skeins that differ have to be marketed separately which creates difficulties for retailers. It takes a spinner on average one year of practice to achieve full consistency in spinning.

The consistency, quality and also productivity increase when spinners work together in a shop. This is because the women can fully concentrate and also because the group leader can easily monitor their work. The ICARDA project did not have sufficient funds to help the group with a workshop and the Markhamat group occasionally uses the home of the group leader to work together.

The spinners enjoy working together but do not yet have a workshop

Establishment of a spinning workshop would substantially improve organization, quality and efficiency of yarn production. It would increase the spinner's productivity and the yarn quality and allow the group leader to pay spinners more frequently, for example after they complete a single skein. It would provide the group with a space to set up a generator or solar panels and work during winter months when there is no electricity in the village. The new AKF project plans to help the group set up a workshop in 2014.

Dyeing

The last operation the project tried to develop is dyeing yarn. American buyers are interested primarily in dyed yarns and the project trained women in Markhamat and other nearby villages in dyeing yarn with natural and chemical dyes. The yarn dyeing operation is also not fully organized for scaled-up processing. Similar to scouring, the project did not have sufficient resources to organize a dyeing center which would require running water and large stainless steel containers with a heating element that could be used to dye large lots of yarn. The project did supply the group with quality dyes imported from the USA, and the women currently dye smaller batches of yarn in large pots on electric burners.

Women were trained to dye mohair with natural dyes

Improving scouring and dyeing is a priority and the Markhamat processing group plans to invest some of the proceeds from mohair sales to improve these operations in 2014.

Financing and accounting

The ICARDA project provided financing for all processing operations and the project team worked with the group leader to develop an accounting system to manage the funds and document all other business transactions. It has been a challenging task given that prior to becoming the group leader, Ms. Abdulazizova had no experience in accounting or even simple record keeping. With the assistance of the

project team she learned how to maintain an accounting system which is continuously being improved and will serve as a model for other processing groups. In order to help her keep records of financing all processing groups and operations (dehairing, scouring, carding, spinning and dyeing), the team gave her a separate folder for each operation. Each folder includes a notebook and prepayment funds for processing a certain volume of yarn (40 kg). When she pays the dehairers, for example, she takes funds from the dehairing folder and records the transaction in the dehairing notebook. This system has proven very effective and transparent for the leader and the project team.

In summer 2013 the project team and the group leader began working on setting up an electronic version of the accounting system. The electronic account will be maintained by Farhod Kosimov who is the leader of the mohair processing Hub, and updated on monthly basis.

Farhod Kosimov and Ms. Abdulazizova maintain an expense account of the processing business

Communication, coordination and other logistics - (Hub)

The last component of the processing model is a support center that links all processing groups with international buyers and helps them to secure, fill and ship export orders – the Hub. In 2012 the project team began working with Farhod Kosimov, a graduate student and a fiber specialist, on setting up a Hub for processing groups. Mr. Kosimov has experience with evaluating mohair fiber, yarn and products, understands fiber processing technologies and has worked effectively with women's groups since the start of the project. He agreed to manage a Hub that unites all processing groups and helps them to communicate with buyers, receive orders for yarn and products, fill the orders, ship products and arrange payments. All women and men who work in mohair production and processing know and trust Farhod which gives him the authority to represent them vis-à-vis local and international buyers. Mr. Kosimov's brother, Alisher Kosimov, is fluent in English and helps Farhod to correspond with foreign buyers.

The Hub will also help the groups to develop into small businesses by informing them of current

legislation regarding business registration, taxation, etc.. Mr. Kosimov will help the groups register, open a bank account, pay taxes and obtain legal assistance and information about their rights and obligations vis a vis governmental agencies.

Marketing products through the Hub

The Hub helped the group to accomplish their first shipment of yarn to the US. In winter 2012 the producer group led by Tuluikhon Abdulazizova produced 30kg of yarn that was shipped to the United States in spring 2013. The Hub helped the group package the products and, after a long search and exploration of a variety of shipping options, decided to ship the products with DHL. Mr. Kosimov helped to prepare the shipping paperwork including veterinary certificates and all other documents required by Tajik governmental agencies. The project team helped him with US tariff numbers for all the products required by US customs. In March 2013 the yarn and products were successfully shipped to the yarn buyer (Knit Outta the Box) in Washington, D.C. 20kg of dyed yarn was immediately sold and the Hub helped to identify the cheapest way to send $3,187.33 from the yarn buyer in USA to Tajikistan. It also assisted Ms. Abdulazizova with opening a local bank account for the group. The group will be saving the earnings from sales to invest into processing in 2014.

The first shipping experiment allowed the project team to calculate the actual FOB price for the yarn. The FOB price for 1kg of yarn is calculated as follows: $80 production cost + $25 profits + $2 packaging and documentation + $10 tariffs & fees in the US per 1kg of yarn + $20 shipping cost per 1kg of yarn + $3 other expenses = $140

Production model in action in 2012-2013

In spite of the shortcomings outlined in the description, the business/processing model developed together with the Markhamat group was fully operational in 2012 - 2013. In spring 2012 the team purchased kid mohair fiber on the market, with the help of the group leader who was helping to select quality fleeces. The Markhamat group then received funds for processing and produced 30kg of yarn for export. The project coordinator found a buyer for the yarn in Washington D.C. and the yarn was shipped to the USA with the assistance of the Hub in spring 2013. Payment for the sold yarn in the amount of $3,187.33 was received and deposited to the group account. Payments for the remaining 10kg of yarn will be received as the yarn in sold and wired to the group.

The first processing and marketing experiment helped the group calculate prices along the entire value chain including the FOB price to the USA, and estimate the processing time needed for the next 30 kg of fiber. The group leader estimated that her group could produce 30kg of yarn by early September 2013. The Hub leader and the group leader also calculated how much money it would cost to fund the processing - to dehair, scour, card, spin and dye 30kg of yarn. The group leader received pre-payment for all these operations in separate folders, with instructions to record the expenses in notebooks included in the folders. In July-August the production process was ongoing and the yarn is expected to be ready for shipping in September 2013. This will allow the buyer receive the yarn in time to market during the peak winter season. The group leader and the Hub leader will maintain an electronic account of all expenses, earnings and profits in the course of the processing cycle.

Replication of the yarn production model in 2013

Now that the yarn production model has been tested, it can be replicated. The project began replicating the model by training the leader and members of a new group from Taboshar village. The leader of the new group visited the Markhamat village in May 2013 and received training on yarn production and how to organize a processing group. The new group now includes 20 women and is starting to produce yarn

samples that will be sold together with the yarn produced by the Markhamat group. The replication of the processing model will not only increase the number of women earning income from processing, but generate competition and collaboration between the groups with a positive impact on their growth and development. However, the new group will face the same problems with poor scouring and dyeing infrastructure, lack of workshop facilities and access to electricity in winter. These problems need to be resolved for both groups to become efficient and sustainable.

Leader of the Markhamat group trains women from the Taboshar group

Product sales during project duration

After scaling up yarn production, the project team developed stable market outlets for the yarn in Wisconsin, Washington D.C and Colorado. It also started collaborating with clothing stores in Madison, Wisconsin on marketing knitwear and established a market outlet for mohair blankets and knits at the Hyatt Hotel gift shop in Tajikistan. Yarn was also sold to knitters from the US Embassy in Dushanbe, Tajikistan. Since the start of the project, samples of yarn and products for $9,293.84 have sold and $6,125.39 was reinvested into processing activities (Table 1).

Table 1: Product Sales and Reinvestment

Period	Markets/Buyers	Amount Received from Sales	Amount Reinvested into ICARDA Project	Used for	Remainder
2008	Sow's Ear yarn store, "Spirals" store, Madison WI	$921.22			$921.22
2009 – June 2010	Fair Trade Show, Madison, WI, USA "Sow's Ear" yarn store, Madison WI, USA	$1,020.58 (yarn and scarf samples)			$1,941,80
January 2009			$1,000 (wired to Matazim Kosimov)	Yarn sample purchase	$941,80
August 2010	Yarn store, Vienna, Austria	$392.36 (yarn samples)			$1334,16
November 2010			$500 (to Farhod Kosimov)	Yarn sample & fiber purchase	$834,16
December 2010	Fair Trade Show, Madison, WI, USA	$702 (yarn and scarf samples)			$1536.16
March 2011	"Spirals" store, Madison WI, USA	$153 (scarf samples)			$1689.16
April 2011			$500 (Liba Brent, Farhod Kosimov)	Mohair fiber purchase	$1189.16
May 2011			$500 (Farhod Kosimov)	Samples of yarn & knitted products	$689.16
June 2011	"Sow's Ear" yarn store, Madison WI, USA	$102.60 (yarn and scarf samples)			$791.76
July 2011	"Clothroads" yarn retailer, Colorado, USA	$452.12 (yarn samples)			$1243.88
August 2011	"Sow's Ear" yarn store, Madison WI, USA	$107 (yarn samples)			$1350.88
September 2011			$10.41 (Tuluikhon Abdulazizova)	Yarn samples purchased from Ms. Abdulazizova	$1340.47
September 2011			$300 (Tuluikhon Abdulazizova)	Mohair dehairing	$1040.47
October 2011			$80.83 (Tuluikhon Abdulazizova)	Yarn for carpets	$959.64
October 2011			$62.50 (Dilorom Khaitova)	Knitted samples purchased	$897.14
October 2011			$250 (Nazir)	2 spinning machines purchased	$647.14
November 2011			$520 (Dushanbe market)	Solar panel purchased	$127.14

December 2011	Fair Trade Show, Madison, WI, USA	$761.00			$888.14
December 2011			$50 (fee for participating at the Fair Trade Show, Madison WI	Fee paid to CALA, Madison, WI	$838.14
April 2012	Yarn to Sara Penhune from US Embassy	$124.00			$962.14
April 2012	Yarn to Joe Gross from US Embassy	$114.00			$1,076.14
May 2012			$1,000 to Matazim and Farhod Kosimov	purchase ½ of carding machine for spinner's group	$76.14
June 2012	Yarn to Sara and Joe from US Embassy	$338.00			$414.14
December 2012	Mohair Blanket sold at Fair Trade Holiday Festival	$75.00			$489.14
April 13 2013	Order from American Embassy	$131.48			$620.62
April 2013			$769.50 to Matazim and Farhod Kosimov	Purchase of 104kg of kid mohair for processing purchased	- $148.88
April 2013	Sales from Hyatt Hotel	$375.00	$245 payment to Shoira Kosimova for blankets		-$18.88
May 13 2013	Knit Outta the Box	$2,528.96			$2,510.08
May 13 2013	Peace Fleece	$172.15	$172.15 to Farhod and Matazim Kosimov for fiber sold		
May 13 2013	Purchase of Mohair sweater from Dilorom	$165.00	$165 Payment to Dilorom Khaitova		
July 21 2013	Yarn sale to Clothroads	$658.37			$3168.45
Total		**$9,293.84**	**$6,125.39**		**$3168.45**

Annex 5. Implementation of the cashgora breeding program in Badakhshan, Tajikistan

Introduction

A baseline study undertaken in Badakhshan, Tajikistan showed that the rural population is mainly involved in agriculture and that livestock production is a major source of income. Most domestic animals are goats followed by sheep and a few cattle. Goats that belong to individual households of a village graze together as a communal flock with farmers taking turns in shepherding the animals to pasture each day. From May to September the village flocks migrate to summer pastures. None of the households interviewed practice directional selection of breeding animals. Some of the households keep one or two non-castrated bucks that mate with goats in the communal flock. These bucks are selected randomly and there is no trade or purchase of bucks from other villages. As a result of this unorganized, unselective breeding, there are many different types of goats in the village herds and most of them are not particularly good as either meat or fiber producers. The local meat type goats represent about 65% of animals in the flocks. Out of the 35% of fiber type goats, approximately 20% are Angora crosses, 10% are Altai crosses and 5% are local cashmere-type crosses. Some of the meat-type goats produce 50-150 g of fine, short cashmere; the Angora crosses produce 500-700 g of 20-24 mic fiber that is about 4-8 cm in length; the Altai crosses produce up to 500 g of light to dark brown cashgora-type fiber that is 17-21 mic and 3-5 cm in length; the cashmere-type crosses produce fiber that is 16-18 mic and about 3 cm in length. Because of the short staple length, cashmere-type fiber is not suitable for hand spinning, cashgora-type fiber is preferable. It was concluded that the village households would benefit from increased productivity of local goats in terms of meat and fiber through a proper breeding program.

Materials and methods

Target population

Based on accessibility from the city of Khorog in the Ishkashim district of Badakhshan, eight villages with a total of 2,568 people belonging to 334 families were considered for the breeding program. The villagers and community leaders interviewed by the research team showed a great interest in developing a goat breeding program. All producers understood the importance of improving the overall productivity of their goats and proposed methods of organizing a community based breeding program. A preliminary survey held in 2010 on the number and type of goats involved in each village is shown in Table 1. Major goat groups include: crosses of indigenous goats with cashgora-type of goats, crosses with mohair producing goats, indigenous goats with and without cashmere fiber. The number of cross-bred does in each village is an indicator of nucleus candidates and the number of goats combed is an indicator of the interest in fiber production in each village (Table 1).

Table 1: Distribution of project participants and their goats.

Village name	People	Families	Goats	Cross-bred does	Goats combed
Andarob	437	56	366	140	138
Dasht	296	37	310	88	41
Devlokh	155	19	198	60	0
Garmchashma	620	86	228	58	96
Khaskhorog	261	32	257	69	49
Kukhilal	245	30	464	109	47
Snib	265	37	243	68	30
Syst	289	37	210	23	42
Total	**2568**	**334**	**2276**	**615**	**443**

Breeding objective

From discussions with farmers, extension officers and traders it became clear that in addition to size, health and reproductive ability of the goats the objective is to increase the production of white cashgora fiber that can be spun, dyed and knitted into colorful products such as the Jurabe socks which contribute substantially to the income of the farmers, in particular rural women.

Breeding structure

A simple village (community) based breeding structure was envisaged and discussed with farmers. The structure is requires to identify best females in each village and mate them with the best males available in a nucleus flock. By doing so, the probability of obtaining outstanding males in the nucleus is increased compared to the traditional all-flock random mating. Male progeny from non-nucleus females are castrated and nucleus born males become candidates to replace existing old or inferior bucks. The essentials of the breeding plan are the same for each village but operation differs slightly between them and between years following particular situations and agreements.

Selection of initial nucleus does

Selection of nucleus does was planned to be based on fiber quantity and quality amongst those females reproductively sound and healthy. Selected females are tagged. Fiber quantity was planned to be based on combed fiber weight and fiber quality determined visually with preference of white, fine and long cashgora.

Selection of initial nucleus bucks

Few adequate bucks were identified in the different villages; therefore it was considered importing cashmere producing bucks from Herat, Afghanistan or Altai cashgora bucks from Russia. The Herat cashmere goats were easier to import (on land) but have two disadvantages – they produce short cashmere (about 2 cm long) that would be much more difficult to process into yarn than cashgora. Secondly, they are raised in a different climate and might face difficulties adapting to the conditions in the Pamirs. The Russian Altai goats were more difficult to transport to Tajikistan but produce similar fiber to the present Altai and Angora crosses. Their fiber can be easily spun and they have a history of adapting well to the local conditions. According to the information obtained from their origin, Altai goats have a strong constitution, harmonic body structure and show good adaptation to harsh conditions of year-round rangeland grazing in mountain areas. It was decided to bring in 8 young (1.5-2.5 year-old) white Altai bucks produced near Novosibirsk as opposed to brown Altai bucks that were imported in the 1980s.

Selection of replacement females and males

Selection of male and female kids born in the nucleus of each village was planned to be based on visual assessment of own cashgora quantity and quality as well as on the reproductive performance and cashgora quality of its dam. Whenever possible, combed fleece weight and fiber analyses results were used instead of visual assessment for selection.

Implementation of the breeding program

The breeding program started in summer 2010 with the identification of nucleus does in each village flock. At the same time 8 Altai bucks were selected and bought in Russia. The selected bucks were transported by truck from the Altai farm to Novosibirsk, and flown from Novosibirsk to Dushanbe, Tajikistan. After two weeks in quarantine at the Tajik Livestock Institute in Dushanbe, the bucks were shipped by truck to Khorog and from there on to the villages arriving at the end of October 2010. At this time, mating had already started in village nucleus flocks with available local bucks. Each year additional nucleus does were selected and tagged. Additional nucleus does selected in 2012 have the following

characteristics: average live weight is between 22.3-31.0 kg; average cashmere yield ranges from 90-140 g (it needs to be noted that in 2012 fiber productivity was well below average due to malnutrition of the goats resulting from a very cold and long winter, and due to incomplete combing); over 90% of the goats produced fiber of first quality. The numbers of nucleus does of each village mated beginning of October in 2010, 2011 and 2013 are shown in Table 2.

Table 2: Number of nucleus does by village and mating season.

