Chapter 9
The Feed-Livestock Nexus: Livestock Development Policy in Tajikistan

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Abstract This chapter discusses livestock development policy in Tajikistan in the context of the transition from intensive to extensive livestock husbandry since the late 1980s. The structure of feed demand and supply in Tajikistan in the postindependence period is discussed in order to understand the driving factors behind feed imbalances. Measures to address feed shortages with projections to indicate anticipated effects are analyzed. A comprehensive livestock development strategy for Tajikistan could employ these measures as cornerstones of a program for improving the feed-livestock nexus for Tajikistan.

Keywords Feed balance • Silage • Hay • Barn feeding • Dehkan farm • Feeding • Feed sources • Feed concentrates • Feed units • State farms • Collectives • Privatization • Animal productivity [and indicators] • Milk yield • Grain yield • Grain self-sufficiency • Crop rotations • Livestock inventories • Lucerne • Irrigated land • Yaks • Donkeys • Horses • Poultry • Feed requirements • Pasture Trust • Freedom to farm • *Jayits* • Pasture user groups • Russia • Kazakhstan • Kyrgyzstan • Azerbaijan • Moldova • Georgia

Key Points

- A three-tier system of animal feeding was the norm in Central Asia in Soviet times, and it rested on three pillars: (i) an elaborate organization for procuring animal feed for winter feeding based on intensively cultivated feed crops raised in large-scale state and collective farms, (ii) sizable imports of concentrates, and (iii) an organized system of pasture management and utilization, including pasture maintenance, transportation along established routes, clear assignment

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of pasture rights, animal veterinary points, shepherd supply facilities along the routes, and an established schedule of transhumance pasturing. This system was dismantled after the break up of the Soviet Union, leading to the present situation of low productivity and dire feed shortages.

- Breaking the downward spiral of animal yields and poverty requires the gradual implementation of policy measures to address the feed shortage in the country. The first step toward formulating these policies is to understand the root cause of the imbalance between the supply and demand for feed.
- The main constraint on the development of the livestock sector in Tajikistan is an extreme imbalance between the supply and the demand of cultivated feed and concentrates for dairy and beef cows. First, demand for all-year winter and fall-spring pastures is much too high to be sustainable. Clearly, demand for these pastures needs to be limited in order to ensure sustainable use of these resources. The main users of these pastures are dairy and beef cows. In order to limit grazing of cows and cattle on these fields, the supply of cultivated feed and concentrates must be increased and made available to farmers. This will allow farmers to keep animals in barns for feeding rather than letting them feed in nearby fields.
- The mismatch between feed and animals is such that household farms raise only 6% of required feed on farm and must utilize the pastures of agricultural enterprises and dehkan farms or purchase cultivated feed from enterprises and dehkan farms. Agricultural enterprises and dehkan farms, however, have nearly five times the feed resources required to support their livestock inventories.
- The feed-livestock nexus is only one of a number of issues that should be addressed under a sustainable livestock development policy. Other issues, including the establishment of a viable plan for supplying livestock advisory and health services, a forward-looking livestock breeding policy, development of marketing channels for livestock products, livestock product safety, and environmental impacts of livestock, should also be part of such a policy.

1 Introduction

The end of the 1980s and the beginning of the 1990s signaled the deterioration of the socialist system of livestock production in all CIS countries. The changes that transpired during those years transformed the livestock husbandry system in many CIS countries, and certainly in Central Asia, from one based on intensive livestock farming to one based on extensive livestock husbandry. Intensive farming is an agricultural production system characterized by high inputs of capital, labor, or heavy usage of technologies such as pesticides and chemical fertilizers relative to land area. In the Soviet Union, including Soviet Central Asia, intensive livestock farming was conducted in large dairy and meat complexes where cultivated feed and purchased concentrates were fed to dairy cows, poultry, and hogs. The livestock production system that has emerged since 1991 relies primarily on grazing of livestock with limited feeding of cultivated feed and concentrates.

The transition from an intensive to extensive system of livestock production is not necessarily a bad thing. However, like any system, it needs to be managed sustainably. When the number of animals allowed to graze on pastures is not controlled, extensive livestock systems can lead to overgrazing and to a vicious cycle of inadequate feed and ever-lower animal yields, contributing to ever-lower returns from livestock husbandry. Because of the risk of a persistent decline in yields and hence rural incomes, the transition from an intensive to an extensive livestock production system carries a significant danger of pervasive and continuing rural poverty.

Breaking the downward spiral of animal yields and poverty requires the gradual implementation of policy measures to address the feed shortage in the country. The first step toward formulating these policies is to understand the root of the imbalance between the supply and demand for feed. Since animal feed derives from two main sources—cultivated feed for barn animals and pasture feed for grazing animals—the analysis of the feed demand overhang should address supply and issues for both types of feed. The heart of the feed-livestock nexus is in understanding the reasons for the excess demand for feed.

The feed-livestock nexus is only one of a number of issues that should be addressed under a sustainable livestock development policy. Other issues, including the establishment of a viable plan for supplying livestock advisory and health services, a forward-looking livestock breeding policy, development of marketing channels for livestock products, livestock product safety, and environmental impacts of livestock, should also be part of such a policy. However, the first key challenge of livestock policy is ensuring adequate and accessible supplies of feed for livestock. Feed adequacy is the first-level constraint on income from livestock husbandry. Previous studies have concluded that livestock product marketing and safety, advisory and health services, and environmental impact issues do not represent first-level constraints on farm incomes (Bravo 2005; World Bank 2007). Instead, most studies (e.g., Nolan 2005, 2006; O'Mara 2006; Bravo 2005; FAO 2009) conclude that the feed-livestock nexus is the most immediate problem for sustainable livestock development, though little has been written on this problem.

This chapter discusses livestock development policy in Tajikistan in the context of the transition from intensive to extensive livestock husbandry since the late 1980s. The structure of feed demand and supply in Tajikistan in the postindependence period is discussed in order to understand the driving factors behind feed imbalances. Measures to address feed shortages with projections to indicate anticipated effects are analyzed. A comprehensive livestock development strategy for Tajikistan could employ these measures as cornerstones of a program for improving the feed-livestock nexus for Tajikistan.