Village Name	2011*	2012
Andarob	132	130
Dasht		150
Devlokh	--	--
Garmchashma	180	160
Khashkorog	170	180
Kukhilal	--	--
Snib	--	80
Syst	--	--
Total	482	700

*Does at vaccination 28 Sep 2011.

The distribution of the individual imported Altai bucks, Altai crosses and other suitable local bucks in each mating season is detailed in Table 3.

Table 3: Selected nucleus bucks by village, mating season and breed type.

Village Name	2010	2011	2012
Andarob	5260-5089A	060-089A	9192X
Andarob	--	5315-2525A	7166X
Dasht	060-089A	060-089A	9508A
Dasht	--	5315-2525A	9379L*
Dasht	--	--	8428L
Dasht	--	--	9138L
Devlokh	5069-5085A	--	--
Garmchashma	5057-2295A	5215	5080-5434A
Garmchashma	--	--	9642L
Khashkorog	5278-2566A	9295	5315-2525A
Khashkorog	--	5069-5085A	9760X
Khashkorog	--	5057-2295A	7110L
Khashkorog	--	--	9868A
Kukhilal	5315-2525A	5315-2525A	--
Snib	5080-5434A	5215	9852L
Snib	--	--	9169X
Snib	--	--	9166X*
Syst	5259-5029A	--	--
Total	8	10	15

A: imported Altai; X: Altai cross; L: Local type; *: nucleus born (also 9168, 9139).

As mentioned before mating in 2010 started with unidentified local bucks but proceeded with the imported bucks. For the 2011 mating the villages of Andarob and Dasht decided to join their flocks and mate them together with the same bucks. In 2012 some selected nucleus born bucks were already available and used for mating. Some suitable local type bucks were also used in 2011 and 2012 to complete the required number since 3 of the imported Altai bucks were lost (deceased in fighting and accident). To avoid inbreeding, Altai bucks and their crosses and the selected local bucks were relocated at each site to ensure that each village had a different buck.

Nucleus progeny born in March 2011, 2012 and 2013 increased over time (Table 4). Progeny belonging to the smaller villages are included in the larger village flocks.

Table 4: Nucleus progeny by village and year of birth.

Village Name	2011[a]	2012	2013
Andarob	19 (6)	34	75
Dasht	13 (11)		85
Devlokh	0		
Garmchashma	2 (4)	30	49
Khashkorog	39 (5)	58	159
Kukhilal	(6)		
Snib	(9)		
Syst	0		
Total	73 (41)	122	368

[a] in parenthesis progeny from imported Altai bucks.

To prevent other than selected bucks from mating, inferior local bucks were castrated with the assistance of villagers in early 2012. Also about 300 base born and inferior male kids born in 2011 and 2012 were castrated.

Evaluation of the breeding program

Following FAO guidelines, evaluation of a breeding program should be in terms of broad socio-economic and technical criteria to evaluate the outcome, impact and management of the program.

From the socio-economic point of view:
The level of participation and dimension of the breeding program has been described in Tables 1-4. A large number of farmers (2568) of 8 villages participated in the planning and conduction of the breeding plan and share its benefits through the village wide use of imported and selected bucks and their improved progeny. Farmers were impressed by seeing the first results of targeted breeding that showed how using quality breeding bucks resulted in offspring that produced a larger volume of quality fiber and had a higher live weight. Combed quality fiber was readily marketed with improved prices or transformed into high value textile products.

From a technical point of view the following results were obtained:
The breeding program was not designed to prove genetic progress and rather was designed to be effective for genetic progress under village conditions. To formally prove genetic progress it would have been necessary, for example, to run a control flock or regress breeding values on year of birth. Control flocks are not available and population wide breeding values are not possible to calculate because of lack of comprehensive genealogy of the animals. However, genetic progress can be predicted from the design of the program making some assumptions, for example considering selection differentials. Combed fiber

production of imported bucks was about 50% higher than that of local bucks and selected local bucks were also about 50% better than regularly used bucks so that if such differences were of genetic origin we can expect an improvement of 25% in their progeny. The progress might be somewhat higher since does for the nucleuses were also selected to resemble more the Altai type. In fact the data collected in the villages show that combed cashmere weight is about 15% higher in Altai type does than in Local type does. Angoras are intermediate. Live body weights are fairly similar in the different breeds (Fig 1).

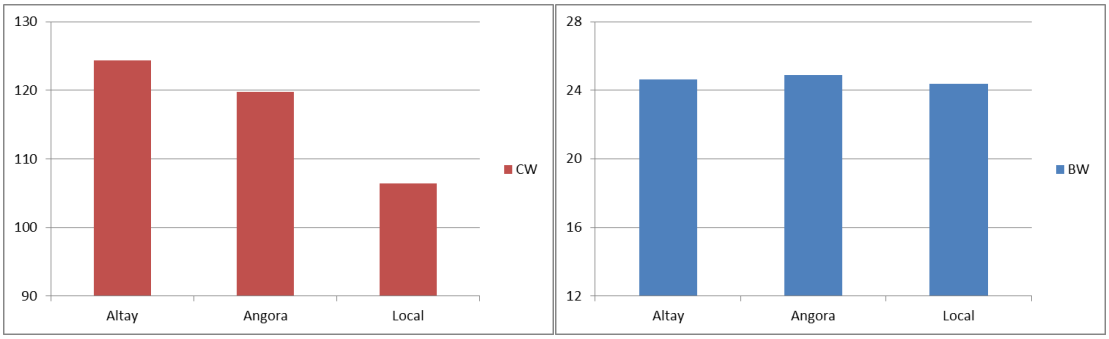


Fig 1: Combed cashmere weight (g) and live body weight (kg) in nucleus does of different breed types (average of 2012 and 2013).

Live weights of the breeding bucks were taken after their return from the summer rangelands in 2012. Altai bucks weighted 52.3 kg, Altai crosses 30.4 kg and local bucks 33.0 kg. Altai and Local bucks were adults and Altai crosses were young and still growing. Note: The largest local buck weighed 34.6 kg while the same indicator for young Altai crosses (1.5 year old males) was 28.0 kg. From these weights it is expected that live weight will increase considerably in the progeny of Altai bucks. Larger progeny will also produce more cashgora fiber since the correlation (of residuals of a model adjusting for other effects) between body weight of doe and its combed fiber weight is positive (r=0.27).

As the breeding program advances, annual genetic progress will also depend on generation interval. Generation interval is planned to be shortened by discarding old bucks and replacing them with young improved ones. Age structures of breeding males and females are easy to obtain from field data and may, in the future, help to infer annual genetic progress.

Eventually genetic progress should be apparent in the phenotypic performance of progeny born. In Table 5 the performance of the 3 first progeny crops is described. However from these results it is not possible to draw conclusions on production trends because of large environmental effects between years and because the dates of body weighing varied in each year and the fiber growing period also differed.

Table 5: Least squares means of phenotypic performance of nucleus progeny.

	Progeny born 2011				Progeny born 2012			Prog. born 2013	
Factor	BW	WW	CW	YW	BW	CW	YW	BW	WW
		168	397	397		365	396		44
Andarob	2.53	12.1	349	16.5	2.71	293	18.2	2.71	6.0
Dasht	2.41	11.9	342	16.3	2.77	282	19.5	2.62	6.1
Garmchashma	2.78	11.7	338	16.8	2.75	284	19.0	2.64	5.9
Khaskhorog	2.68	12.2	356	16.8	2.57	276	19.1	2.65	5.9
Snib	--	--	--	--	--	--	--	2.77	5.7
Females	2.56	11.8	344	16.1	2.55	272	18.4	2.39	5.6
Males	2.64	12.2	349	17.0	2.85	295	19.5	2.97	6.3
Black	2.59	11.9	346	16.5	2.72	285	18.7	2.73	5.9
Grey	2.59	12.0	345	16.4	2.72	281	19.2	2.63	5.9
White	2.63	12.0	348	16.8	2.66	285	18.9	2.67	5.9

BW: birth weight taken from birth up to 5 days of age; WW: weaning weight; YW: yearling weight; CW: combed cashgora weight. Note: Figures below WW, YW and CW denote average age of animals.

Coat color of bucks was not recorded systematically, although the use of the imported white Altai bucks increased the proportion of white bucks in the villages. The effect of these bucks on the color of the progeny born from black grey and white does can be seen in Table 6. More than halve of the progeny from black does resulted white (47%) or grey (12%) and 81% of progeny from white does resulted white.

Table 6: Number of progeny with different coat colors born from does of different coat color.

Color of Dam	Color of Progeny		
	Black	Grey	White
Black	18	5	20
Grey	8	4	20
White	4	3	29

Coat color is not dependent on environment and shows a clear progress in successive years (Fig 2). This is clearly an effect of the imported white Altai bucks. The frequency of the desirable white coat color animals has increased and will continue to increase.

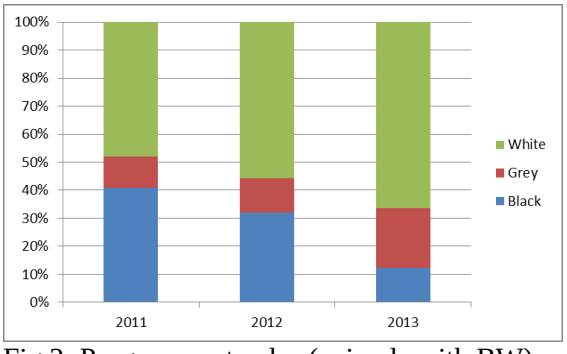


Fig 2: Progeny coat color (animals with BW)

The progressive increase of white coated does in the nucleuses and general flocks will also increase combed cashgora weights and not decrease liveweights. Data comparing productivity of adult does of different color indicate such relation (Fig 3).

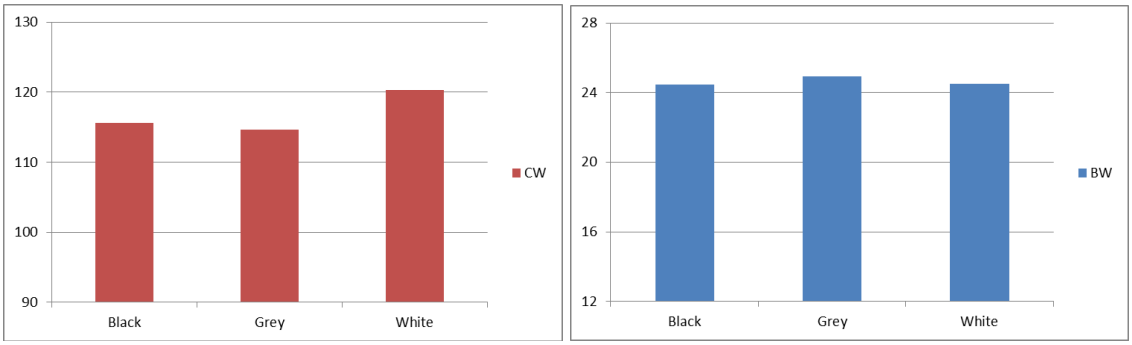


Fig 3: Combed cashgora weight (g) and live body weight (kg) in nucleus does of different coat colors (average of 2012 and 2013).

Sustainability

The breeding program has been implemented with external technical and economic support in the period 2010-2013 but is expected to be sustainable for several reasons. The program was purposely kept with minimum costs in order to assure a high potential for ongoing development and low risk of discontinuation. A line of command and allocation of responsibilities has been put in place for the critical feature of the program: selection, castration and nucleus mating. Farmers in all villages learned about market oriented selection criteria and would continue to focus on them since the benefit resulted tangible. Ideally castration of inferior bucks should be done by a veterinarian but many farmers were trained to perform this crucial task themselves. Selected, nucleus, animals should mate together; this has been undertaken by responsible nucleus keepers which were identified amongst farmers. These persons were acceptable to villagers and can continue this task. The principle of community based nucleus breeding is understood and can be continued with little external help but, clearly, active involvement of the local extension service would be very beneficial and would reassure continuation of the program, in particular helping participating farmers to discuss upcoming issues and opportunities in the community.

Annex 6. Characteristics of wool producer in Lakhol and Min-Bulak villages

A survey of wool producers was conducted in Lakhol and Min-Bulak villages located in the Naryn district in 2010.

The major objectives of the survey were to find out the current status of agricultural activities in households; to study smallholders' agricultural assets; to analyse farmers' perceptions on income generation and expenditures; to study their sheep wool production practices as well as their awareness about felt products; and to see their willingness to participate in this project. The project team developed a questionnaire, pretested it and conducted interviews of livestock producers in both villages.

There are about 1125 households in Min-Bulak, and 15 artisan women are involved in the project for fiber processing. About 210 households live in Lakhol, and 10 artisan women participate in the project. The number of the interviewed farmers was 51 in Lakhol and 35 in Min-Bulak. In Lakhol, 88% of respondents were men and 12% women, while in Min-Bulak only men answered the survey questions. By legal status in Lakhol (Min-Bulak) village a share of households formed 63% (64%) and that of the registered farms 37% (36%). The average farmland area accounted for 1.1 ha in Lakhol and 2.57 ha in Min-Bulak. Farmers in both villages mainly grow hay, and there are more farmers in Min-Bulak growing vegetables that can be explained by the larger arable land endowment compared to farms in Lakhol. As anticipated from the smaller cropland in Lakhol, Figure 1 indicates that there are more farmers in Min-Bulak than in Lakhol who have sufficient crops for both sale and feeding of livestock. The same figure shows that more farmers in Lakhol choose one of the two options, i.e. they either sell the entire harvested crops or only feed their animals.

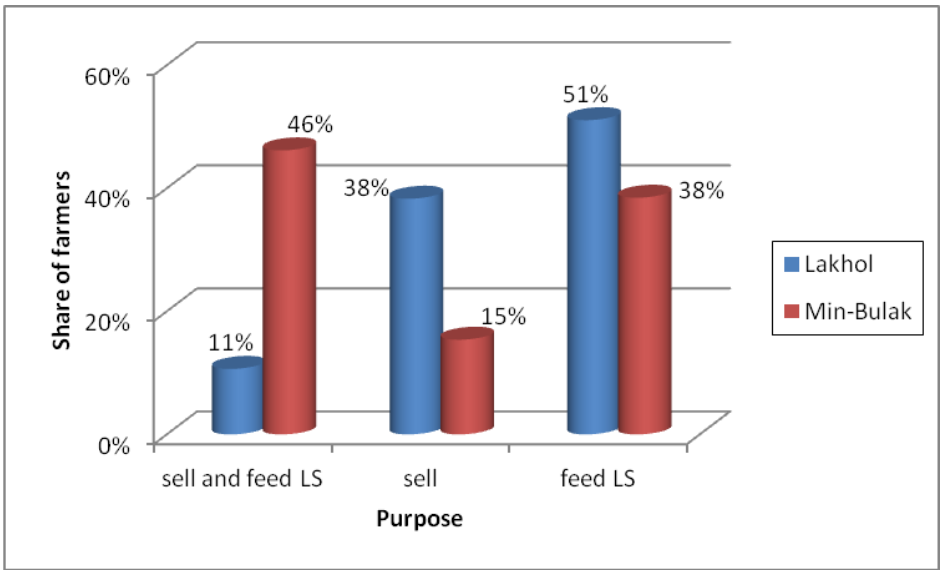


Figure 1. Purpose of crop production

The analysis of the livestock kept by farmers in the two villages shows that in both villages the number of small ruminants is similar and the highest compared to other livestock (see Table 1). Comparison of the share of farmers keeping livestock indicates that there are more farmers in Min-Bulak than in Lakhol keeping small ruminants and cattle.

Table 1. Livestock flock size

Indicator	Cattle		Sheep and goats		Poultry		Other (incl. horses)	
	Lakhol	Min-Bulak	Lakhol	Min-Bulak	Lakhol	Min-Bulak	Lakhol	Min-Bulak
Average farm flock (calculated for farms keeping certain livestock)	6	6	40	39	6	8	5	5
Share of farms keeping certain livestock	88%	100%	84%	100%	35%	46%	51%	26%

Relatively similar replies were given by livestock producers in both villages on the main purpose of producing sheep and goats. Most of farmers explained that they keep small ruminants for both sale and family consumption (see Figure 2).

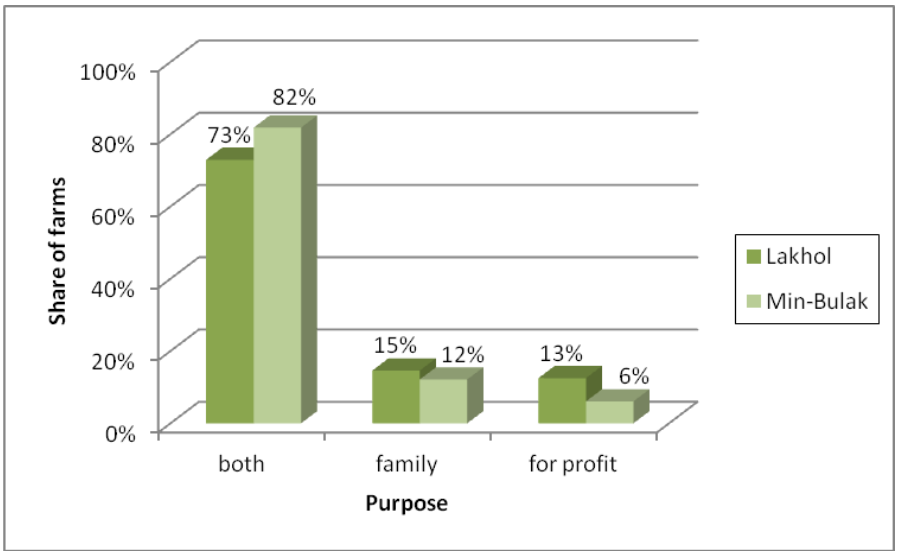


Figure 2. Purpose of small ruminant production

Figures 3 and 4 show farmers' perceptions of the most profitable products they get from small ruminants. In Lakhol, the majority of respondents mentioned meat and wool, while only meat was mentioned by more than a quarter of the producers. In Min-Bulak, selling meat and live lambs provides the highest income for 40% of farmers, while only live lambs and only meat were considered as the most profitable products by 20% and 17% of farmers, respectively.

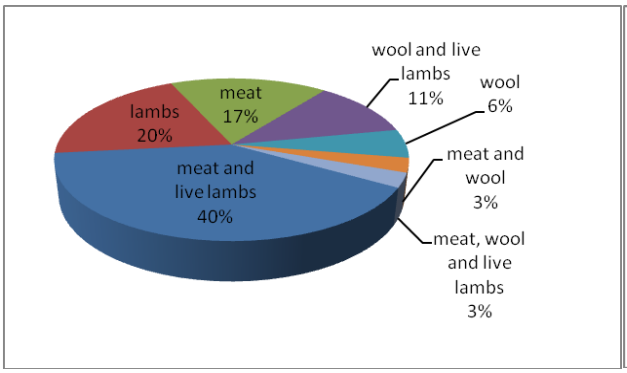


Figure 3. The highest income generating small ruminant products in Min-Bulak

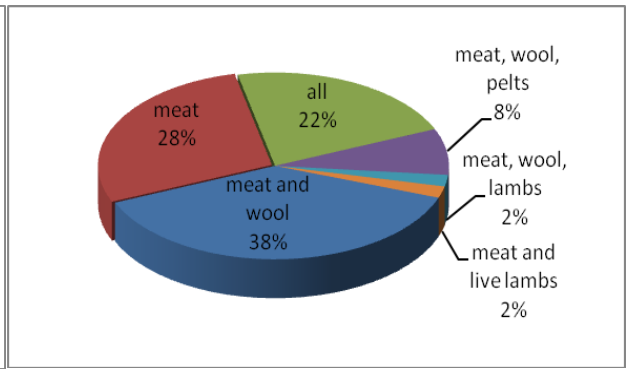


Figure 4. The highest income generating small ruminant products in Lakhol

Marketing practices of the farmers in both villages are similar. Most of them prefer selling entire volume of agricultural products to middlemen or wholesalers rather than to individual buyers as shown in Table 2.

Table 2. To whom farmers sell the agricultural products

Buyers	**Lakhol**	**Min-Bulak**
Middlemen	59%	54%
Wholesalers	35%	34%
Individual buyers	6%	12%

All respondents in both villages advised that they find out the price information for the agricultural products from markets. At the same time, part of them, 33% in Lakhol and 3% in Min-Bulak, try to sell their products at the price that is attractive for them. The survey results showed that more livestock producers in Lakhol village (75%) were willing to cooperate to transport and sell their products than in Min-Bulak (33%; Figure 5).

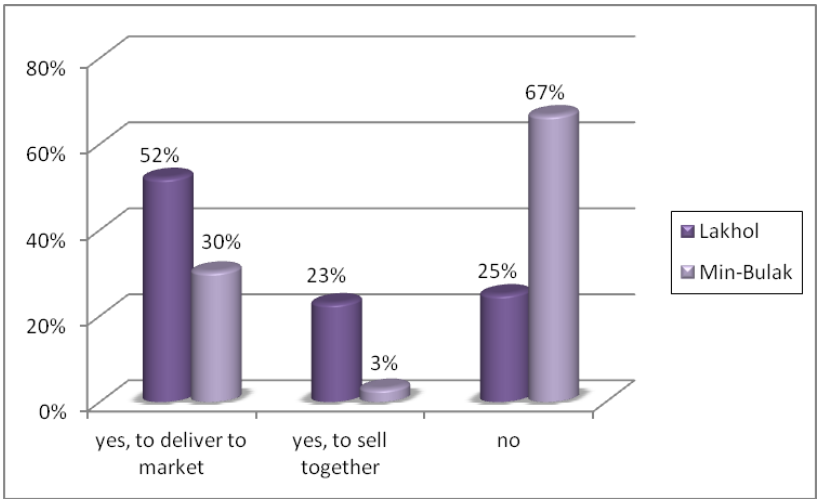


Figure 5. Farmers' willingness to cooperate

The structures of expenditures (Figures 6 and 7) show that the top two expense categories named most frequently by the respondents were the same in both villages (expenses for family and for feed & seeds). Producers in Min-Bulak named expenses for equipment and fuel also very frequently (69%), while in

Lakhol this expense item was mentioned less frequently (20%) instead expenses for hired labour was named more often (27%).

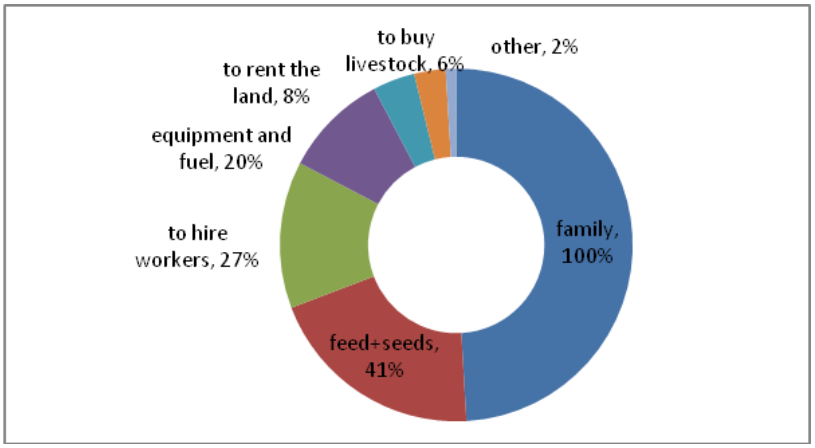


Figure 6. Major expenditures of farmers in Lakhol

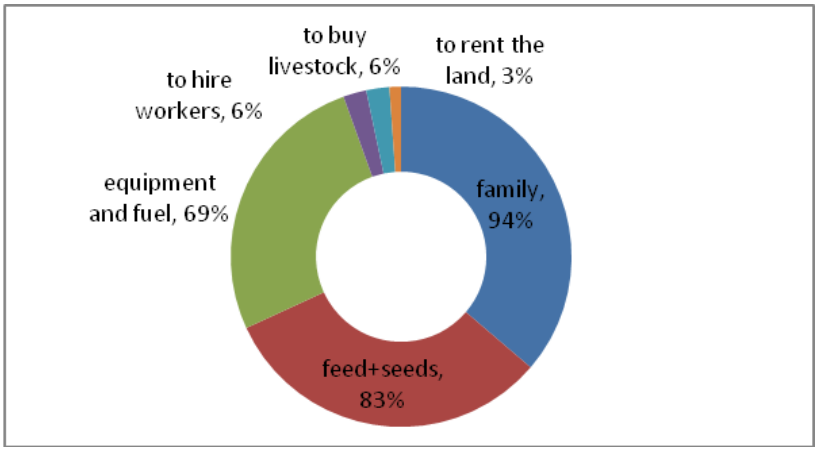


Figure 7. Major expenditures of farmers in Min-Bulak

The analysis of farmers' motivation for wool production led to controversial results in the studied villages. In Lakhol, wool producers that stated for sale and family consumption dominated over those who used all produced wool for family needs only. While in Min-Bulak, most farmers prefered using the produced wool entirely for family. A very low (3%) percentage of farmers in Min-Bulak and none in Lakhol were interested in selling wool after processing (see Figure 8).

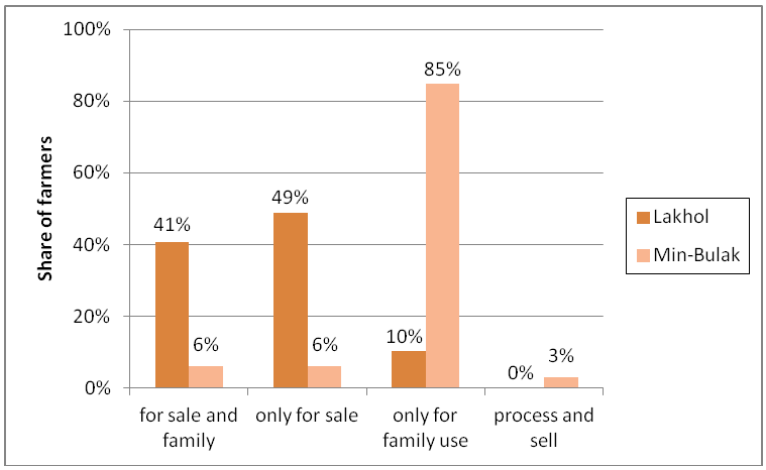


Figure 8. Reason for wool production

Farmers showed a relatively good awareness about felt products. In Lakhol, 94% of wool producers said that they know felt products, only 6% did not know any. In Min-Bulak, farmers' awareness is somewhat lower as 79% of them had heard about these products, while 21% were not familiar with them. As indicated in Figure 9 about three quarters of farmers in both villages know two national felting techniques.

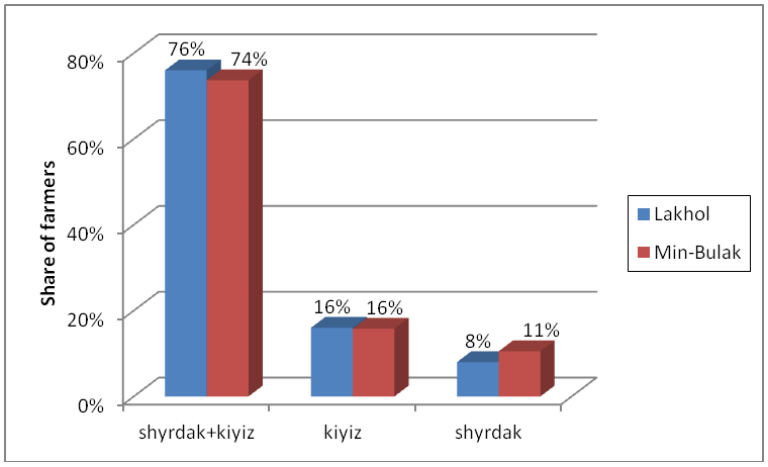


Figure 9. Awareness about felt products

Willingness to be involved in the project was also studied. In Lakhol, 86% of farmers advised that they were willing to participate in the project, while 12% responded negatively (Table 3). And in Min-Bulak, all of the interviewed livestock producers said they would like to join the project activities. Major reasons for participation in the project were listed in Table 3 Most of the reasons specified by wool producers coincide with the project goals.

Table 3. Why farmers want to take part in the project

Reason for participation in the project	Share of farmers who specified a reason (out of those willing to take part in the project and)
Lakhol	
to sell products without middlemen	9%
to improve farm, livestock breeds	9%
to get profit from sales of pelts and wool	2%
Min-Bulak	
to increase family income	20%
to improve farm, livestock breeds	17%
to improve wool processing to produce national felt products	9%

Annex 7. Improving flock structures and sheep wool quality in Naryn, Kyrgyzstan

Improving flock structures

At the beginning of the project in spring 2010 the project team classified the sheep flocks at the target sites by breed proportions (Table 1). Except for Kochkor site (Sabaaji flock), the farmers kept heterogeneous flocks composed of different genotypes producing a variety of wool types.

Table 1. Classification of sheep flocks by genotype in spring 2010

Site	Total number of sheep	Fine wool sheep, %	Tian-Shan sheep (%)	Coarse wool, %
Lakhol	313	-	64.3	35.7
Min-Bulak	210	16.0	49.0	35.0
At-Bashi	1,227	58.8	-	41.2
Kochkor	1,100	100.0	-	-

The project team discussed the situation with the sheep framers in Min-Bulak and Lakhol village and formed a group of farmers in each village that were interested in improving breed homogeneity and wool quality in their flocks. For this purpose, the project procured pure Tian-Shan rams from Lakhol village. Till May 2010, a breeding station for Tian-Shan sheep breed existed in Lakhol village, which was then privatized. Thus, the rams originating from the station were pure-bred and met the breed standards. In each mating season in 2011, 2012 and 2013 the project procured 4 rams (Table 2), 2 for each village. In 2012 seven improved rams were available for mating with 491 ewes. (One of the rams at Min-Bulak site had died in 2012.) Each year in spring the project team visited the participating farmers to discuss and monitor the progress by jointly assessing the wool quality before shearing and the offspring.

Table 2. Improved Tian Shan rams utilized by participating farmers by mating season (November)

	2011	**2012**	**2013**
Lakhol site			
Number of rams	2	4	6
Number of mated ewes	245	251	na
Min-Bulak site			
Number of rams	2	3	5
Number of mated ewes	205	240	na

In spring 2011 the team monitored wool productivity of Tian-Shan adult and young ewes in Lakhol and Min-Bulak. Local coarse wool sheep were not included in the assessment because they produce low quality, coarse, non-uniform wool. There is no demand for coarse wool and this type of wool is not marketed.

Except for G. Usupbaeva in Lakhol village, all other farmers kept Tian-Shan and coarse woo local sheep. The average lambing percentage in the five flocks at Lakhol site was low (69%) due to the very low performance of the ewes in one flock (Table 3). The highest rate – 93 lambs per 100 ewes – was obtained by M. Asanaliev. The reasons for the low productivity is combination of deficient feeding and poor husbandry practices, including uncontrolled mating of ewes.

Table 3**.** Assessment of phenotypic characteristics of sheep and identification of sheep breeds in Lakhol village in spring 2011

Farmer	Ewes' age group	No of ewes	Including		Obtained lambs				Harvested wool, kg		Sold Som /kg
			TSh[1]	LC[2]	Total	Incl.		per 100 ewes	Total	per ewe	
						TSh	LC				
G.Usupbaeva	adult	55	55		49	49		89	242	3.1	105
	young	23	23								
N. Akunov	adult	40	34	6	20	13	7	50	95	2.8	95
R.Kasmaliev	adult	40	32	8	35	24	11	88	140	2.8	100
	young	25	18	7							
M.Asanaliev	adult	30	10	20	28	12	18	93	54	2.7	100
	young	20	10	10							
Y.Sydykov	adult	50	50		45	45		90	225	3.0	100
	young	25	25								
Total		**313**	**257**	**56**	**177**	**143**	**36**	**69**	**756**	**2.9**	**101**

[1]TSh=Tian-Shan breed; [2]LC=Local coarse wool

For households at Min-Bulak site, sheep production is a secondary activity – families produce sheep mainly to satisfy their own need for lamb meat. This is why they keep crossbred semi-fine wool and indigenous coarse wool sheep. The lambing rate was with 48 lambs per 100 ewes very low (Table 4). The harvested wool can be described as crossbred semi-fine wool, with a fiber length of 7-8 cm, fineness of 56 and 58th quality standard (Soviet fiber classification system), and a low fiber density. Farmers do not sell wool but use it locally to produce coarse felt products such as nomad's tent (yurta) and traditional rugs (shyrdaks). In April 2011 the project team also conducted a training for 6 farmers in Min-Bulak on basic principles of sheep breeding using theoretical explanation and practical demonstration.

Table 4**.** Assessment of phenotypic characteristics of sheep and identification of sheep breeds in Min-Bulak village

Farmer	Total ewes	Ewes		Obtained lambs		Harvested wool, kg	
		TSh	LC	Total	Per 100 ewes	Total	per ewe
A. Musaev	30	10	20	18	60	25	2.5
O. Ismadiyarov	20	17	3	8	40	46	2.7
S. Musaev	30	28	2	9	30	69	2.5
Zh. Samakov	30	21	9	17	57	53	2.5
E. Musaev	65	60	5	32	49	160	2.7
T. Asenov	25	19	6	12	48	44	2.3
Total	**200**	**155**	**45**	**96**	**48**	**397**	**2.6**

[1]TSh=Tian-Shan breed; [2]LC=Local coarse wool

The data recorded on flock composition in spring 2013 are provided in Tables 5 and 6. In Lakhol 184 live lambs or 89 lambs per 100 ewes were born; out of which 135 (73.4%) were lambs of Tian-Shan genotype (Table 5). Out of 70 yearling females, 50 (71.4%) were classified as Tian-Shan.