2 The Transition from Intensive to Extensive Livestock Husbandry in Tajikistan, 1991–2007

The socialist intensive livestock husbandry system in Tajikistan relied on three separate subsystems for support of livestock (FAO 2009, pp. 29–32). The first consisted of livestock inventories (predominantly milking herds) in large-scale

enclosures on state and collective farms or complexes attached to industrial concerns. Along with these large-scale holdings went the livestock of employees (predominantly dairy cows) on individual subsidiary plots. The animals in this subsystem fed on hay, mixed feed, and cut feed all year.

The second subsystem consisted of livestock that spent the winter-spring period in enclosures and the summer-fall period in pastures. This was predominantly beef cows, beef cattle, animals of certain alpine regions without winter pastures, and animals in the majority of northern regions. This subsystem required 210 days of cultivated forage for feeding in large enclosures. These first two subsystems included the large-scale industrial livestock complexes common in the former Soviet Union for dairy, hogs, and poultry.

The third subsystem was entirely pasture-based, with transhumance grazing of livestock in summer, spring-fall, and winter pastures throughout the year. This system covered all sheep, goat, and horse inventories of the absolute majority of regions in the south, Khatlon oblast and the Regions of Republican Subordination (RRP). For this subsystem, it was necessary to hold only an emergency stock of cut feed. Intensive livestock husbandry in Tajikistan was based on use of chemical fertilizers and irrigation for grains, resulting in significantly increased yields. Higher grain yields freed up area for planting feed crops, which were also fertilized and irrigated. Central Asia as a whole, including Tajikistan, was also a net importer of feed and food grains. Mixed feed imports assisted in filling the winter feed gap.

In addition to these "technological" aspects of intensive agriculture, the governments of the Soviet Socialist republics also made great efforts to properly manage pasture maintenance, utilization, and transportation, and to supplement pasture feeding with adequate cultivated fodder. This involved matching feed demand and supply through feed balances which took account of use of summer, spring-fall, and winter pastures and the procurement of sufficient fodder to fill the winter feed gap.

The Soviet three-tier system of animal feeding in Central Asia rested on three pillars: (1) an elaborate organization for procuring animal feed for winter feeding based on intensively cultivated feed crops raised in large-scale state and collective farms, (2) sizable imports of concentrates, and (3) an organized system of pasture management and utilization, including pasture maintenance, transportation along established routes, clear assignment of pasture rights, animal veterinary points, shepherd supply facilities along the routes, and an established schedule of transhumance pasturing. Box 9.1 explains the elements of the livestock feed base in Tajikistan.

Table 9.1 illustrates the collapse of the first two pillars supporting the socialist intensive livestock husbandry system in Tajikistan, showing falls in the availability of cultivated feed crops and concentrates. All figures are shown in standard feed units, allowing aggregation. The fall in area and yields of feed crops caused a sharp decrease in the production of cultivated feed crops, the first pillar supporting the socialist intensive livestock husbandry system (Table 9.1, line 1a). Between 1991 and 2000, the total cultivated feed available to livestock in Tajikistan fell by 79%. The second pillar of support for intensive livestock husbandry—imported concentrates—was nearly completely eliminated between 1991 and 2000 (Table 9.1, line 1c). The availability of domestic concentrates also fell by half in this period

Box 9.1 The Livestock Feed Base in Tajikistan

Feed	Definition
Cultivated feed crops	Crops raised specifically for feeding domesticated livestock, which include: (1) Dry forage (perennial grasses, harvested as hay, haylage (from alfalfa), and straw) (2) Green chop (lucerne, a legume), annual grasses, corn and other silage (fermented, high-moisture fodder that can be fed to ruminants, such as cattle and sheep. Usually made from grass crops, including corn, sorghum, or other cereals, using the entire green plant (not just the grain)) (3) Succulents without silage (feed roots and melons, sugar beets for feed)
Domestic and imported concentrates	(1) Coarse grains such as corn, barley, and oats (2) Bran (the hard outer layer of grain, a by-product of milling in the production of flour) (3) Oil meals (in Tajikistan, cotton meal) (4) Mixed feed, feed additives, and other concentrated feed mixtures (grass flour, etc.)
Pasture	Pasture is land with low-growing vegetation cover used for grazing of livestock. Pasture growth can consist of grasses, legumes, other forbs (such as clover or milkweed), shrubs, or a mixture

In the Soviet period, area under *cultivated feed crops* in Tajikistan grew from 7 to 30% (1940–1985) of total sown area, allowing for the rapid growth of the livestock sector. The primary feed crops raised in irrigated fields of collective and state farms were lucerne, corn, sorghum, and sugar beets. Feed crops were raised through a variety of multiple cropping techniques in order to maximally utilize the long vegetative period in Tajikistan. These techniques included planting two harvests of silage per year, adding feed roots to land sown with corn, planting of lucerne together with feed grains, and other methods. In the Soviet period, there were 14 specialized seed farms for supplying lucerne seeds for rotation with cotton. Tajik farms practiced rotation of lucerne with cotton in order to raise cotton yields, secure ample supplies of fodder, and guard against verticillium wilt in cotton-growing areas of Tajikistan.

Concentrates refer to feed that has a higher concentration of energy than a forage diet. These are coarse grains, wheat, oil meals, and feed mixtures. A concentrate diet is the primary basis of intensive livestock production in developed countries.

In addition to cultivated feed crops, Tajikistan has ample *pasture* land used for grazing livestock. In mountainous countries as Tajikistan, pastures are classified according to their season of use depending predominantly on their altitude. Summer pastures in Tajikistan are located from 2,200 to 3,400 m above sea level and are used between June and August. Spring-fall pastures are usually located between 900 and 1,500 m above sea level and are used from March to May and September to November. Winter pastures are used between November and March and are located 500–1,200 m above sea level. All-year pastures are located at the same level as winter pastures but used all year round.

Sources: "Agriculture" in Academy of Sciences of Tajik SSR (1974) and FAO (2009)

Table 9.1 The collapse of available cultivated feed and concentrates in Tajikistan (in tons of standard feed units), 1991–2007

No.	Feed source	1991	2000	2007	Percent change, 1991–2000	Percent change, 1991–2007
1	*Total from cultivated feeds and concentrates (feed units, tons)*	2,196,062	458,131	738,744	–79	–66
a	Total cultivated feed crops	1,500,404	274,858	386,748	–82	–74
b	Domestic concentrates	368,658	182,954	344,439	–50	–7
c	Imported concentrates	327,000	319	7,557	–100	–98
2	*Feed availability per animal (feed units/head)*[a]					
a	Feed per standard animal head[b]	13	4	5	–69	–73
b	Feed per cow[c]	38	8	9	–78	–77

Sources: FAO (2009), p. 22. *Sel'skoe khoziaistvo respubliki Tadzhikistan: statisticheskii sbornik (2007)*

[a]This measure is incomplete because it does not include feed consumed through grazing in pastures

[b]Includes all animals measured in cow equivalent units

[c]Only cows

(Table 9.1, line 1b). Thus, the first two pillars supporting 1.6 million standard head of animals in 1991 were eliminated nearly entirely within 9 years and probably by 1995. Overall, though there was some recovery in the availability of feed in Tajikistan after 2000, it is today a mere 44% of what it was in 1991 (Table 9.1, line 1).

Feed availability per head of livestock also fell after 1991 and has not recovered (Table 9.1, line 2). Total feed availability from cultivated feed and concentrates per standard head fell by 73% between 1991 and 2007, and total feed per cow (the primary consumer of cultivated feed and concentrates) fell by 77%.

The deterioration of the feed base in Tajikistan was largely responsible for an unprecedented initial fall in livestock inventories. In the period 1991–1998, livestock inventories in Tajikistan fell by 30%. The initial fall was nearly exclusively due to liquidation of livestock inventories in agricultural enterprises, as evidenced in Fig. 9.1. Inventories on household plots, not directly supported by the socialist industrial feeding system, remained predominantly untouched by this initial downturn.

The disintegration of the Soviet intensive agricultural system and the resulting fall in both crop and livestock production led to the decision to partially privatize agriculture. The first legal acts on land reform and farm restructuring in Tajikistan were issued in 1992, but land reform began in earnest only in 1995, with a presidential decree allocating additional land to household plots. In parallel (1995–1996), Tajikistan moved to reorganize the traditional collective and state farms into new corporate forms in the hope that restructuring would improve productivity in a notoriously inefficient sector. When this largely cosmetic restructuring failed to produce efficiency gains, the government switched the focus of its attention to dehkan (peasant) farms as a model of family farming. Since 1999, dehkan farms have

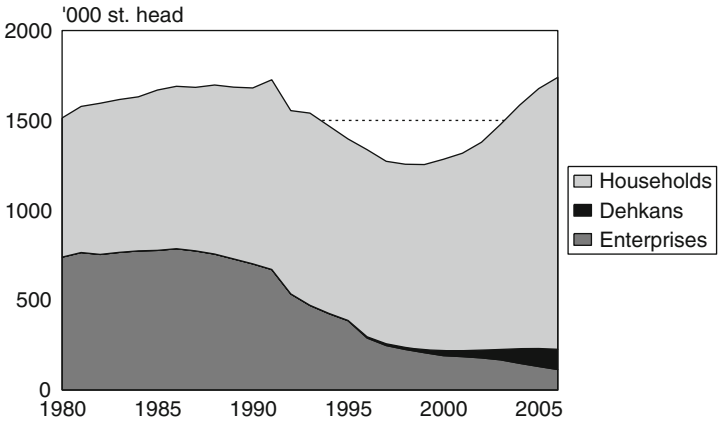

Fig. 9.1 Livestock inventories by farm type, 1980–2007 ('000 standard cow head) (Source: CISSTAT 2008)

largely supplanted the corporate farms—limited liability companies, leaseholding enterprises, joint-stock companies, and agricultural cooperatives—as the main agricultural land users.

The above reforms led to two crucial changes for the livestock production system in Tajikistan: (1) the virtual complete individualization of livestock inventories and (2) an initial fall and then rapid growth of livestock numbers. The individual sector in Tajikistan controlled most livestock even back in the Soviet era. In 1990, 62% of livestock was held outside of corporate farms (Fig. 9.1). But by 2007, the share of household plots in livestock had risen to over 90% (measured in standard head), so that the household farm sector now dominates livestock production, while enterprises and dehkan farms remain minor players. This situation is not unique to Tajikistan: A similarly extreme concentration of livestock production in household plots is also observed in Uzbekistan.

The rapid individualization of livestock herds and the end of hostilities in Tajikistan ushered in a new era of rapid growth in livestock inventories based on household farms. Overall livestock inventories in Tajikistan increased by 82% from 1998 to 2007, nearly exclusively as a result of growth in household farms (Fig. 9.1). The rapid recovery of livestock inventories after 1998 meant that (using official published statistics) by 2007 total livestock inventories were 16% higher than in 1991. The rapid expansion of livestock inventories despite the fall in feed availability has kept feed availability per animal (Table 9.1) extremely low.

Taken together, the above changes signify no less than the transformation of the livestock husbandry system in Tajikistan from one based on intensive livestock farming to one based on extensive livestock husbandry. The livestock production system existing today in Tajikistan relies primarily on grazing of livestock with limited feeding of cultivated feed and concentrates.

The hallmark characteristic of an intensive farming system is relatively high output per unit of input. In livestock, this meant that meat production per animal and

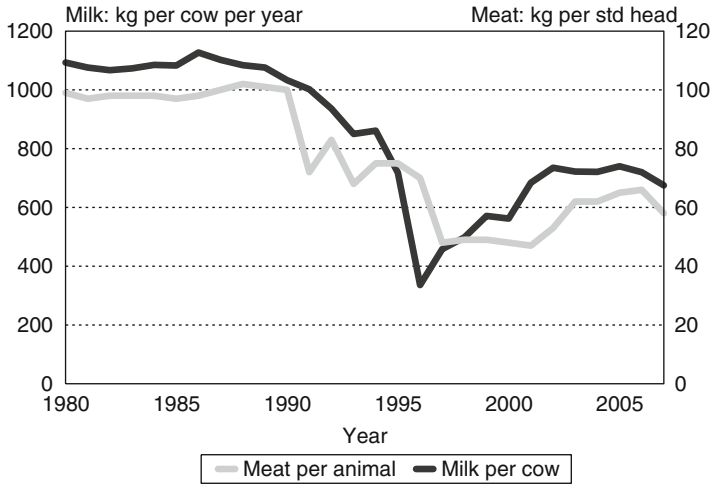

Fig. 9.2 Animal productivity in Tajikistan, 1980–2007 (Source: CISSTAT 2008)

milk produced per cow in Tajikistan were at all-time highs in the 1980s (Fig. 9.2). The decline began in the end of the 1980s when milk per cow and meat per animal started declining gradually. After 1990, this gradual decline turned into a free fall that lasted through 1997, after which both indicators began to rise and level off. Today both productivity indicators have recovered somewhat from the severe decline of the early 1990s but have stopped rising since 2003.