Table 5. Assessment of phenotypic characteristics of sheep in Lakhol village in 2013

Farmer	Total no of sheep	No of ewes	No of Tian-Shan ewes	Female yearling	No lambs born in 2012	No of Tian-Shan lambs
G. Usupbaeva	170	67	66	23	56	55
N. Akunov	46	23	13	10	15	11
R. Kasmaliev	101	41	29	18	32	24
M. Asanaliev	90	34	22	7	35	20
Y. Sadykov	105	45	29	12	46	25
Total	**512**	**206**	**159**	**70**	**184**	**135**

In Min-Bulak, 139 live lambs or 71 lambs per 100 ewes were born, out of which 93 (67%) were lambs of Tian-Shan genotype (Table 6).

Table 6. Assessment of phenotypic characteristics of sheep in Min-Bulak village in 2013

Farmer*	Total no of sheep	No of ewes	No of Tian-Shan ewes	Female yearling	No of lambs born in 2012	No of Tian-Shan lambs
A. Musaev	12	6	3	-	6	3
O. Ismadiyarov	41	19	10	9	13	6
S. Musaev	52	25	15	2	19	18
E. Musaev	49	27	19		22	13
T. Chargynov	114	61	32	15	35	25
Zh. Samakov	59	36	18	-	23	16
B. Musaev	49	21	11	7	21	12
Total	**376**	**195**	**108**	**32**	**139**	**93**

*Please note that there was a change in participating famers compared to 2011. (T. Arsenov left and T. Chargynov and B. Musaev joined the group).

By 2013 the proportion of Tian-Shan sheep in the total number of sheep (including all sex/age categories) in Lakhol village had increased from 64.3% in 2010 to 78.7% and the total number of sheep had increased from 313 to 460. In Min-Bulak the proportion had increased from 49.0% to 63.2%. Although there are still indigenous coarse wool sheep of different colors in the flocks, the transformation of the mixed heterogeneous flocks to more homogenous Tian-Shan breed flocks has progressed well.

The combination of farmers' training, preventive care, improved rams and selection of breeding animals also led to improved fertility: in Lakhol lambs born per 100 ewes increased from 69 in 2011 to 89 in 2013 and in Min-Bulak from 64 in 2011 to 83 in 2012. (Please note that in 2013 the rate was 71 lambs per 100 ewes in Min-Bulak but one farmer had left the group and two new ones had joined.)

Improving and monitoring sheep wool quality

Shearing of sheep on the project sites is done manually using special scissors which actually affects the staple length of the wool as approximately 0.5-1.0 cm of wool is left on the body of an animal after shearing.

In spring 2011, the wool of the Tian Shan sheep from the five household at Lakhol site participating in flock improvement program was evaluated based on visual classification (Table 7).

Table 7. Fiber fineness and length of the wool from Tyan-Shan sheep owned by farmers at Lakhol site (based on visual classification in spring 2011)

Farmers	Sheep group	Quantity	No of sheep by fiber fineness (quality grade) sampled at the sheep's side				Fiber length, cm
			58	56	50	48	
Usupbaeva G.	ewes	55	1	31	21	2	11.5
	young females	23	-	9	14	-	14.7
Akunov Kh.	ewes	34	1	14	11	8	12.0
Kasmaliev R.	ewes	32	3	11	12	6	11.0
	young females	18	4	14	-	-	12.0
Asanaliev M.	ewes	10	-	-	6	4	12.0
	young females	10	-	5	5	-	12.5
Sydykov Y.	ewes	50	4	24	21	1	11.0
	young females	25	4	16	5	-	12.0

The farmers harvested 830 kg wool of which 91% was classified as crossbred wool from Tyan-Shan sheep and the rest was coarse wool from local sheep. Records were taken only from the Tyan-Shian sheep wool, as there is no demand for the coarse wool and hence, it is not marketed. The total volume of the shorn crossbred wool was 756 kg or 2.9 kg per head (Table 8). The fiber length was mostly over 11 cm and the fineness was of the 56th quality standard (28 microns) or higher. Harvested wool was sold to the middlemen in average for 101 Kyrgyz Som per kg. Farmer G. Usupbaeva managed to get a relatively higher price of 105 Som/kg because of a good fiber length. Crossbred wool is a good raw material for production of slippers and chair mats, and because of the relatively good quality of the wool produced at Lakhol, the project procured 400 kg from the contact farmers for the artisan women groups.

Table 8. Shorn wool (kg) by fiber length and wool quality grades at Lakhol site in 2011

Farmer	Collected wool, kg		Distribution of cross-bred wool, kg						
	Total	Cross-bred	Fiber length, cm			Fiber fineness, quality category			
			10	11	≥12	60-58	56	50	≤48
N. Akunov	104	95	2	30	63	2	38	45	10
G. Usupbaeva	242	242	4	100	138	4	138	80	20
R. Kasmaliev	165	140	14	70	56	14	70	30	26
M. Asanaliev	94	54	-	12	42		30	20	4
Y. Sadykov	225	225	23	142	60	23	101	61	40
Total	**830**	**756**	**43**	**354**	**359**	**43**	**377**	**236**	**100**
In %	100	91.1	5.7	46.8	47.5	5.7	50.0	31.2	13.1

At Min-Bulak site, six household farmers sheared 200 sheep including 155 heads (77.5%) of semi-fine wool sheep (Table 9). These sheep produced 397 kg wool with an average shorn wool productivity of 2.6 kg per sheep. Visual assessment of the shorn wool on Min-Bulak site showed that it is characterized as crossbred semi-fine wool (85.2%), with a fiber length between 7-10 cm (72.0%) and mostly a fiber

fineness of 60th and 58th quality (73.6%), insufficient density and inappropriate homogeneity by fiber length and diameter along the fleece and within staple. Only 111 kg (28%) would qualify as crossbred wool (fiber length over 11 cm). Due to small amount and low quality sheep owners did not sell the wool and used it for production of felt for nomad houses (*yurta*), shyrdaks, etc.

Table 9. Shorn wool (kg) by fiber length and wool quality grades at Min-Bulak site in 2011

Farmer	**Collected wool, kg**		**Distribution of semi-fine wool, kg**					
	Total	**Semi-fine/ crossbred**	**Fiber length, cm**			**Fiber fineness, quality category**		
			7 -8	**9 - 10**	**≥11**	**60**	**58**	**≤56**
A. Musaev	55	25		25		15	10	
O. Ismadiyarov	52	46	13	23	10	13	23	10
S. Musaev	71	69	31	20	18	31	32	6
J. Samakov	66	53	25	20	8	25	15	13
E. Musaev	169	160	39	57	64	59	37	64
T. Asenov	53	44	10	23	11	15	17	12
Total	**466**	**397**	**118**	**168**	**111**	**158**	**134**	**105**
In %	100.0	85.2	29.7	42.3	28.0	39.8	33.8	26.4

The qualitative assessment of the wool shorn in 2013 as compared to 2011 showed that the quality of the crossbred and semi-fine wool has been improved due to higher percentage of Tian-Shan rams and increased number of typical crossbred sheep in flocks at bot sites (tTables 10 and 11).

In 2013, percentage of sheared crossbred wool on Lakhol site formed 82.4%. About 92.4% of the crossbred wool had fiber length of 11 cm and more that corresponds to the 1st class. By fiber fineness the entire wool met standards for the 1st subclass, where 87.0% of wool had fineness of 56 and 50 quality standard (QS) typical for medium crossbred wool, 12.0% a fineness of 60 -58 QS or fine crossbred wool, while 7.9% was coarse crossbred wool. Thus, compared to 2011 the wool quality improved, i.e. the share of fiber with length of 12 cm and longer has increased, and most wool corresponds to 56th and 50th quality standard with semi-lustrous luster typical for 1st class/1st sub-class wool.

Table 10. Shorn wool (kg) by fiber length and wool quality grades at Lakhol site in 2013

Farmer	**Collected wool, kg**		**Distribution of crossbred wool, kg**						
			Fiber length, cm			**Fiber fineness, quality category***			
	Total	**Crossbred**	**10**	**11**	**≥12**	**60-58**	**56**	**50**	**≤48**
G. Usupbaeva	396	388	20	102	266	11	228	134	15
N. Akunov	92	55	6	15	34	10	30	15	
R. Kasmaliev	215	175	20	47	108	7	121	37	10
Y. Sadykov	104	47	5	10	32	5	10	15	17
M. Asanaliev	181	150	11	26	113	9	88	31	22
Total	**988**	**815**	**62**	**200**	**553**	**42**	**477**	**232**	**64**
In %	100	82.4	7.6	24.5	67.9	12.0	58.5	28.5	7.9

*A lower quality category indicates coarser wool

Assessment of quality traits for the wool shorn in "Min-Bulak" site showed that in 2013, compared to previous years, the fiber length had improved, and the share of the crossbred wool in semi-fine wool and

overall had increased (Table 11). In 2011, the share of semi-fine wool with a length of 11 cm and longer was 28.0%, while in 2013 it reached 33.9%; also the share of crossbred wool went up by 4.7% in 2013.

Table 11. Shorn wool (kg) by fiber length and wool quality grades at Min-Bulak site in 2013

Farmer	Collected wool, kg		Distribution of semi-fine wool, kg						Share of crossbred in semifine wool
			Fiber length, cm			Fiber fineness, quality category			
	Total	Semi-fine	7-8	9-10	≥11	60	58	≤56	
A. Musaev	15	9		9			9		4
O. Ismadiyarov	72	35		15	20	10	15	10	18
S. Musaev	93	72.9		41	31.9	15	29.9	28	35.9
E. Musaev	63	46		35	11	20	15	11	26
J. Samakov	89	56	12	20	24	10	16	30	34
T. Chargynov	193	100	25	45	30	60	25	15	20
B. Musaev	70	47		40	7	25	15	7	22
Total	**595**	**365.9**	**37**	**205**	**123.9**	**120**	**114.9**	**131**	**159.9**
In %	100	61.5	10.1	56.0	33.9	32.8	31.4	35.8	43.7

*A lower quality category indicates coarser wool

In addition to the visual assessment, twenty-one samples were collected from three age/sex groups and analyzed with OFDA-2000 equipment in 2011 (Table 12). The range in fiber diameter was 23.9-34.8 microns and in fiber length 9.0-13.0 cm. The sampling was repeated in 2013. The results of the analysis indicate that sheep wool produced by farmers at Lakhol site meet requirements for crossbred wool by fiber diameter and fiber length, while wool at Min-Bulak site meets the standards for crossbred wool only by fiber diameter. The results also indicate that the wool quality in rams and yearlings improved during project duration in the Lakhol flocks but the number of samples was too small to confirm this trend.

Table 12. Results from OFDA 2000 analysis of wool samples by age group, site and year

Age/Sex group by site	2011			2013	
	n	fiber diameter, microns	fiber length, cm	fiber diameter, microns	fiber length, cm
Lakhol					
rams	4	27.8	13.1	26.5	11.3
ewes	3	26.7	14.0	27.0	11.0
yearling females	12	29.2	12.9	25.4	13.3
Min-Bulak					
rams	2	25.1	11.3	27.1	12.1
ewes		-	-	27.8	10.0
yearling females		-	-	25.5	9.8

At both sites the total wool produced by the flocks either increased or remained the same, while the yield per sheep increased in all flock with the exception of one flock at Min Bulak site (Table 13). The number of sheep in the flocks fluctuated largely.

Table 13. Changes in wool production from semi-fine wool sheep at Lakhol and Min Bulak sites from 2011 to 2013

Farmer	2011			2013		
	No of sheep	shorn wool (kg)		No of sheep	shorn wool (kg)	
		total	per sheep		total	per sheep
Lakhol						
G. Usupbaeva	78	242	3.1	108	388	3.6
N. Akunov	34	95	2.8	17	55	3.2
R. Kasmaliev	50	140	2.8	52	177	3.4
M. Asanaliev	20	54	2.7	43	152	3.5
Y. Sadykov	75	225	3.0	38	117	3.1
Total/Average	**257**	**756**	**2.9**	**258**	**889**	**3.5**
Min-Bulak						
A. Musaev	10	25	2.5	3	9	3.0
O. Ismadiyarov	17	46	2.7	13	36	2.8
S. Musaev	28	69	2.5	23	73	3.2
J. Samakov	21	53	2.5	18	56	3.1
E. Musaev	60	160	2.7	19	47	2.5
T. Asenov	19	44	2.3	41	113	2.7
B. Musaev				18	47	2.6
Total/Average	**155**	**397**	**2.6**	**135**	**380**	**2.8**

Concluding, the systematic monitoring and visual assessment of wool quality, consistent selection by moderate culling of atypical animals, and utilization of pure-bred rams in the flocks, led to improvements in the quality of crossbred (semi-fine) wool available to the artisan groups in Min-Bulak and Lakhol village. The envisaged direct wool supply was confirmed in Min-Bulak where in 2013 73 kg of the crossbred wool produced by farmer S. Musaev was purchased and utilized by the artisan women's group of this site, which had not been the case before. Furthermore, farmer E. Musaev managed to sell 46 kg of his wool at 45 Kyrgyz Som per kg.

Annex 8. Developing and test-marketing Kyrgyz felt products on local, regional and international markets

The project test marketed several products to assess demand for different types of products on different markets. The following products were tested on different markets:

Local markets:	Shyrdaks, shyrdak chair mats, ala-kiyiz chair mats with traditional ornaments, felt slippers.
Regional markets:	Felt slippers, scarves.
International markets:	Felt slippers, chair mats, felt scarves, silk & felt scarves, shyrdaks.

The results of test-marketing the products are outlined below:

Test-marketing of different felt products

Felt pillows:

One of the first products developed and test-marketed by the project were felt pillows. Unfortunately the pillows found little demand on local and regional handicraft markets. Felt pillows could potentially sell on high-end export markets. However, the women's groups would need assistance from professional designers to make luxury felt pillows for export. The pillows also have a relatively large weight and volume which makes their shipping cost prohibitively high. Based on the analysis of production cost and market opportunities, the project stopped producing this type of product.

Ala-kiyiz chair mats

Another product developed by the project and the groups were ala-kiyiz chair mats with traditional and non-traditional ornaments. Ala-kiyiz chair mats found good demand on local and regional markets, craft fairs, and also on export markets. However, they proved to be too expensive to export because of their weight and bulkiness. The price of a chair mat from crossbred wool is $8-11 on local and regional markets, and the price on the international market (European fairs) is 8-11 Euros. In 2013, the groups sold chair mats for $1.4 thousand, which constitutes 7.5 % of overall sales of handicraft products in 2013. In the course of 4 years the groups sold chair mats for $7.6 thousand which is 15 % of the overall income from product sales. Altogether, 700 chair mats were sold during the 4 years of project implementation. Production cost of one chair mat from crossbred wool is 270-300 Kyrgyz Som ($5.6-$6.3); profit is 40-50%.

The artisans mastered production of chair mats with traditional and non-traditional ornaments for different markets.

Chair mats with authentic patterns

Chair mats with non-authentic patterns

In 2011, the project organized a competition among the pilot groups for the best set of ala-kiyiz, two-sided chair mats. The jury distinguished chair mats made by artisans from the "Uz-Nur-Ayim" Group (Min-Bulak village), who won the competition and were awarded monetary prices.

The competition encouraged the artisans to improve product quality and increased competitive spirit within and among the groups. It also helped to identify and promote the most skillful artisans in the groups.

A series of two-sided ala-kiyiz chair mats from wool dyed with locally prepared natural dyes (onion peels, barberries, nut membranes, herbs) was awarded a UNESCO Award of Excellence for Handicraft Products in Central Asia in 2012. The awarded chair mats were produced by the women of the Min-Bulak group.

The artisans also experimented with designing one-sided alakiyiz chair mats (with design only on one side) to reduce the product thickness and weight (by as much as 135-150 grams) and make the chair mat transportation more economical. One-sided chair mats are lighter and their production cost is lower which makes them better suited for export.

Test-marketing have shown that chair mats with one-sided design are associated with decorative products such as wall-hangings as opposed to utilitarian ones. Based on the test-marketing analysis, a new design for these types of chair mats will be developed in an experimental studio that was set up in Bishkek in 2013. The studio provides the opportunity for young artisans affiliated with the Naryn groups who develop new products that will be later produced by the groups.

Seamless felt slippers

Out of the entire assortment of products designed and produced by the pilot groups, felt slippers designed by the project team proved to be the most successful product with the best marketing potential for regional and international markets.

The project team and the artisans developed several prototypes of the slippers. Each prototype was further developed in terms of shape, type of raw material and other specifications. The artisans mastered the production of several types of felt slippers, for example seamless (hollow-shaped) felt slippers. The demand for these slippers is strong on regional and international markets but their production is demanding in terms of physical labor and time. Usually men are engaged in this type of work.

Stitched and felted slippers

The project team helped the artisans to develop a new type of stitched felt slippers based on a prototype imported from Denmark and brought to Kyrgyzstan by Dr Liba Brent. To replicate the Danish slippers, the Kyrgyz artisans needed specific shoetreets which are used to shape the slippers. The project had to special-order such shoetrees from China twice as the first shoetrees turned out to be inaccurate. As a result the development of the final prototype of the slippers took almost two years. The extensive work on developing this product proved to be justified – the new Danish-style slippers are the highest quality slippers produced in Kyrgyzstan to date by any felting group and there is a strong demand for them on local, regional and international market. The groups plan to focus on producing the slippers in a large volume and work with designers to develop new, decorative versions for women.