Despite recent increases, there is a generally low level of livestock productivity in Tajikistan. Milk yields are representative of the problem. Though milk yields recovered and have remained fairly constant since 2002, their recovery and stabilization does not appear to be directly linked to improvements in animal nutrition. The availability of feed crops per cow declined sharply from 1991 to 2000 and then stabilized (Table 9.1). At less than 700 kg per cow per year, milk yields in Tajikistan are far below yields in Western countries and rock bottom in the CIS (Fig. 9.3). Even during the heyday of Soviet Tajik agriculture, milk yields were far below those of the other 15 republics.

3 Crop Policies Limiting Feed Resources in Tajikistan

The fall in available feed crops per animal and the rapid expansion of livestock inventories after 1998 raise the issue of an expansion of the feed base in Tajikistan through increasing feed crop production. However, feed issues in Tajikistan should not be considered in isolation from other crop policies which impact on feed availability in the country. The three principle crops grown in Tajikistan have historically been cotton, grain, and feed crops, and the area in feed crops has always been linked to the area sown to the other two major crops. Figure 9.4 illustrates the complementary relationship between the three crop groups from 1940 to 2007. The postwar

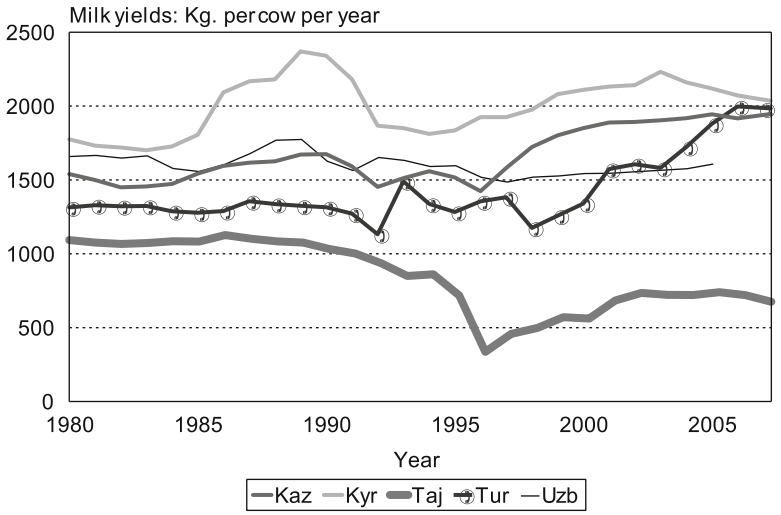

Fig. 9.3 Milk yields for Tajikistan and other Central Asian countries, 1980–20007 (Source: CISSTAT 2008)

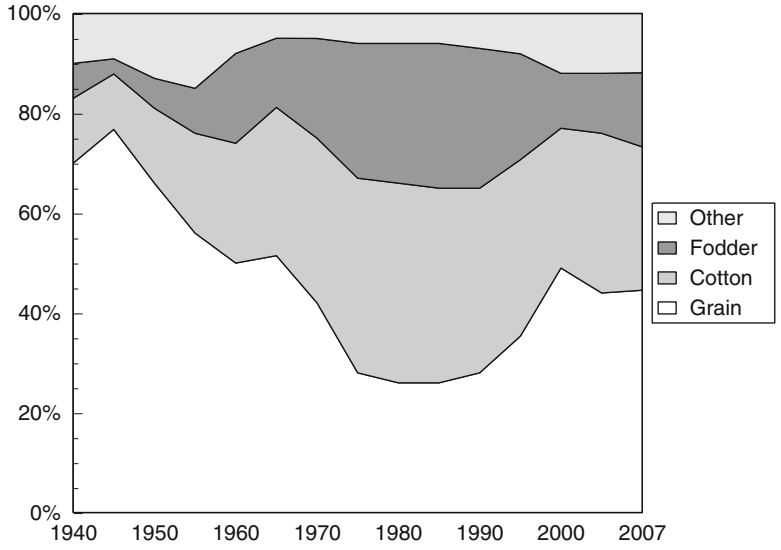

Fig. 9.4 Tajikistan crop areas, 1940–2007 (in percent of total sown area) (Sources: *Sel'skoe khoziaistvo respubliki Tadzhikistan: statisticheskii sbornik* (2001, 2002, 2003, 2004, 2005, 2006, 2007); *Narodnoe khoziaistvo Tadzhikskoi SSR: statisticheskii ezhegodnik* (1961, 1965, 1971, 1972, 1976, 1977, 1978, 1979, 1980, 1981, 1984, 1985, 1988))

Soviet period was characterized by shrinking area in grains as the area under cotton and feed crops increased through 1985. Falling grain area had no adverse effect on production volumes, because grain yields were growing quite rapidly due to increased applications of fertilizers, herbicides, and insecticides, as well as improvements

Table 9.2 Grain area, production, and imports in Tajikistan, 1988–2007

Year	Cereal production (without beer) (1,000 tons)	Cereal imports (1,000 tons)	Cereal availability[a] (1,000 tons)	Imports (% of availability)	Food use (1,000 tons)	Per capita food use (kg/cap)
1988	303	1,320	1,623	81	915	185
1989	322	1,300	1,622	80	915	180
1990	252	1,350	1,602	84	890	170
1991	286	1,250	1,536	81	700	131
1992	265	1,771	1,135	156	980	178
1993	259	1,503	1,089	138	978	175
1994	209	1,011	1,028	98	934	164
1995	235	627	1,134	55	1,048	182
1996	380	271	1,037	26	926	158
1997	545	389	1,148	34	1,063	179
1998	477	516	1,225	42	1,162	194
1999	459	439	1,163	38	1,100	181
2000	518	410	1,056	39	1,024	166
2001	464	355	1,064	33	1,030	165
2002	671	473	1,144	41	1,024	162
2003	846	419	1,265	33	1,129	177
2004	843	492	1,335	37	1,238	192
2005	882	789	1,671	47	1,250	191
2006	877	829	1,706	49	1,286	194
2007	889	970	1,859	52	1,234	183

Sources:
1988–1991: USDA, Economic Research Service, Former Soviet Union Commodity Balances
1992–2005: FAOSTAT Supply and Use Tables (http://faostat.fao.org/site/368/default.aspx)
2006–2007: *Sel'skoe khoziaistvo respubliki Tadzhikistan:statisticheskii sbornik (2008)*
[a]Production plus imports

in agronomic practices. In addition, starting in the early 1960s, the Soviet Union began to import grain, and Central Asia became a net importer of grain within the country.

When yields fell after 1985, it was natural that grain area would grow at the expense of fodder and cotton area. However, by 2005, though Tajik grain yields had surpassed peak levels during the Soviet period, grain area remained high. In fact, grain production and production per person in Tajikistan were at all-time highs in 2007. Yet grain sown area remained at nearly 50% of total sown area rather than at 26% as it had been in 1980 and 1985.

Grain area in Tajikistan remains at levels not seen since the 1950s because of state policies that limit areas sown to cultivated feed or rather support areas sown to grain and cotton. The first policy is the encouragement of grain self-sufficiency. The calculation of grain availability in Table 9.2 illustrates the issue. Tajikistan today imports about one-third to one-half of the grain imported annually during the late Soviet period. Because of significantly lower grain imports, the domestic production of grain in Tajikistan required to attain Soviet levels of food grain availability is far greater than under the USSR. The second policy limiting sown area to cultivated feed relates to cotton. Even in the food insecure years during the war, cotton area in Tajikistan remained at over 30% of sown land.

It is not clear that Tajikistan actually requires so much area in cereals. According to FAOSTAT, *per capita food use since 2004* has been above or at its level in the late Soviet years (Table 9.2). The cereal supply and utilization balances for Tajikistan in Table 9.2 are rough estimates at best. However, they do raise the question of whether current policies aimed at supporting grain area are really necessary. In considering ways and means to increase the availability of feed crops in Tajikistan, we will concentrate on limiting demand for and raising production of feed crops, leaving the important issues of cotton and grain areas alone. However, the wisdom of these two policies should not be taken for granted, and the issue deserves further study.

In addition to the limitations on fodder crops imposed through the wheat self-sufficiency policy, the absence of crop rotation on soils used for cotton cultivation also limits the area available for fodder. Crop rotation is a planned order of specific crops planted on the same field. Crop rotation also means that succeeding crops are of a different genus, species, subspecies, or variety than the previous crop. Examples would be barley after wheat, row crops after small grains, grain crops after legumes, etc. The planned rotation sequence may be for a 2- or 3-year or longer period. Some of the general purposes of rotations are to improve or maintain soil fertility, reduce erosion, reduce the build-up of pests, spread the workload, reduce risk of weather damage, reduce reliance on agricultural chemicals, and increase net profits.

4 Demand and Supply of Feed Resources in Tajikistan, 2007

In order to understand the specifics of livestock feed inadequacy in Tajikistan, the first step is to understand the nature of demand for and supply of feed resources.

4.1 Feed Demand

Feed demand may be calculated using standard feed units and standard head allowing one to aggregate demand over species and over feed types. Table 9.3 illustrates the calculation of total feed demand of animal inventories in Tajikistan. Livestock inventories by species are first converted into *standard head* by comparing the total feed a given species consumes in relation to the standard animal, in this case beef cattle (Table 9.3, column 4). For instance, one sheep requires on average only about 15% of the total oat unit equivalents required by beef cattle per year to lead a healthy and normal life. This means that one sheep is equal to only 15% of a beef cow in terms of *standard head*. The feed demand of standard head can be calculated using the information that one beef cow requires 2.12 tons per year of oat unit equivalents to lead a healthy and normal life. Feed units are calculated in a common *feed unit equivalent* based on the nutrient value of oat feed. The last column of Table 9.3 gives the portion of total feed demand in Tajikistan by species.

Table 9.3 illustrates an important fact about demand for feed in Tajikistan: Nearly 70% of demand originates from cows (dairy and beef), whereas sheep and goats, though they are numerous in Tajikistan, are responsible for a mere 20% of overall

Table 9.3 Feed demand based on animal inventories in Tajikistan, 2007

Livestock	Livestock inventories (1,000 s)	Beef cattle equivalent per head	Total beef cattle equivalents (1,000 s)	Feed units required per year (tons)	Percent of total demand
Beef cattle	838.2	1.0	838.2	1,776,984	33
Dairy cows	864.3	1.0	864.3	1,832,316	34
Hogs	0.6	0.4	0.2	445	0
Sheep and goats	3,798.4	0.1	531.8	1,127,365	21
Poultry	3,280.4	0.0	65.6	139,089	3
Horses	78.5	1.0	78.5	166,420	3
Donkeys	155.0	1.0	155.0	328,600	6
Yaks	15.2	1.0	15.2	32,224	1
Total demand			2,393.8	5,074,843	100

Source: *Sel'skoe khoziaistvo respubliki Tadzhikistan: statisticheskii sbornik (2007)*
Note: Beef cattle equivalents per head are Soviet era coefficients still used in Tajikistan to calculate standard head in beef cattle units. Required (oat) feed units are based on 2.12 tons of oat units required for feeding cattle per year

feed demand. This is important because cows, and particularly dairy cows, spend most of their time near the village grazing in local pastures or eating forage and concentrates.

A second important issue of feed demand is that it must adapt to the seasonality of pasture use over the course of the year. That is, because of seasonal variation, each species eats different feeds at different times of the year. It is of little use to aggregate all feed demand and all feed supply and compare the two. Both feed demand and feed supply must be compared for different categories of pasture, forage crops, and concentrates.