An artisan from the At-Bashy group, Tologon Kyzy Meerim, developed a new technology of slipper production that uses the centrifuge of a washing machine. This process makes it possible to reduce the number of seams in the slippers and makes their production faster and less labor-intensive. The artisans can product 4-5 pairs of slippers per day and the production is profitable.

The average market price for one pair of slippers with a leather sole is 450 - 500 Kg Som ($9.8 –$ 10.8), the price for slippers with a man-made sole is 350 - 400 Kg Som ($7.5 - $8.6). The production cost is about 320 Kg Som ($ 6.9) and 260 Kg Som ($5.6) accordingly.

Quality of slippers directly depends on the quality of felt: the felt must be evenly thick, without coarse specks and quite dense.

The «Asia-Runo» factory does not produce felt of the needed quality and felt sold at the Osh bazaar in Bishkek also leaves much to be desired. Therefore, the artisans make the felt for slippers themselves, on their felting machines and also by hand. The use felt made on a felting machine to produce single color slippers, and use hand-made felt for multi-colored, ala-kiyiz slippers.

Felt slippers that are stitched and then felted on a shoe form

The leather soles of the slippers are stitched by hand. The groups tried to subcomtract the sole stitching to a shoe-making factory but the factory refused to do it because the orders were too small and the factory had to reset their machine to do the job. Considering that slippers are in demand on local, regional and international markets, it is justified to purchase a special sewing machine for stitching soles to slippers through the new project financed by IFAD – AKF.

Ala-kiyiz felt slippers

Ala-kiyiz slippers are more costly to produce especially in terms of skilled labor, but enjoy a strong market demand if they are made according to standard.

Stitched ala-kiyiz slippers were successfully sold in Hungary ($17 – 20), in Germany ($25 – 30), at local and regional markets ($12 – 15). The average production cost of such slippers with a leather sole is $10.

Stitched, open heel felt slippers

The groups started to produce a new version of sewn felt slippers based on a prototype made by an Italian designer from "Altra Qualita" who worked with felting groups in Tajikistan. Although a strong demand for these slippers has not been identified to date, the project team believes that the basic form is satisfactory and with improvements in decoration and felt quality these slippers will also find a good market. Another reason why the team wants to invest in fully developing this product is that the sewn slippers are easy to make, can be produced in large quantities, and their production does not require wet felting. This means that the women's groups can produce them even in winter.

The process of organizing production of stitched slippers was the following: templates of stitched slippers of different sizes were prepared and distributed to the groups. The women cut felt using the templates, then stitched on the leather sole by hand or on a special sewing machine. Scraps of leather, terme cord, lace and woven fabric were used for decoration. At the local market such slippers are sold for $8 – 9. The production cost is $6 - 6,5.

Stitched felt slippers without back parts

In 2012 the project purchased an industrial sewing machine PFAFF (German production) with the income from product sales for sewing soles to the slippers. The machine was given to the "Uz-Nur-Ayim" group in Min-Bulak village which specializes in slipper production.

Felt scarves

Felt scarves made from factory-spun merino tops are demanded on local, regional and export markets. Several types of felt scarves have been developed, including warm silk&felt scarves for men which were designed by Kamala Abdykadyrova. "Cheber Koldor" group in Acha-Kaindy village is the main producer of felt scarves for men.

Felt scarves are sold on local and regional markets for $25-30 and on international markets for $35 and more. Production cost is $13-14 (pure felt scarves) and $16-17 (silk&felt scarves for men).

Felt and silk scarves

Felt and silk scarves were successfully test-marketed on local and regional markets and at international craft fairs. However, the competition in these types of products is extremely high as most Kyrgyz felting groups produce such scarves and the local and regional market is saturated. The scarves require wet felting and can be produced in Naryn only in summer. The scarves are relatively simple in terms of the felting technique but the women groups require assistance from a professional designer in choosing color combinations and in developing design. Test marketing of scarves on different markets showed that the scarves are profitable although prices differ on different markets.

Also, scarves for different markets may require different design. The groups make scarves with traditional ornaments for local and regional markets and for international craft fairs. They also make scarves with non-traditional ornaments for all markets, including sale in boutiques in the USA and Europe.

The project worked with the artisans on developing new types of scarves and provided them with designer samples, photographs of scarves of various designs and also with raw materials such as silk and merino tops. The project also hired a professional designer, Kamala Abdykadyrova, who specializes in these types of products, to help the groups with scarf design. Seven artisans from Acha-Kaindy, Lakhol and Kulanak village had a fellowship at her studio of and received salaries as well as practical training.

In the course of the project, the groups sold scarves in the amount of $12,000 on local, regional and international markets.

The artisan group from Acha-Kaindy village is a leading producer of scarves. They sold scarves for more than 1/3 of their total income of $4300 (Table 1). The group actively works on different markets - local, regional and international. Market analysis shows that the scarves sell well at international craft fairs: almost 70% of income from scarf sales was earned in 2013 at international craft fairs in Kuwait, Hungary and Santa Fe (USA).

Table 1. Incomes from selling scarves by the group from Acha-Kaindy village in 2013 (total amount $ 1694)

International markets, $US			Regional markets, $US		Local markets, $US		
Kuwait	Santa Fe (USA)	Hungary	Almaty, (Kazakhstan)	«Oimo» Festival (Bishkek, Cholponata)	Naryn	Shopping Centre (Bishkek)	Tourists
442,3	293,0	403,0	17,0	75,0	42,0	212,0	210,0
Total: $ 1138,0			Total: $ 92,0		Total: $ 464,0		

Test-marketing in Europe

In 2012 the project began active cooperation with the company "Felt for you"; products of Naryn artisans were sold through www.felt4you.nl website and at fairs in the Hague where the company's office is located.

Co-owner and manager of the company "Felt for you" Asel Zelenina with artisans Gulbarchyn and Mairamkul from Lakhol village

From September 2012 to May 2013 the company has bought products in the amount of 2570 Euro: scarves, chair mats, slippers and shyrdaks. It should be noted that all products were supplied to the company "Felt for You" on consignment and for Bishkek wholesale prices. The groups agreed to sell their products on consignment to gain access to the European market and to help the newly formed company to develop its business. In fall 2013 the Naryn groups and the "Felt for You" company began negotiations regarding product prices and new terms of supplying products to the company.

The project team also worked with the founders of a Belgian company www.caravanistan.com on placing 20 scarves made by the Naryn artisans on consignment in Belgium and selling them through an online store that will open in October 2013. However, all scarves successfully sold before the New Year at a holiday fairs in Belgium. Conditions of supplying scarves to Belgium are as follows: the company buys 50% of scarves at the price of 20 Euro per scarf, and the second half of scarves is given to them on consignment. Caravanistan successfully sold the scarves for 45-65 Euro at fairs in Belgium, which is encouraging. The experience with Felt for You and Caravanistan shows there is a good potential for the Naryn artisans to develop further collaboration with small European wholesale buyers.

*Saule Kalysheva (*www.caravanistan.com) with scarves *of Naryn artisans at the fair in Belgium*

Test-marketing at the Festival of Folk Arts in Hungary in August 2012:

The project helped finance Svetlana Balalaeva's trip to the 26th Festival of Folk Arts in Budapest during 17-21 August 2012. Ms. Balalaeva's visit was also supported by the Association of Hungarian Folk Artists.

Ms. Balalaeva had the opportunity to test-market handicrafts made by the Naryn groups and receive feedback from Hungarian customers. The buyers showed keen interest in the felt slippers, especially in large sizes. Chair mats were less popular but there was some interest in chair mats with traditional Kyrgyz

ornaments. The demand for felt and silk scarves was low partially due to a strong competition from similar products at the fair.

The Hungarian Association of Folk Artists agreed to invite Kyrgyz artisans as guests to the next Festival that was held in August 2013. 15 Kyrgyz artisans received official invitations to present an assortment of traditional felt handicrafts at the festival. The guest status included a full coverage of expenses in Hungary by the hosting party, including the rental of a booth at the festival. The Kyrgyz side had to cover only the cost of airfare for the participants.

Participation in the Festival of Folk Arts in Budapest, Hungary in August 2013:

The 27th Festival of Folk Arts in Budapest was held on 17-20 August 2013 at the famous Buda Castle. The program of the Festival included crafts exhibition, master-classes, tasting of traditional culinary products, parades, dances, theatrical performances and other events.

This year a guest-country of the Festival was Kyrgyzstan and 16 artisans, designers and craftsmen from Kyrgyzstan participated in the Festival. Representatives of the project pilot groups Burulush Zhamanbaeva and Toyunbubu Amanova were among the participants. They exhibited products made by the groups, demonstrated felting techniques, conducted master-classes, attended meetings and shared experiences with other artisans. Felting demonstrations by Kyrgyz artisans generated a great interest on the part of the visiting public.

The fair was very well organized. All Hungarian artisans brought their tools, raw materials and demonstrated various techniques in their booths. The guest group from Kyrgyzstan was provided with 5-day accommodation, meals and Russian-speaking volunteers. Participation in the festival gave the Kyrgyz artisans a unique exposure to a wide variety of folk arts including felting done by Hungarian artisans. The Festival was attended by more than 800 people, primarily from different parts of Hungary.

The artisans also sold a number of products at the Festival. The sales of felt and silk scarves exceeded expectations. Felt slippers were also in good demand similar to the last year. Chair mats were less demanded. Altogether, the project sold products in the amount of $3700 during the 4-day Festival (Table 2).

Table 2. Summary of sales at the Budapest Festival of Folk Arts, 17- 20 August 2013.

Name of the product	Quantity	Average price, $US	Amount $US
Scarves	50 pieces	29.0	1466
Slippers	47 pairs	20.0	924
Chair mats	10 pieces	13.2	131
Shyrdaks	5 pieces	185.0	924
Other			255
Total:			**3700**

B. Zhamanbaeva

T.Amanova

B. Zhamanbaeva in her boutique at the Festival

T. Amanova with buyers

B. Zhamanbaeva gives a master class on making a chair mat for visitors of the Festival

Participation in the International Festival of Homeworkers in Bulgaria in June 2013:

In June 2013 the Association of Homeworkers in Sofia, Bulgaria invited the group leader from At-Bashy village to participate in the International Festival of Homeworkers in Sofia and Russa, Bulgaria. During the Festival she sold felt slippers, scarves and shyrdaks in the amount of $1230.
During the visit Shaigul Omuralieva learned about the work of the Association of Homeworkers in Bulgaria and plans to promote the ideas of the HOME network in the Naryn region.

Home-based work is the most widely spread type of labor in Naryn region and "family business" is becoming more and more popular. In Kyrgyzstan the family is a key social institutions and a very important foundation for a small business development. Family business and home-based business brings economic advantages and raises social status of the Kyrgyz artisans.

Home Net seeks to provide all workers, including home-based workers, with decent conditions of work and basic guarantees of economic and social stability. Svetlana Balalaeva was invited by the Association of Home-based workers to participate at the Home Net Inter-regional Commission session in Sofia in March 2013. During the session it was decided to extend a grant to Kyrgyzstan in 2014 to organize work in the area of domestic work.

Shaigul Omuralieva at the Fair in Russa, Bulgaria, June 2013.

Annex 9. Implementation of the cashmere breeding program in Kerman, Iran

Introduction

Goat productivity depends on the ability of the farmer to maintain his animals in good condition and health. Productivity and product quality also depend on the genetic quality of the flock. Directional selection or culling policies to increase productivity in nomad goat flocks are very rare since systematic evaluation of animals is not easy and mating of animals is at random. Sporadically some farmers near the city of Baft have access to bucks from a governmental breeding station in the region (O. Alipour, 2013, unpublished). These bucks are selected for high body weight and high fleece weight but not for cashmere quality (Maghsoudi, 2009, Mohammadi et al., 2012). Most nomads have no access to improved bucks and have no guideline or example to establish a breeding program in their flocks. The characteristics of the nomadic cashmere production system pose a major challenge for carrying out effective breeding plans. This report describes the experiences collected in the design and implementation of a cashmere breeding program amongst nomads of Southern Iran.

Materials and methods

Baseline study and selection of nucleus herds

A survey covering the 29 farms was performed to obtain basic production system data including the collection of cashmere samples taken in spring 2010 (Ansari-Renani et al., 2012; Ansari-Renani et al., 2013). In March 2010, 8 farmers were selected to initiate the breeding program out of 29 farmers visited for the baseline study. The criteria to select these 8 farmers included: interest to implement a breeding program which includes animal identification of selected animals, data recording and fleece sampling. Since it was also intended to examine the opportunities of adding value to the cashmere on farm, an additional criterion was the interest of the women in the family in cashmere combing, yarn making and further yarn processing. Although farmers move up to 100 km within a season, there are family and tribal links and arrangements which help locating a particular farmer at most times. Location of farmers is also facilitated by the recent spreading of cell phones and, in our case, by the participation of a nomad guide, a member of a well-known nomad tribe in Baft.

In spring 2011 goats from the 8 farmers joining the breeding program were sampled again. Fleece weights were taken and right midside samples were collected from 4 randomly selected goats of each sex (males, females) by age (1, 2, 3 and 4 years old) combination in each flock and sent to the Alrun Fiber Laboratory in Almaty (Kazakhstan) for determination of down yield (DY) and mean down fiber diameter (DD) as described by Ansari-Renani et al. (2012, quality). Least squares means obtained from a model including farmer, year, sex and age as fixed effects were compared considering differences with $P<0.05$ as significant.

Definition of breeding objective and selection criteria

Farmers expect to increase their economic return from their goat flocks through higher meat, milk and fiber output and trough reduced costs. Therefore higher reproduction rate, higher growth rates and higher fleece weight of the goats are of main interest. Farmers sell all fleeces, although middlemen prefer fleeces with low fiber diameter, high luster and low spur (Ansari-Renani et al., 2013, ICARDA). The latter feature is related to down yield. In the international market the value of dehaired cashmere is associated to its origin, whether Iranian-Afghan or Mongolian or Chinese (Schneider, 2013) and for its color, fiber diameter and fiber length (WMR, 2013). White color, fine fibers and high fiber length fetch better prices. The baseline study undertaken by Ansari Renani et al. (2012, SRR, cashmere quality) in the core cashmere producing region of Iran helped to identify its strengths and weaknesses. The results showed that Raeini cashmere is largely of white color, has long fibers but is relatively coarse.

Breeding objective traits must be heritable in order to be improved by breeding. Typically, reproduction performance depends largely on management issues rather than on genetic differences (Mohammadi et al., 2012). Reductions in costs can be achieved by running healthy animals, condition which depends on proper management and on availability of replacements when culling problematic animals. Thus, the breeding objective for Raeini cashmere goats should be to increase live weight, increase cashmere weight and reduce cashmere fiber diameter in healthy, easy care animals. Similar objectives were also proposed in cashmere goat breeding programs in Australia (Pattie et al., 1990; Ponzoni and Gifford, 1990) and New Zealand (Baker et al. (1991), whereas in China state farm breeding objectives till recently focused more on down weight and fiber length (Bai et al., 2006) since Chinese cashmere is known to be already very fine but rather short. More recently Chinese cashmere breeding programs also aim at reduction of down fiber diameter ().

A breeding objective function was developed following the methods of Ponzoni (1979) and selection indices were constructed following standard selection index theory (e.g. Mrode, 2005) were the index weighting factors are derived such that the correlation between index values and breeding objective function is maximized.

Development of a breeding structure

Several breeding system options were proposed by the project team and comprehensively discussed, first with regional agricultural officials and scientists and then also with farmers and shepherds. The option of one farmer producing bucks for all 8 farmers was quickly discarded. Even though the 8 participating farmers knew each other well, all preferred to run their own program, independently from each other. The nomadic lifestyle hinders such collective initiatives. The option of concentrating selection efforts on a few animals in each flock, that is the establishment of a nucleus with best males and best females, was readily accepted. Open nucleus theory allows optimization of such structures (James, 1977; Mueller, 1984). Typically 10% of breeding females of a flock should be in the nucleus. Flock size of participating farmers ranged 300-400 with about 50% breeding females. Thus, depending on the individual flock size, about 20 females and one buck would be enough. However, in order to decrease inbreeding rate and reduce the risk of choosing an inferior buck it was agreed to have 2 bucks and a total of 40 does in each nucleus, even though not all flocks were of the same size.

Initially it was proposed to use one own buck and apply for one buck from the regional, governmental, Raeini goat breeding station (Figure 1). This option was eventually discarded and only home bred bucks were used. In the following years the proposed breeding system considers progeny testing of the two bucks and replacement of the inferior one in the test with a young male with outstanding performance. A key management practice is to maintain nucleus male progeny intact, but castrate all general flock male progeny.

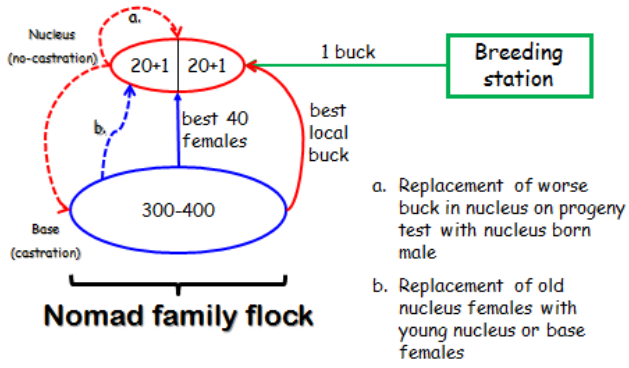


Figure 1: Initially proposed breeding system for each of the 8 nomad family flocks.

Implementation

Baseline cashmere production results

The baseline study revealed significant (P<0.05) sex effect on fleece weight (FW), down weight (DW) and down yield (DY), males having higher FW, DW and DY than females. Age was significant only for down diameter (DD) with cashmere from one year old goats being finer than 2, 3 or 4 year olds. There was no significant difference between years for any trait (Table 1).

Table 1: Sex, age and year effects on Raeini cashmere production of breeding program participants (Least squares means ± SE)

Effect	FW (g)	DY (%)	DW (g)	DD (mic)
Females	475±15	54.9±0.8	257±11	20.0±0.1
Males	605±14	58.6±0.8	363±11	20.2±0.1
1-year-olds	532±18	59.8±1.1	311±14	19.0±0.1
2-year-olds	518±18	58.4±1.1	305±14	20.3±0.1
3-year olds	571±18	57.0±1.1	316±14	20.3±0.1
4-years-olds	--	51.8±1.6	--	20.7±0.2
2010	540±10	55.6±0.9	310±8	19.9±0.1
2011	--	57.9±0.8	--	20.2±0.1

Farmer as fixed effect was significant (P<0.05) for FW, DW and DD but not for DY (Table 2). The quite large differences in FW and DW between farmers may arise from different cashmere growth periods or different grazing grounds.

The results confirm previous findings about the relatively coarse cashmere produced in the region. Overall down fiber diameter is 20.0 mic with a range between flocks of 1.5 mic. The flock of Alireza Mousapour has the finest down, 19.2 mic. From these results it also becomes clear that evaluation of animals for down diameter requires consideration of age within sex class.

Table 2: Farmer effect on Raeini cashmere production (Least squares means ± SE)

Farmer	FW (g)	DY (%)	DW (g)	DD (mic)
Alireza Mohammad Gholi Mousapour	472±29	57.2±1.6	281±23	20.2±0.2
Alireza Mousapour	510±29	54.6±1.6	274±23	19.2±0.2
Daud Mohammad Mousapour	550±29	58.5±1.6	338±23	20.7±0.2
Ebadullah Mousapour	664±29	56.0±1.7	360±23	20.5±0.2
Mohammad Mousapour	498±29	55.2±1.6	284±23	19.6±0.2
Mousa Mousapour	645±29	59.7±1.7	376±23	20.4±0.2
Rostam Mousapour	436±30	54.9±1.7	242±24	19.6±0.2
Sohrab Mousapour	549±29	58.0±1.6	328±23	20.4±0.2

Definition of breeding objective function and construction of selection indices

In order to construct formal selection indices a breeding objective function is necessary and was developed. To do this, the target production system needs to be described (Ponzoni, 1979). A typical Raeini cashmere flock consists of 209 adult goats including 122 breeding does (Ansari Renani et al., 2013, pastoralism). Fleece weights are about 500 g/goat and 64 animals of different ages are sold or consumed annually. Price of shorn cashmere is on average 21 USD/kg and the price of goat meat is 8 USD/kg (S. Momen and H. Ansari-Renani, December 2013). Based on the Chinese cashmere market data, the micron premium is about 10% of the cashmere price (LeCraw et al., 2005). For such a production system and product prices the following breeding objective function has been derived:

H = 0.16*FW - 7.97*DD + 1.20*WW + 0.82*YW +1.98*AW

In this function fleece weight (FW) is in g, down fiber diameter (DD) is in mic and weaning (WW), yearling (YW) and adult (AW) body weight is in kg.

To construct formal selection indices, appropriate phenotypic and genetic parameters are required. Phenotypic parameters were taken from own field data. It was planned to record WW, YW, FW and DD. This was done progressively over the years. Own field data were available for some traits (Table 3).

Table 3: Phenotypic parameters in Raeini cashmere goats

Parameter	FW (g)	DD (mic)	WW (kg)
Mean	464	20.7	14.3
CV (%)	0.31	0.07	0.16
Correlation with FW		0.09	0.06
Correlation with DD			0.10

Source: Own field data.

Heritabilities and genetic correlations were taken as averages from published results on Asian goat populations (Table 4). Since in China goats are combed, genetic parameters for combed down weight (DW) instead of fleece weight (FW) are available and were used for index calculations. Similarly, genetic parameters for body weight (BW) at shearing were used instead of body weight at weaning (WW).

Table 4: Genetic parameters from Asian cashmere goat populations

Source	Data origin	Heritabilities			Genetic correlations		
		DW	**DD**	**BW**	**DW-DD**	**DW-BW**	**DD-BW**
Maghsoudi et al. (2009)	Iran	--	--	0.20	--	--	--
Mohammadi et al. (2012)	Iran	--	--	0.32	--	--	--
Bai et al. (2006)	China (IM)	0.30	0.28	0.07	0.03	-0.06	0.03
Li et al. (2001)	China (IM)	0.26	0.14	0.16	0.35	-0.19	0.32
Zhou et al. (2002)	China (IM)	0.28	0.32	0.10	0.02	0.25	0.41
Average		**0.28**	**0.25**	**0.17**	**0.13**	**0.00**	**0.25**

Based on the above breeding objective function and parameters, three selection indices were constructed for different combinations of available performance records. Index1 is for the case of having recorded weaning weight, fleece weight and down fiber diameter. Index2 is for the case when yearling weight rather than weaning weight is available together with fleece weight and down fiber diameter. Index3 is calculated for the case when fiber analyses are not available.

Index1 = WW + 0.117 FW – 3.59 DD
Index2 = YW + 0.054 FW – 1.83 DD
Index3 = YW + 0.057 FW

Accuracy of Index1 is 0.52, Index2 is 0.55 and Index 3 is 0.53. Clearly Index2 is slightly more efficient to achieve the breeding objective. The use of Index2 with one standard deviation of average selection differential would improve fleece weights of all shorn animals in the flock by 182 g, reduce fiber diameter by 0.27 mic and slightly increase adult body weights by 2.3 kg in 10 years. The economic benefit is about 3.7 USD more per goat in the flock per year.

Selection of foundation animals for the nucleus flocks

The breeding program started with the selection of foundation nucleus animals and mating in 2010. Selection of the 40 nucleus foundation females and 2 bucks was undertaken by visual inspection of goats in each flock by its owner and the project team in April 2010.

Only white coated bucks and young (2 and 4-teeth) does were considered as nucleus foundation animals. Visual selection criteria also included health status, size of the animals, density of the fleeces and softness of the fiber, all these traits are related to traits in the breeding objective. An overall visual score from 1 (inferior) to 5 (superior) was used. In general animals with a score of 4 or 5 are visually acceptable for mating in the nucleus and animals with a score of 1 or 2 are rejected or culled.

Selected animals were identified with ear tags and their horns painted at random with two colors. All 8 farmers arranged to get the 40 nucleus does mated with two bucks separately from the base flock and in separate color groups using fenced corrals. To do this, the project provided all 8 famers with 42 m^2 meshed wire fence and either barley or its equivalent in cash to help feed the nucleus in the corrals or to help to pay for the extra labor required for separate shepherding. This contribution in goods or cash has been an incentive for farmers to adopt the new technology rather than a necessity since its monetary value is not substantial. Farmers found out that the fenced corrals are easy to construct, easy to transport and relatively cheap. Five farmers kept the nucleus animals in the fenced corrals day and night, other three farmers preferred to keep them in the corral during the night but graze the two colored groups separately during the day. After about 20-30 days of separate mating, all animals were run together.
In order to assess the selection differentials effectively achieved in the first visual selection process (May 2010), fleece samples were taken from females of the general flock and from females of the nucleus flock

from each farmer and analyzed for down yield and down diameter at the Almaty Fiber Laboratory (Kazakhstan). Selection differentials for females were calculated as the difference between the average performance of nucleus females and the average performance of females in the whole flock. The whole flock average was calculated by weighting the average performance of nucleus and base females with the respective number of animals in each part.
Table 5 shows that selection differentials achieved for the traits analyzed in the samples were variable amongst farmers and on average not significantly different from zero. Clearly, important traits like down yield and down fiber diameter were not accurately assessed visually or were not considered properly during selection. It is however also possible that other traits of importance, such as body weight, fleece weight and body condition (as indicator of adaptation) achieved positive selection differentials.

Table 5: Selection differentials of visually selected foundation nucleus females (2010 mating)

Farmer	**Nucleus females**		**Whole flock females**		**Selection differential**	
	DY (%)	DD (mic)	DY (%)	DD (mic)	DY (%)	DD (mic)
Alireza Mousapour	54.5	19.9	52.5	20.2	1.9	-0.3
Daud Mohammad Mousapour	58.9	21.5	54.3	20.8	4.6	0.7
Ebadullah Mousapour	58.7	19.7	57.7	20.1	1.0	-0.4
Mahmoud Ghasemi	55.3	18.8	51.1	18.7	4.3	0.2
Mehrab Ghasemi	57.9	18.9	59.1	18.6	-1.2	0.4
Mohammad Mousapour	54.7	20.1	53.5	19.7	1.2	0.4
Mohammad Reza Gholi Mousapour	56.4	20.7	55.6	20.6	0.7	0.1
Sohrab Mousapour	52.4	20.3	56.6	21.0	-4.1	-0.8
Average	**56.1**	**20.0**	**55.1**	**20.0**	**1.1**	**0.0**

Selection differentials of foundation bucks are not available and, given the small number of animals involved, not reliable.

For the second year mating, the same females were used but more selection pressure was made on males. Farmers visually selected 10 one-year-old and 10 adult male candidates in January/February 2011 amongst all males available in the flock. Note that at this phase of the breeding program there were no nucleus born candidates and no progeny tested bucks available. The project team took fleece samples from these 20 animals of each farmer and tested them in the Bariloche Fiber Laboratory (Argentina) to obtain down yield and down fiber diameter. Thus, in April/May 2011 bucks for the second mating in the nucleus were selected in two further stages. The top 3 males within each of the two age groups were selected on an arbitrary index combining down weight and down diameter. Fleece weights were not available therefore down weight was estimated from the individual down yield and a constant fleece weight. Down weight was weighted by its price and down diameter deviation by a tenth of down weight price per kg. Out of the 3 bucks of each age group (yearlings and adult), farmer's selected one for mating his nucleus in June/July 2011. Table 6 shows the selection differentials achieved in each flock. On average selected bucks (one old buck and one young buck in each flock) were 1.0 mic finer and had 5.9% higher down yield. Since fleece samples were taken after a first visual selection; selection differentials calculated as the performance difference between selected bucks and sampled bucks, probably underestimate the real selection differential. Also, other, non-measured, traits may have achieved additional favorable selection differentials.

Table 6: Selection differentials of nucleus males selected visually amongst top indexed on down yield and down fiber diameter (2011 mating)

	Nucleus males		**Whole flock males**		**Selection differential**	
Farmer	DD (mic)	DY (%)	DD (mic)	DY (%)	DD (mic)	DY (%)
Alireza Musapour Mohammad Gholi	21.3	82.0	21.9	74.1	-0.7	7.9
Alireza Musapour Rostam	18.8	71.8	20.5	66.1	-1.6	5.7
Dad Muhammad Musapour	20.4	76.3	22.2	71.9	-1.8	4.4
Ebadullah Musapour	21.2	80.9	22.6	74.7	-1.4	6.1
Mahmood Ghassemi	21.3	92.2	21.8	70.6	-0.5	21.5
Mehrab Ghassemi	18.8	73.1	20.3	72.5	-1.5	0.6
Muhammad Musapour (Namdar)	22.2	76.3	21.9	76.5	0.3	-0.2
Sohrab Musapour	21.0	78.2	21.8	76.7	-0.8	1.5
Average	**20.6**	**78.8**	**21.6**	**72.9**	**-1.0**	**5.9**

With the selection of nucleus replacements for the third year mating in June/July 2012 the breeding program entered a selection and mating procedures routine; since nucleus-born animals were in reproductive age (first progeny was born in November/December 2010). As in the previous year one adult and one young, in this case, nucleus born buck were selected to replace original nucleus bucks using the same arbitrary index as in the previous year but this time with individual fleece weights. Table 7 shows that by using records on fleece traits, substantial selection differentials were achieved.

Table 7: Selection differentials of nucleus males selected visually amongst top indexed on down weight and down fiber diameter (2012 mating)

	Nucleus males		**Whole flock males**		**Selection differential**	
Farmer	DW (g)	DD (mic)	DW (g)	DD (mic)	DW (g)	DD (mic)
Alireza Musapour (Masoumeh)	584	18.6	550	19.2	34	-0.6
Dad Mohammad Musapour	391	19.7	521	20.6	-131	-0.9
Ebalolah Musapour	667	19.0	629	19.8	38	-0.8
Haj Mehrab Ghasemi	416	18.9	455	19.3	-40	-0.4
Mahmood Ghasemi	587	18.8	418	19.1	169	-0.3
Mohammad Gholi Musapour	743	20.4	457	20.6	286	-0.3
Mohammad Namdar	418	17.9	350	18.9	68	-0.9
Sohrab Musapour	269	19.8	443	19.9	-175	0.0
Average	**584**	**18.6**	**550**	**19.2**	**31**	**-0.5**

Progeny test of nucleus sires

Controlled mating and kidding in the nucleuses allowed pedigree recording. In addition, progeny born in 2011 was recorded for weaning weight at about 4 month of age, fleece weight and down diameter based on the analyses of a fleece sample sent to the Almaty Fiber Laboratory. Formal Index1 (based on WW, FW and DD) was used to evaluate these animals. The index values of the progeny of each of the two sires used in each of the nucleuses were averaged so that a superior sire could be selected in each nucleus

based on average progeny performance. From Table 8 superior bucks can be selected and used with relatively high confidence in his breeding value. The selection accuracy based on a progeny test with 15 progeny measured on a trait with 0.25 heritability (such as down fiber diameter) is 70% as against to an accuracy of 50% for individual selection.

Table 8: Selection of nucleus males on progeny test (2013 mating)

Farmer	Sire	n	WW (kg)	FW (g)	DD (mic)	In-dex1
Abadolla-Musapoor	1358	10	15.9	439	20.2	95
Abadolla-Musapoor	1367	10	12.7	453	20.5	92
Alireza-Musapoor-Masoumeh(Rostam)	1373	12	12.3	317	19.7	78
Alireza-Musapoor-Masoumeh(Rostam)	o0823	5	12.5	373	19.6	81
Dadmohammad-Musapoor	1341	10	15.2	511	21.4	98
Dadmohammad-Musapoor	349-0011	10	14.1	485	21.2	94
Mahmood-Ghasemi (1)	1305	0	16.6	--	--	--
Mahmood-Ghasemi (1)	1312	0	16.3	--	--	--
Mehrab-Ghasemi (1)	1335	0	13.3	--	--	--
Mehrab-Ghasemi (1)	1396	0	13.4	--	--	--
Mohammad-Gholi-Musapoor	1006	12	13.5	513	20.1	104
Mohammad-Gholi-Musapoor	o0326 (2)	0	15.4	--	--	--
Mohammad-Musapoor-Namdar	1328	16	14.5	485	21.2	95
Mohammad-Musapoor-Namdar	o0039	13	13.9	520	21.1	99
Sohrab Musapoor	1265	11	14.6	498	20.8	98
Sohrab Musapoor	370-0015	12	15.3	458	21.8	91

Note: (1) These two farmers were replaced by others with no progeny test information. (2) This buck produced colored offspring which was sold and not measured at shearing.

Selection of replacement males and females

The progeny test provides one of the two bucks for the nucleus. The second buck is selected visually by the famer amongst the nucleus progeny based on the 3 top ranked young bucks on Index1. Table 9 shows the selection differentials achieved in each nucleus by selecting young replacement bucks for the 2013 mating (average of the 3 proposed bucks in relation to average of candidates). Next best young bucks were used to replace old and inferior base flock bucks.

Table 9: Selection differentials of young nucleus males (2013 mating)

Farmer	Candi-dates	Selec-ted	WW (kg)	FW (g)	DD (mic)	In-dex1
Abadolla Musapoor	11	3	2.3	207	0.5	24
Alireza Musapoor Masoumeh (Rostam)	7	3	-1.3	54	-1.2	11
Dad Mohammad Musapoor	12	3	0.0	150	-0.4	20
Mahmood Ghasemi (1)	0	0	--	--	--	--
Mehrab Ghasemi (1)	0	0	--	--	--	--
Mohammad Gholi Musapoor	8	3	-1.7	164	-0.8	19
Mohammad Musapoor Namdar	21	3	0.3	155	-0.2	20
Sohrab Mousapoor	6	3	-2.0	36	-0.3	4
Total/average	65	18	-0.4	144	-0.5	19
Percent			-3	27	-2	18

Note: Selection differential is based on top 3 indexed. (1) These two farmers were replaced by two others with progeny information at this stage.