Pastures in Tajikistan are divided into those utilized in winter, spring-fall, summer, and year round. Table 9.4 illustrates the various types of pastures and their characteristics.

Different animals spend their time feeding from different sources during the course of the year. Small ruminants, such as sheep and goats, graze in pastures for a long period during the year (often in quite distant alpine pastures), while milk cows spend their time eating forage and concentrates and grazing in nearby pastures. Table 9.5 illustrates these differences by animal species in Tajikistan.

By distributing the feed requirements of each animal over pasture and forage resources according to Table 9.5, the total feed requirements can be estimated for each animal species by source of feed (Table 9.6). The resulting calculations illustrate an important mismatch in Tajikistan between demand and supply of pasture feed. Though Tajikistan has ample summer pastures (over 50% of total pasture area, see Table 9.4), most demand pressure is on all-year and fall-spring pastures, which account for only 28% of total pasture area. All-year pastures, with only 10% of pasture land, serve 41% of total pasture feeding needs. This mismatch between demand for feed and availability of pasture resources is a serious difficulty for livestock development.

Table 9.4 Pasture types in Tajikistan

Pastures	Winter	Spring-fall	Summer	All-year
Altitude (meters above sea level)	500–1,200	900–1,500	2,200–3,400	500 to 1,000–1,200
Use months	Nov–Mar	Mar–May, Sep–Nov	June–Aug	Jan–Dec
Use days	120–150	90–110	80-90	300–330
Total area (1.1.08) (1,000 ha)	699.0	675.9	2,081.3	400.0[a]
Percent of total pasture area (%)	18	18	54	10
Of which, in farm units (1,000 ha)	625.0	598.6	1,334.6[b]	360.0
Yield average (tons/ha of edible dry mass)	0.35	1.15	2.25	0.29
Distance from villages (km)	0.8–1.4 to 4–5	1.2–1.8 to 30	200–600[c]	less than 1 km

Source: Safaraliev (2009)
[a]85–90% degraded
[b]76.2% of area in dehkan farms
[c]6–8 weeks per year are spent traveling from winter to summer to winter pastures by animals using summer pastures per year

Table 9.5 Animal feeding throughout the year, by animal species and feed source (percent)

	Percent of time through year by feed source (%)					
Animal types	Summer pasture	Fall-spring pasture	Winter pasture	All-year pasture	Cultivated feed and concentrates	Total
Beef cows	17	17	7	21	38	100
Cows	0	16	4	22	58	100
Hogs	0	0	0	0	100	100
Sheep and goats	22	18	12	24	24	100
Poultry	0	5	0	41	54	100
Horses	13	14	11	32	31	100
Donkeys	0	14	10	45	31	100
Yaks	34	2	38	26	0	100

Source: Safaraliev (2009)
Note: This table is distilled from a larger table of feed days in Tajikistan by region by animal

4.2 Feed Supply

Feed supply, just as feed demand, is differentiated by type, consisting of forage crops, concentrates, and various pasture types. The supply of feed available in Tajikistan is calculated in Table 9.7. The total tons of feed units derived from forage and concentrates is taken from Table 9.1. The supply of pasture feed is a function of the area of pastures by type and the yield of edible dry matter (DM) obtained. Dry matter available per year is then converted into tons of oat feed units.

Table 9.6 Feed demand in Tajikistan, by animal species and source, 2007

Feed demand (tons of feed units)	Pasture feed					Cultivated feed and concentrates
	Total pasture	Summer	Fall-spring	Winter	All-year	
Beef cows	1,072,952	303,919	288,191	121,203	359,639	669,522
Cows	768,389	0	293,258	72,782	402,350	1,061,275
Hogs	0	0	0	0	0	436
Sheep and goats	856,990	246,057	203,692	137,864	269,377	268,788
Poultry	64,221	0	6,992	0	57,229	74,670
Horses	115,336	20,996	22,989	17,563	53,788	50,908
Donkeys	249,934	0	50,560	34,884	164,490	112,671
Yaks	32,136	11,021	514	12,266	8,334	0
Total feed demand	5,398,226	581,993	866,196	396,563	1,315,206	2,238,268
Structure of total feed demand, %	*59*	*11*	*16*	*7*	*24*	*41*

Source: Table 9.5

Table 9.7 Feed supply and feed adequacy in Tajikistan, by source, 2007

		Pasture feed					Cultivated feed and concentrates
	Feed supply	Total pasture	Summer	Fall-spring	Winter	All-year	
1	Pasture area in 2007 (ha)	3,856,246	2,081,287	675,909	699,003	400,047	n/a
2	Yield of edible DM (t/ha)	1.53	2.27	1.15	0.36	0.39	n/a
3	Total edible DM (t/year)	5,910,608	4,723,750	780,246	248,759	157,853	n/a
4	Total feed supply (tons of feed units)	2,955,304	2,361,875	390,123	124,379	78,927	738,744
5	*Total feed availability (percent)*	*80*	*64*	*11*	*3*	*2*	*20*
6	*Feed adequacy coefficient (ratio of supply to demand, %)*	*94*	*406*	*45*	*31*	*6*	*33*

Source: Estimates based on Safaraliev (2009)
Note: This table is derived from a larger table of pasture area and yield by region
DM dry matter

Line 6 of Table 9.7 indicates feed adequacy in Tajikistan by category of feed. This is calculated by comparing total feed demand in Table 9.6 by type with total feed supply by type in Table 9.7. The feed adequacy results in Table 9.7 illustrate that, though pasture resources in Tajikistan may be adequate in total, fulfilling 94% of total demand, this calculation carries very little meaning as it hides extreme differences in feed adequacy of different pasture types. While summer pastures are in excess supply, pastures grazed during other seasons meet a very small share of demand. Moreover, demand for forage crops is satisfied by only one-third.