Replacement females are selected visually amongst young nucleus females and amongst young general flock females in about the same proportions.

The selection and mating procedure applied in 2013 follows almost exactly the originally planned breeding program.

Evaluation of the breeding program

Following FAO (2010) guidelines (or Mueller et al., 2014), evaluation of the outcome, impact and management of a breeding program should be in terms of broad socio-economic and technical criteria.

Socio-economic evaluation

The breeding program involves 8 extended families with about 120 persons running a total of about 3000 goats. The nomads participated in the planning and conduction of the breeding plan and share its benefits through the use of selected bucks and their improved progeny. The level of participation and dimension of the breeding program has to be evaluated in the context of the difficulties of nomadic way of life and its limited infrastructure. The breeding program generated additional interaction between farmers, local authorities and scientists. The resulting organization and communication allowed discussion and consideration of other important issues such as value adding and marketing.

Technical evaluation

The breeding program was not designed to prove genetic progress and rather was designed to be effective for genetic progress under nomadic conditions. To formally prove genetic progress it would have been necessary, for example, to run a control flock or regress breeding values on year of birth. Control flocks are not available and population wide breeding values are not possible to calculate because of lack of comprehensive genealogy of the animals. However, genetic progress can be predicted from the design of the program, for example considering the selection differentials achieved, such as those described in the previous Tables. Expected genetic progress can be estimated from the product of average selection differentials and heritabilities of traits.

Recommendations

The breeding program in the 8 farmer flocks is now in its fourth cycle. Some planned aspects worked smoothly others advanced with more difficulties than expected. For example nucleus and general flocks are mated separately as planned despite demanding considerable management innovations. On the other side it was planned to record birth date, type of birth and body weight at birth in order to adjust weaning weights and other early live measurements but this was apparently too complicated for farmers. Ignoring type of birth, date of birth and age of dam may introduce a bias in fleece weight and live weight against twin born, late born and maiden born progeny when selecting replacements at young age (Gifford et al., 1990). For progeny tests such lack of information is less relevant since it can be assumed that biases are compensated when enough progeny records are averaged. It was also not possible in the first 3 years to record yearling weight therefore Index1 was used instead of the more efficient Index2.

In the period 2010-2013 the breeding program has been implemented with external technical and economic support. However the paramount challenge of a community based breeding program is to progressively become self-sustainable or sustainable under local support conditions. For this to happen extra costs and labor must be kept as low as possible. In order to keep costs and labor low, fiber analyses and recording must be minimized. For this a simplified system was proposed for the future. In this system only top male progeny in the nucleus requires fleece analyses (Figure 2).

Example for flock of 140 does, 7 bucks and 80% weaning rate

	Nucleus		Base	
	Males	Females	Females	Males
Parents	2	40	100	5
Progeny	16	16	40	40
At weaning	Keep/tag 12			Castrate all
At shearing	Take fleece w. Keep top 6 Take sample			
At mating	Select top for N Next 2 for B	Select/paint top 10 for N Next 25 for B		

- Separate mating of nucleus > pen or separate grazing
- Identification of nucleus male progeny > not difficult
- 12 (6) ear tags and fleece weights > use vet ear tag? Need scale
- 6 fiber diameter determinations > ASRI lab?

Figure 2: Simplified selection system for each of eight nomad extended family flocks

Crucial incentive to select for cashmere quality is that farmers get price premiums. At present there is no micron premium paid to farmers but this may change as the marketing becomes more competitive and objective information is valued along the transformation chain. The project which launched the present cashmere breeding program facilitated the analyses of fleece samples by using foreign Fiber Laboratories. The logistics to collect, submit and get the results from these laboratories in addition to the costs involved exceed the capacity of farmers and the capacity of local extension officers. In particular since at present there is no fiber analyses laboratory providing sample analyses services to farmers. Thus, a sustainable breeding program requires operating without fleece samples. Index3 does not require fiber analyses and could be used together with visual appraisal of fiber diameter. Crimp frequency is thought to be a good visual selection criterion for fiber diameter. Unfortunately in wool and mohair visual selection for fiber diameter, based on crimp frequency is not very efficient and its value or alternatives need to be studied in cashmere.

Conclusions

The difficulties in establishing breeding programs described here are the regular difficulties found in most small holder systems. This is a case study to further discuss the essentials in the design, implementation and sustained operation of breeding programs in such systems. In the long run we expect a largely self-sustained improved buck supply system for nomad flocks with higher fleece weights and lower cashmere fiber diameter in nucleus and base flocks. We also expect nomad farmers to be sensitive to further genetic improvement proposals and other project interventions. Clearly the formation of these nucleus schemes is a useful "rehearsal" for genetic improvement programs, and an opportunity to train operators, consolidate breed or strain genotypes while achieving genetic progress in the desired traits.

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Annex 10. Minutes of the Regional Stakeholder Workshop in Dostuk Hotel, Bishkek, Kyrgyzstan, 13-14 May 2013

The Regional Stakeholder Meeting for the IFAD funded Programme in Bishkek combined a formal workshop highlighting the research achievements of the project for a smaller group of partners on 13 May with a wider stakeholder meeting including a knowledge fair with exhibitions and facilitated discussions open for policymakers, buyers of raw fiber and fiber products, potential donors, NGOs active in related activities and at the sites, and the artisan women and farmers on 14 May.
The objectives of the stakeholder meeting included:

- ✓ Share success stories and challenges with partners and other stakeholders;
- ✓ Discuss exit strategies with partners;
- ✓ Create interest for taking over/sustaining project activities at the pilot sites.

Summary of the Project Team Meeting, held on 13 May 2013

In his welcome address, Acad. Djamin Akymaliev, ICARDA Focal Point, Director General, Kyrgyz Research Institute of Crop Husbandry, greeted all participants and emphasized the importance of the work done by the project in addressing the two major issues in agriculture including limited access to world market and insufficient technological provision of farmers and rural women.

Ms. Laura Puletti, IFAD Task Manager, made an opening statement (please see Annex A).

In his opening address, Mr. Antonio Rota, IFAD Technical Division, emphasized the importance of scaling up from pilot project to a larger project. He specified that the crucial part of the grant projects is the knowledge generated by these projects. Mr. Rota pointed out that it is important to establish international knowledge management platform to bring the livestock producers together for knowledge sharing. Pasture management, animal health, breeding and, especially, red meat (sheep and goat) value chain will be very important in development of the future IFAD grant projects. There is a potential to develop a Gissar sheep value chain project in Tajikistan. Mr. Rota informed that the follow up project to be implemented by the Aga-Khan Foundation (AKF) will take over the fiber project's activities related to rural women with more focus on the microcredit schemes to support the artisan women. Finally, Mr. Rota stated that partnership with ICARDA is fundamental for IFAD and he is looking forward to development of cooperation with this institution.

The workshop continued by the presentations of the national project team members on the project achievements in 2013.

Following presentations made by Dr. Ajibekov and Ms. Balalaeva participants discussed Mr. Rota informed about the nearly completed project including a diversification of livelihoods component targeting dairy production in Naryn and Issyk-Kul provinces and that the work of CACSARC-kg will be monitored by a team of experts preparing a new project proposal for the Kyrgyzstan government to be implemented in Naryn and other provinces. During discussion, Dr. Rischkowsky highlighted the importance of linking of farmers in Kochkor district with artisan women to ensure a sustained sheep wool supply. Ms. Mansurova, ACTED, recommended that donors should require from the national governments to establish a favorable legislative environment to support artisans in rural areas.

After the presentation of Dr. Ansari-Renani on goat fiber production in Iran, participants discussed the publication of project achievements in Iran including the extension leaflets for farmers and fiber processors and global cashmere production. Then Ms. Borzi discussed fiber processing in Iran, and participants raised

questions on pricing of yarn in Iran. Dr. Brent suggested starting pricing of yarn from calculation of the actual costs of dehairing and yarn spinning. The next issue discussed at the workshop was the efficiency of trainings on improving the skills of women in yarn spinning and required spinning devices.

Discussion of presentations made by Mr. Davlatov and Dr. Brent cashgora fiber quality, adaptation of the imported Altay breeding bucks in Badakhshan, and fiber fineness of the crossbred offspring obtained from the Altay bucks and local goats.

Then Dr. Ma'tazim Kosimov and Mr. Farkhod Kosimov presented achievements in mohair goat breeding through artificial insemination by the frozen Angora goat semen and mohair processing.

In the closing remarks, Dr. Barbara Rischkowsky encouraged knowledge sharing among the participants representing farmers, artisans, NGOs, and other stakeholders. She explained the agenda of the Regional Stakeholder Workshop on 14 May. She emphasized importance of scaling up of the implemented activities and technical backstopping for livestock producers and artisan women.

Summary of the Regional Stakeholder Workshop, held on 14 May 2013

In the welcome address, Prof. Rysbek Nurgaziev, Rector, Kyrgyz National Agrarian University (KNAU), briefly described the organizational structure of KNAU and highlighted the importance of the fiber project in addressing issues of women's unemployment and improving living standards of the rural poor in Naryn province.

In the welcoming statement, Dr. Josef Turok informed the participants that ICARDA has been working with 10 international centers and national agricultural research systems since 1998. He pointed out that outscaling of the results and big knowledge generated in the course of the fiber project is a challenging task. Dr. Turok stated that the cooperation with IFAD will be continued in the new IFAD funded CACILM Knowledge Management project. He also briefed the stakeholders about the launched Consortium Research Program 1.1 on Dryland Systems with the action sites in Fergana valley, Aral Sea, and Rasht valley.

Then Ms. Laura Puletti, IFAD Task Manager, made an opening statement (please see Annex B).

The Knowledge Fair was introduced by Dr. Barbara Rischkowsky who briefed the stakeholders about the project sites, project goal, value chain model developed by the project and activities on livestock breeding, fiber processing, and linking of beneficiaries to international markets. She also announced the following objectives of the stakeholder meeting:

- ✓ Share project achievements and experience through a lively dialogue;
- ✓ Listen to perspectives of different partners involved in the project;
- ✓ Receive feedback and new ideas from interested stakeholders;
- ✓ Discussing the future: how to sustain the development at the sites;
- ✓ Creating new alliances.

Then the workshop participants visited the project exhibition where the site teams introduced their project outputs through:

- Short statements from all involved at the project sites:

  - Farmers, Processor Women, Research Institutes, NGOs
  - explaining involvement and outputs
- Posters describing activities and achievements
- Photos showing characteristics of the sites: People, Landscape, Animals, Processing methods
- Raw fiber and fiber products
- Additional printed information (leaflets, guides):
  - **Manual on Goat Breeding**, Author: Matazim Kosimov, Working group: F. Kosimov, N. Nishanov, Sogd Branch of Livestock Institute at Tajik Academy of Agricultural Sciences, IFAD, ICARDA. Dushanbe, 2013.
  - **Improvement of the fine sheep wool quality** (Recommendations for farmers), Authors: D. Chebodaev, A. Ajibekov, IFAD, ICARDA, Kyrgyz National Agrarian University named after K. Skryabin, Kyrgyz Research Institute of Livestock Production and Rangelands (2 separate versions issued in Russian and Kyrgyz languages). Bishkek, 2013.
  - **Manual on Goat Breeding Using the Imported Genetics**, F. Ikromov, Kh. Davlatov, Livestock Institute at Tajik Academy of Agricultural Sciences, IFAD, ICARDA. Dushanbe, 2013.
  - **Improvement of cashmere from nomadic Raeini goats**.
  - **Marketing of cashmere in Iran**
  - **Cashmere shedding and combing.**

The exhibition started from a 'guided tour' of the 4 site specific stands (see photos) for all participants followed by individual 'site visits' to the stands by stakeholders to acquire more detailed information.

After the exhibition, the stakeholders came back to the plenary session to share their feedback and presentations. This session was facilitated by Ms. Laura Puletti who encouraged participants to share their views with regard to sustainability and exit strategies.

Mr. Najmiddin Gulomiddinov, Coordinator for Rural Economic Development, Agha Khan Foundation (AKF), emphasized significant project outputs of the fiber project related to fiber production, processing, and marketing. He advised that a new project to be implemented by AKF will have the pilot sites in Tajikistan, Kyrgyzstan, and Afghanistan and will support the small women-led businesses. Mr. Gulomiddinov informed that the new project will look at institutional, financial management and legal side, provision of technologies, strengthening of market linkages, protection of environment, and cooperation with livestock institute. He appreciated the efforts of IFAD and ICARDA in setting up a good basis for the forthcoming project.

The following presentation was made by Ms. Assel Zelenina, Project Manager, Felt4You project. She informed about internet shop for handmade crafts from Central Asia based in the Netherlands (www.Felt4You.nl). Ms. Zelenina advised that Felt4You project started offline sales in April 2012 the web shop was launched in August, 2012. She also specified the obstacles facing her project such as logistics and transportation; high costs of rent at markets and transportation; lack of physical shop; lack of vehicle and no driving license in Europe; strong commercial competition . In her view, sustainability of Felt4You can be achieved through:

- sharing the commitment;
- potential visits of the female crafters;
- organizing a visit to the Netherlands (workshops);
- joint efforts on promotion and marketing;
- capacity building.

Fair Trade registration (through www.wfto.com, www.fairtrade.net) is one more way to ensure sustainability of Felt4You.

Ms. Rano Mansurova, Country Director, ACTED, advised that the fiber project is a good example of project strengthening the role of women, as it was very successful in addressing the gender issues. She highlighted other achievements of the project including the established supply value chain model, integration of three participating countries and knowledge exchange among them, timely small business support given the high labor migration in Tajikistan and Kyrgyzstan. Access to microfinance institutions should be ensured for artisans. She also advised that 4 years is a short period for ensuring sustainable development, and the implementation period could be 6-7 years. Ms. Mansurova recommended that the project could have paid more attention to open access of artisans to local markets in addition to development of international marketing. She emphasized that the project needs to work more on capitalizing the project outputs so that the breeding results obtained during implementation are not lost and introduced to state academic institutions. Finally, Ms. Mansurova suggested involving more policymakers to ensure the corresponding legislative support for farmers and artisan women.

Mr. Faizullo Abdulloev, Manager, NAU - Agency Supporting Development Process, pointed out that the project activities on mohair goat breeding in Sogd province were crucial for revitalizing the sector as 13,000 mohair goat flock kept by state farms in Oshoba had dramatically declined to 1,045 goats. He appreciated the very strong project team formation. In his view, to ensure sustainability the project needs to answer the question "Who will take other the implemented activities and marketing at local level" - association, cooperative, jamoat (community), farmers' group? Mr. Abdulloev advised that the project could be more successful through cooperation with NAU, other NGOs, and local self-governing authorities (jamoats). He recommended for future projects to pay more attention to rangeland degradation issues.

Dr. Rischkowsky recommended that NGOs and other partners jointly collaborate in addressing the land ownership issues facing the goat producers in Tajikistan. She advised that the sustainability of mohair processing can be questioned without clear land ownership rights.

Ms. Chogjmoo Miller, Owner of the Souvenir Shop in Hayatt Hotel, Dushanbe, informed that her shop sells products from Afghanistan, Central Asia, and Mongolia. In her view, lack of a sustainable supply chain consistently meeting the international standards is a major challenge. She informed that she is very interested in linking the producers to buyers. Ms. Miller advised that mohair products and scarves have a good market.

Mr. Kubanychbek Abdykerimov, Veterinary Consultant, Mol Bulak Finance company, informed about his company. He advised that the goal of Mol Bulak Finance company is to provide small unsecured group loans for groups, mainly women, living in rural communities of Kyrgyzstan to support and encourage their

economic development through establishment of the small enterprises. The company conducts training of farmers on plant growing, gardening, animal industries, poultry farming, farm management. Mol Bulak Finance has introduced an Online Farm web-platform to link farmers to consumers.

Mr. Melis Berdibekov, Regional Manager, Mountain Societies Development Support Programme, AKF Kyrgyzstan, informed that they have a good experience of project implementation in the Osh province. He advised that the new project on sheep wool through CACSARC-kg will continue support of the five artisan women's groups currently involved in the fiber project. Mr. Berdibekov stated that he is looking forward to further cooperation.

In the end of the plenary session, Dr. Rischkowsky provided a brief introduction to group work. She suggested that, while discussing the site-specific exit strategies, participants should address the following questions:

- What interventions are required to support goat/sheep producers in the future?
  - What needs to be continued
  - What are new challenges to be addressed
  - Who will/could implement the required interventions (roles/responsibilities of potential partners)
- What interventions are required to support women processor groups in the future?
  - What will be continued in the new project by whom?
  - What are new challenges that will be addressed and by whom?
- What institutional/policy problems should be addressed?

Following the discussion of the project exit strategies for each specific site, participants met again at the plenary session for reporting. Please see results in Annex C.