The information in Tables 9.6 and 9.7 leads to the conclusion that the main constraint on the development of the livestock sector in Tajikistan is an extreme imbalance between the supply and the demand of cultivated feed and concentrates for dairy and beef cows. First, demand for all-year winter and fall-spring pastures is much too high to be sustainable. Clearly, demand for these pastures needs to be limited in order to ensure sustainable use of these resources. The main users of these pastures are dairy and beef cows. In order to limit grazing of cows and cattle on these fields, the supply of cultivated feed and concentrates must be increased and made available to farmers. This will allow farmers to keep animals in barns for feeding rather than letting them feed in nearby fields. Only after such limitations on use are introduced can the pastures themselves be rehabilitated, thus increasing total pasture feed available in Tajikistan. Second, demand for cultivated feed and concentrates far outstrips supply. Clearly, there is an immediate need to make cultivated feed and concentrates for cows more available and accessible to farmers.

The two above imbalances are complicated by yet another imbalance, an extremely unequal distribution of livestock inventories and feed resources across farms of different types in Tajikistan. Table 9.8 illustrates the concentration of feed resources in agricultural enterprises and dehkan farms in contrast to the extreme concentration of livestock inventories in household farms. Only 36% of cultivated feed resources are raised in household farms, while 90% of animal inventories are in their ownership.

The mismatch between feed and animals is illustrated in Table 9.9, which shows that household farms raise only 6% of required feed on farm and must utilize the pastures of agricultural enterprises and dehkan farms or purchase cultivated feed from enterprises and dehkan farms. Agricultural enterprises and dehkan farms, however, have nearly five times the feed resources required to support their livestock inventories.

5 Policies to Support a Return to a Sustainable Livestock-Feed Balance in Tajikistan

This chapter has analyzed the issues surrounding what has been described as the most important immediate constraint on livestock yields and rural incomes from livestock husbandry, animal nutrition. It was argued in the previous section that the main impediment to the reestablishment of proper animal nutrition in Tajikistan is

Table 9.8 Estimated distribution of cultivated feed and concentrates in Tajikistan, 2007

Cultivated feed in Tajikistan	Household farms (percent)	Agricultural enterprises and dehkan farms (percent)
Total cultivated feed	*36*	*64*
Dry forage		
Hay	26	74
Straw	42	58
Haylage	n.d.	n.d.
Green chop[a]	*10*	*90*
Succulents without silage[a]	*10*	*90*
Concentrated feed		
Corn	75	25
Barley and oats	36	65
Bran	42	58
Cotton and other meals	40	60
Imported concentrated feed	0	100

Source: FAO (2009), p. 22

[a]There are no statistical data on these feeds. It is assumed that 10% of green chop and succulents are raised in household farms

Table 9.9 Distribution of total feed resources by farm type in Tajikistan, 2007

		Total	Household farms	Agricultural enterprises and dehkan farms
1	Cultivated feed and concentrate availability, 2007 (tons of feed units)[a]	738,744	265,247	473,497
2	Pasture production, 2007 (tons of feed units)[b]	2,955,304	0	2,955,304
3	Total available feed resources, 2007 (tons of feed units)	3,694,048	265,247	3,428,801
4	Standard head (beef cattle units) of animals in Tajikistan (Jan 1, 2008)[c]	2,393,794	2,154,415	239,379
5	Feed units per std head per year (tons, 3/4)	1.54	0.12	14.32
6	Feed units required per std head per year (tons)	2.12	2.12	2.12
7	Deficit (surplus) (6–5) (tons of feed units/std head/year)	0.58	2.00	(12.2)
8	Percent of requirement met (5/6, percent)	*73*	*6*	*675*

Sources: Tables 9.1 and 9.7

[a]From Table 9.1, production and imports in 2007

[b]Uses estimates from Table 9.7

[c]Inventories from Table 9.3 converted to standard head in beef cattle equivalents

increasing the availability of cultivated feed and concentrates primarily for dairy and beef cows. It would be a mistake, however, to understand the problem as merely one of excess demand for feed. There is a clear need to limit the number of animals allowed to feed in fall-spring, winter, and all-year pastures. This can only be accomplished by giving farmers themselves a stake in the sustainable management of pastures (Box 9.2).

Box 9.2 Limiting Pasture Use Through Pasture Users' Associations

Goal	Policies	Short run results	Longer run results
Raise milk and meat yields through increased supply of cultivated feed and concentrates	Make pasture management the responsibility of users through a pasture users association	Clearly defined rules of pasture use that will establish access to pastures on a sustainable basis. Sustainable use of pastures will include limitations on pasture use enforced by pasture user associations	Pasture rehabilitation possible due to controlled use

The pasture management system in Tajikistan remains largely unchanged since Soviet times with the exception that the lowest rung in the management system (agricultural enterprises) no longer has adequate resources for pasture maintenance and management. In some other CIS countries (e.g., Azerbaijan), pasture lands have been transferred into a separate category of municipal lands with a municipal management structure. However, in Tajikistan, pastures are under state ownership, just as all agricultural land, but are mainly held by agricultural enterprises and dehkan farms. Farms of all types—agricultural enterprises, dehkan farms, and household farms—use pasture land for their animals.

Legislation on pasture management has not been adapted to the post-land reform farming structure (Halimova, Chap. 13). According to existing legislation on pasture management, the following institutions are responsible for the rational utilization of pasture resources in Tajikistan:

- Local executive organs of the state at the regional level
- Regional and municipal land-surveying organizations
- Local (village-level) authorities
- The state committee on environment
- The Pasture Trust of the Ministry of Agriculture

The existing system of pasture management responsibilities in Tajikistan is ill-defined and not designed to involve the end-user in the management of pasture resources. The existing system is not well adapted to managing a public good

such as pastures in the post-socialist period when over 90% of animals are held in household farms, not in large-scale enterprises. In other countries, pasture land is state-owned, just as in Tajikistan, but the management of pasture land, as for other public goods, such as irrigation works, involves significant involvement of and financial contributions from users.

One institution ensuring that pasture management incorporates the needs of pasture users is the pasture users association. Kyrgyzstan has recently adopted pasture legislation that changes the system of pasture management to one which may be better suited to the environment of smallholder agriculture. Table 9.10 compares pasture legislation in Tajikistan and Kyrgyzstan. In the Kyrgyz system, pastures are state-owned public goods, just as in Tajikistan. However, the management, including permission to use pastures, pasture rehabilitation, fee assessment, and collection, has been decentralized to the level of the pasture users association. The idea of decentralizing such decisions puts the users themselves in control of the public good they require to graze their animals. Thus, it could be expected that pasture users would have an intrinsic interest in better husbandry of pasture resources (Robinson, Chap. 11) (Box 9.3).