In the closing remarks, Dr. Rischkowsky appreciated all project collaborators for preparing this non-standard workshop, the stakeholders who shared their valuable feedback, and donor representatives for attending the workshop, and project consultants for efficient inputs. She advised that there will be other opportunities for cooperation including the CRP 1.1.
In the closing address, Mr. Rota emphasized the significant outputs delivered by the project. He informed that the credit part of value chain will be addressed in the coming project. Mr. Rota pointed out that ICARDA as a traditional partner by the end of projects always delivered a model that can be taken over by a bigger investment project. He reminded that red meat value chain concept with focus on sheep meat (mutton) should be developed. Mr. Rota informed that IFAD will start a policy dialogue with the national governments that could not be done within the grant project. He appreciated all women who have been working in the fiber project.
In the closing statement, Dr. Ajibekov appreciated all stakeholders for attending the workshop and advised that he and other team members are looking forward to future fruitful cooperation.

Annex A. Opening Remarks by Ms. Laura Puletti, IFAD Task manager, at Project Team Meeting held on 13 May 2013

Dear Colleagues,

First of all let me thank the Kyrgyz authorities and our ICARDA team for welcoming us all so warmly to Kyrgyzstan and organizing this completion workshop.

My extended gratitude goes also to all our colleagues from the various teams as well as the members of our target groups, women and men farmers, that have traveled to Bishkek to attend this meeting and have shown intense commitment during these years of implementation, in addition to flexibility and motivation that goes beyond "business as usual".

After four years of hard work we have come to the successful completion of a programme that has exceeded expectations and built trust and a new modality of work among its members.

IFAD considers this as a model programme for its results and way of operandi that by mixing livestock community breeding and value chain development has crucially contributed to improving the lives of more than 600 people in the area linking Central Asia to international firms and developing opportunities for scaling-up in future investment projects already underway.

In particular, I would like to commend the programme's efforts in sharing its knowledge and results with the international community and within Central Asia through scientific publications, videos, articles and the creation of a specific website where development of communities is described through beneficiaries' pictures and products are sold to Europe and the USA.

I look forward to listen to your presentations on the latest results and challenges and to discuss with all of you about future opportunities for collaboration.

Thank you.

Annex B. Opening Speech by Ms. Laura Puletti, IFAD Task manager, at Regional Stakeholder Workshop held on 14 May 2013

Dear Colleagues,

I would like to thank the Kyrgyz authorities for coming to attend our meeting today and the rest of the team for having updated us on recent development of the programme during yesterday's session.

I believe that today's organization of the sessions is going to be very interactive and ensure more networking and exchange among all the members of the group. It will be also an occasion for the farmers, women and men, from all countries concerned by the programme to proudly present the results of their 4 year efforts.

I still remember Dr Liba Brent presenting the project in 2009 in Bangkok in a similar way to the IFAD Asia and the Pacific team. Already at that time it was evident that this programme would have been a very interesting, innovative and gender sensitive project.

As we said yesterday, this programme will be scaled up in different ways but I would like to reiterate the importance for defining exit strategies for each pilots during these last months and agree for a strong support from the institutes and master students for the years to come in order to increase the positive domino effects and ensure strong linkages with the private sector and key national non-governmental organizations.

I would also like to suggest holding regular meetings with the IFAD country presence officers in both Tajikistan and Kyrgyzstan, Ms Kenjaeva and Mr Sultananiev respectively, in order to receive information on IFAD and other donors' activities in the region and provide us with useful feedback on our performance.

I look forward to visit today's "country stands" and admire the first mohair carpet and spend some time with the rural farmers that have worked so hard to improve their skills and accommodate western demand and taste.

As my friends were saying yesterday evening at dinner: Friendship, Health and Success to you All!!!

Thank you.

Annex C. Results of group discussions

Iran group

Interventions required to continue the project activities

1. Breeding program to improve the goats to have good quality cashmere
2. Trainings to improve the handicrafts (to meet international standards)

Challenges

- to adopt policies in the area of imports and exports
- government should adopt policies to establish and develop new cooperatives
- to develop local production of tools and devices under state support
- to develop local dehairing technologies suitable for nomadic conditions
- to outscale extension work

***Which institutions can implement these interventions*?**

There are 4 organizations in Iran:

1. Nomad organization
2. Livestock Department of Ministry of Agriculture
3. Animal Science Research Institute
4. NGOs

What interventions are needed?

- offer low interest rate credits
- training
- organizing producers through developing cooperatives and their unions
- linking farmers to processing and marketing
- visual classing and sorting

What institutional/policy problems should be addressed?

- export related policies (to export finished products)
- sustainable use of rangelands
- support of nucleus herds (including using new techniques such as artificial insemination)

During discussion, it was mentioned that ASRI has to set up a modern fiber testing laboratory.

Kyrgyzstan group, Naryn site.

1. It is necessary to develop a database on quality raw material, to continue breeding with the best animal breed, and to establish stations for artificial insemination.

2. Lack of state support
   - to develop a workplan with microcredit institutions (MCI). Designing of an agricultural product for work with MCI at low interest rate.
   - Improved marketing

Strategic plan for development of producers and processors

I. Resource base for raw materials
- Market analysis for raw material and exports
- Raw material reserve
- Improved feeding and husbandry for animals
- Genetic improvement of animals

II. Lacking legal framework
- state and private partnership
- access to credits (loans)

III. Marketing services
- quality management
- machinery and equipment
- credit institutions
- strengthening of coordination with the stakeholders

IV. Policies
- establishment of a legislative base
- cooperation with wool producing farmers and processors
- marketing services for sales
- support through grant projects (IFAD, ICARDA, World Bank, EBRD)

Tajikistan, Khujand site group

1. Continue improving of farmers' goat flock quality:
- work with nucleus groups and establishing of new nucleus groups;
- coordination of goat breeding;
- maintenance of goats' health;
- support linkages with research institutes, NGO and international organizations.

2. Rangeland management:
- conservation and improvement of rangelands;
- certification of rangelands for farmers.

3. Joint action of farmers for promoting their interests:
- establish associations (cooperatives) in certain microzones with further aggregation into a single center;
- establish infrastructure (system) of association;
- provide information and knowledge exchange;
- protect farmers' rights and interests;
- resolve problems of labor migration;
- seasonal lax loans

Tajikistan, Badakhshan site group

I. Improved goat breeding. For further project work and improving livelihoods of rural women and farmers activities should be directed to continuation of the breeding work, as cashmere goats in Badakhshan are the main source of raw material. At this stage of work, breeding work on enhancement of pedigree and productivity traits was resumed with efforts of project collaborators for further development of Pamiri cashmere goats. However, stopping of work at this stage is not desirable. It is necessary to continue selection of appropriate goats for developing of body structure, phenotypic and genotypic characteristics corresponding to cashmere goat breeds, cashmere productivity, etc. Recording of obtained cross-bred progeny in the breeding flocks using Altay bucks (imported from Russia), and their further assessment should also go on. In this direction, it is necessary to expand breeding work to other districts, establishment of scientific breeding farm (center) at Pamir Scientific Research Center of Tajik Academy of Agricultural Sciences in Khorog for conservation and rearing of nucleus (pedigree) group of Pamiri cashmere goats.

II. Improved forage production for farmers and households as well as enhancement and management of rangelands for their rational utilization. In this direction, joint action with farmers on sawing of the most adapted forage crops (legumes and cereals) and development of rangeland improving activities is considered promising. Veterinary services at household level (regular preventive measures and treatment of animal diseases), implementation of consultative and methodical work with farmers on livestock management, keeping, feeding, and animal husbandry should be undertaken by scientific staff of research institutes with local specialists.

III. Activities to support fiber processing women. Technical endowment or technical support, i.e. establishing of the collective workshop, procurement of required equipment, wool and goat cashmere processing machines (scouring, dehairing, carding machines, spinning and knitting equipment, etc.).

IV. Marketing of products, improved fiber processing:

- development of standards for yarns as well as production of the best samples, yarn models and knitted products, organization of work on sorting, classification of raw material, yarn and products;
- data recording for production, processing of wool and cashmere by households, of products, transportation expenses, etc.
- setting up of communication networks with NGOs, attracting of donor institutions, informational linkages, business relations, improving market access, collaboration with other interested organizations and neighbor countries
- Training of interested women's groups in mohair and cashmere processing as well as knitwear production, etc.

Annex D. Program of the Project Team Meeting, 13 May 2013, Dostuk Hotel, Bishkek, Kyrgyzstan

Opening session		**Chairperson: Dr. Jozef Turok**
13:00-13:10	Welcome address	Acad. Djamin Akymaliev, ICARDA Focal Point, Director General, Kyrgyz Research Institute of Crop Husbandry
13:10-13:20	Opening statements	Ms. Laura Puletti, IFAD Grant Manager Mr. Antonio Rota, IFAD Technical Division
Presentation of project achievements		
13:30-14:15	Kyrgyzstan: Sheep wool production Processing and marketing felt products Discussion	**Chairperson**: Dr. Matazim Kosimov Dr. Asanbek Ajibekov Ms. Svetlana Balalaeva
14:15-15:00	Iran Goat production Fiber processing Discussion	**Chairperson:** Dr. Tolibek Bukhoriev Dr. Hamidreza Ansari-Renani Ms. Najmeh Kargar Borzi
15:00-15:30	***Group photo and Coffee break***	
Presentation of achievements in 2012 (cont.)		
15:30-16:15	Badakhshan: Goat production Processing and marketing fiber products Discussion	**Chairperson:** Dr. Fazzlidin Ikromov Mr. Khurshed Davlatov Dr. Liba Brent
16:15-17:00	Khujand: Goat production Processing and marketing fiber products Discussion	**Chairperson:** Dr. Asanbek Ajibekov Dr. Ma'tazim Kosimov Mr. Farkhod Kosimov
17:00-17:15	Closing remarks	Dr. Barbara Rischkowsky

19:00	***Conference Dinner***

Annex E. Program of the Regional Stakeholder Workshop, 14 May 2013, Dostuk Hotel, Bishkek, Kyrgyzstan

Plenary		**Chairperson: Acad. Djamin Akimaliev**
09:00-09:30	Welcome address	Mr. Nurlan Duysheev, Secretary of State, Ministry of Agriculture and Amelioration, Kyrgyzstan
	Welcome address	Prof. Rysbek Nurgaziev, Rector, Kyrgyz National Agrarian University
	Welcoming statement	Dr. Josef Turok, Head of CGIAR-PFU, Regional Coordinator of ICARDA-CAC office
	Opening statement	Ms. Laura Puletti, IFAD Grant Manager
09:30-09:45	Introduction/Orientation	Dr. Barbara Rischkowsky
Knowledge Fair (stands)		
09:45-10:45	Guided tour - all participants	Facilitator, Presenters at each stand/site
10:45-11:15	***Group photo and Coffee break***	
11:15-12:00	Individual tours of stands	
Plenary		**Chairperson**: Ms. Laura Puletti
12:00-13:00	Feedback from Key Stakeholders and discussion	
13:00-14:00	***Lunch break***	
14:00-14:15	Introduction to the group work	Dr. Barbara Rischkowsky
Group Work		**Facilitators for each site**
14:15-16:00	Group Work (4 sites)	
16:00-16:20	***Coffee break***	
Plenary		**Chairperson:** Dr. Jozef Turok
16:20-17:20	Report back from 4 groups (each 10 min and 5 min for clarifications)	Group Rapporteurs
17:20-17:40	General Discussion	
17:40-18:00	Closing remarks	ICARDA, IFAD, Host country

Annex F. Participants in the Regional Workshop – team members

#	Name/Surname	Position	Organization
ICARDA and Project Consultants			
1	Dr. Barbara Rischkowsky	Project Coordinator	ICARDA
2	Dr. Josef Turok	Head of PFU, Regional Coordinator of ICARDA-CAC office	CGIAR-PFU, ICARDA-CAC
3	Mr. Nariman Nishanov	Professional Officer, Socioeconomics	ICARDA-CAC
4	Dr. Liba Brent	Principal Investigator	University of Wisconsin
5	Dr. Joaquin Mueller	Principal Investigator	INTA
IFAD			
6	Ms. Laura Puletti	IFAD Task Manager	IFAD
7	Mr. Antonio Rota	Senior Technical Adviser Livestock and Farming Systems	IFAD
Kyrgyzstan			
8	Acad. Djamin Akymaliev	ICARDA Focal Point, Director General	Kyrgyz Research Institute of Crop Husbandry, Kyrgyzstan
9	Dr. Asanbek Ajibekov	PI on Livestock Productivity, Director General	Kyrgyz Research Institute of Livestock and Rangelands
10	Mr. Jayik Isakov	PI on Socio-economics, Assistant Professor of the Marketing Dpt.	Kyrgyz Agrarian University
11	Dr. Dmitriy Chebodaev	Researcher	Research Institute Livestock and Rangelands
12	Ms. Svetlana Balalaeva	Representative	Central Asian Crafts Support Association (CACSA)
13	Dinara Chochunbaeva	Representative	Central Asian Crafts Support Association (CACSA)
14	Rasalieva Kenjekan	Bishkek, Trainer	“CACSA-Trade”, Director
15	Tatyana Vorotnikova	Bishkek, Trainer	Studio of Tatyana Vorotnikova
16	Zhamanbaeva Burulush	Group leader	“Uz-Nur-Ayim” artisan group
17	Omuralieva Shaygul	Group leader	“Ak-Bairak” artisan group
18		Group leader	Lakhol artisan group
19	Amanova Toyunbewbew	Group leader	“Cheber Koldor” artisan group
Iran			

20	Dr. Hamidreza Ansari-Renani	Head of Research Dpt.	Animal Science Research Institute
#	**Name/Surname**	**Position**	**Organization**
21	Mr. Syedmojtaba Syedmomen	Scientic Board Member	Agriculture and Natural Resources research center
22	Mr. Mohsen Ehsani	Scientic Board Member	Agriculture and Natural Resources research center
23	Mr. Omidali Alipour Ashrafi	Head of Animal Science Dep	Jahad-Agriculture Org
24	Ms Najmeh Kargar Borzi	Working with women	Research Centre for Agriculture and Natural Resources
Tajikistan -Sogd Province			
25	Dr. Ma'tazim Kosimov	Deputy NC, PI, Livestock productivity Head of the Sogd branch	Tajik Research Institute of Livestock
26	Mr. Farkhod Kasymov	PhD Student	Tajik Research Institute of Livestock
27	Mr. Alisher Kosimov	MSc student Socioeconomics	
Tajikistan -Dushanbe			
28	Dr. Khukmatullo Akhmadov	Focal Point, President	Tajik Academy of Agricultural Sciences (TAAS)
29	Dr. Fazzlidin Ikramov	National Coordinator,Director	Tajik Research Institute of Livestock
30	Mr. Khurshed Davlatov	Site Coordinator	Tajik RI of Livestock
Tajikistan - Badakhshan			
31	Mr. Qonun Davlatqadamov	Researcher	Agr. Adm. Department
Uzbekistan			
32	Mr. Askarov Akhror	Interpreter	
33	Mr. Artur Ambartzumyan	Interpreter	

Annex G. Participants in the Regional Workshop – other stakeholders

#	Organizations	Names
	Current and Potential collaborators	
	Tajikistan	
1	NAU - Agency Supporting Development Process, Asht	Mr. Faizullo Abdulloev, Manager
2	AKF (Agha Khan Foundation) - Mountain Societies Development Support Programme), Dushanbe	Najmiddin Gulomiddinov, MSDSP Tjk Programme Coordinator for Rural Economic Development
3	Cashmere Processing Facility, Herat, Afghanistan	Mr. Abdul Basir Hotak
4	ACTED Tajikistan	Rano Mansurova, Country Director
	Kyrgyzstan	
5	Ministry of Agriculture and Amelioration	Duysheev Nurlan Arstanbekovich, Secretary of State
6	Kyrgyz National Agrarian University	Nurgaziev Rysbek, Rector, Corresponding Member of the National Academy of Sciences of the Kyrgyz Republic, Professor
7	Kyrgyz National Agrarian University	Chortonbaev Tyrgoot - Deputy Rector on Science.
8	Kyrgyz trainers and Designers	Gulmira Ahmatova
9	Kyrgyz trainers and Designers	Kenjekan Toktosunova,
10	Kyrgyz trainers and Designers	Tatiana Vorotnicova , Felt art
12	Mol Bulak Finance company	Mr. Kuban Abdykerimov
	Iran	
13	Head of Nomad Organization, Kerman Agriculture Organization	Mr. Alireza Shakeri
	Buyers	
14	Company AZ projects, Project Felt for you	Ms. Assel Zelenina, Owner, Project Manager
15	Souvenir Shop Hayatt Hotel, Dushanbe	Ms. Chogjmoo Miller

Khujand stand at the Knowledge share fair on 14 May 2013 in Bishkek

Badakhshan stand at the Knowledge share fair on 14 May 2013 in Bishkek

Kyrgyz stand at the Knowledge share fair on 14 May 2013 in Bishkek

Iranian stand at the Knowledge share fair on 14 May 2013 in Bishkek