There are many policies that can potentially raise the availability of livestock feed. A first area of policy is the introduction of better agronomic practices such as crop rotation for cotton and wheat. A second issue under good agronomic practices is to increase funding for agronomic research aimed at raising feed crop yields. Certainly, feed crop yields could be raised to levels of 1991 and greater.

A second general area of policy concern is so-called freedom to farm. Elimination of informal controls on cotton sowing area would enable farms to increase feed crop production as demand increases. According to a USAID and World Bank survey of dehkan farms, cotton growers in Tajikistan have much less freedom of decision than other dehkan farms (Lerman and Sedik 2008). Hukumat intervention is quite pervasive for cotton growers and virtually nonexistent for other farms. Among cotton-growing dehkan farms, only 14% have freedom of decision, whereas in 56% of the farms, the decision is made by the manager, and in a staggering 28% of the cotton growing farms, the local authorities (the hukumat) directly intervene in planting decisions. This is in a striking contrast with the decision-making process in other dehkan farms, where 60% make the decisions themselves and the hukumat intervenes in only 5% of the cases.

A third area for policy attention is to raise forage and mixed feed availability for farmers by making land and business permits easily available for mixed feed production facilities and forage and mixed feed sales points operated by farmer cooperatives in rural areas. This may necessitate new investment for construction of mixed feed storage or production plants. Uzbekistan, for example, has a program to improve access of rural households to concentrate feed by an expansion of storage facilities and sales outlets in rural areas (Presidential Decree of the Republic of Uzbekistan PP-308, 23 March 2006; Resolution of the Cabinet of Ministers of the Republic of Uzbekistan no. 67, 21 April 2006). Under this program, the state-controlled Uzkhlebprodukt system has been required to establish feed storage facilities and sales outlets in rural areas. The program envisages a sevenfold increase in the number of sales outlets for concentrated feed across the country, from 113 in 2005 to 773 in 2010.

Table 9.10 Description of legal responsibilities for pasture management in Tajikistan and Kyrgyzstan

Tajikistan	Kyrgyzstan
Ownership	
All pastures owned by the state	All pastures owned by the state
Land users	
Physical or juridical persons of Tajikistan	Physical or juridical persons of Kyrgyzstan or foreign country (by international agreement or intergovernmental agreement)
Pasture border demarcation	
Majlisi Oli (parliament)	Carried out by local commission appointed by the local state administration The government of Kyrgyzstan establishes a commission to settle disputes
Pasture management	
A multitude of agencies and government at various levels are responsible for pasture management. The Tajik national government is responsible for the organization, development, and realization of government and intergovernmental programs for the rational use of pastures, raising productivity and soil fertility, and for environmental protection. It also has responsibility for general management of pasture resources, establishment of the plan for cadastre works, and monitoring pasture resources. *Oblast level government organs (goskomzem, giprozem, and their local organs)* are responsible for cadastre, monitoring the state of pastures, improvements in management within existing legislation, and the development of legislation for state management of pastures. *The Jamoat (municipality), the local representative organ,* is to control the utilization of pasture and protect pasture lands. *Local regional government administrations within the administrative boundaries of their region* are to propose pasture use plans to the local government, control the use of pasture, and protect pasture lands. They are also responsible for the establishment of agricultural land, state forest land, and other lands for pasture use. *Pasture users are responsible for the protection of pastures as well*. They are responsible for the rational use of pastures, rehabilitation of soil fertility, protection of pastures from water and wind erosion, other soil damage, and protection from weeds, all to prevent degradation. *The Pasture Trust of the Ministry of Agriculture is* responsible for state control of pasture use and protection	The *local self-government body* (pasture users association) has responsibility for management of pasture resources except for the right of disposal. The interference of state organs and local state administrations in the work of local self-government bodies and the pasture users associations in the area of pasture utilization is forbidden, except in cases foreseen in legislation (Article 4) The *pasture users association* represents the interests of the users from within a certain territory. This association draws up a community pasture management plan on an annual basis. *The executive committee of the pasture users association is the Jayit* which consists of representatives of pasture users, deputies of local self-government bodies, and heads of executive local self-government bodies. Pasture users elect their members to the Jayit. The authority of the Jayit is to develop community pasture use plans, annual pasture use plans, implement these plans, monitor pasture conditions, issue pasture use tickets according to the plans, fix and collect pasture fees, resolve disputes, and manage pasture revenue for pasture improvement *Community pasture use plan* includes pasture utilization, maps for boundaries, stock routes, protected areas, watering places, pasture infrastructure, and pasture conditions and quality; also contains a map of carrying capacity of various pastures, plans for the development of pastures and maintenance operations, and plans for the reconstruction of infrastructure. These plans are updated annually and are approved by local self-government bodies. *The annual pasture use plan* includes a list of pasture users holding tickets for the year and an inventory of their livestock, a list of animal health measures that users must carry out in order to exercise their grazing right, a map of seasonal grazing routes, a pasture rotation plan, herd movement routes, cattle pens, etc.

(continued)

Table 9.10 (continued)

Tajikistan	Kyrgyzstan
Establishment of a list of pasture users	
A multitude of agencies and government at various levels are responsible for allowing or not allowing pasture use. The Tajik government has the right to grant and confiscate pasture plots for government purposes in Tajikistan in agreement with local executive authorities. *Oblast level government organs (goskomzem, giprozem, and their local organs)* state registration of right to use pasture and issue of land certificates for pasture use. *Local government (oblast and regional)* grants pasture plots for agricultural production and grants and confiscates plots when used not according to their prescribed use, including pasture land use rights. *The Jamoat, the local representative organ,* makes proposals to local governments on granting pasture use rights on the establishment and approval of tax norms within the bounds established by tax legislation. The Jamoat also keeps a list of pasture users and pasture lease agreements and regulates the use of additional pasture land established from non-pasture resources. *Local regional government administrations* propose pasture use plans to local governments and establish the uses of agricultural land and state forest land and other lands within the administrative boundaries of the region. *The Pasture Trust of the Ministry of Agriculture is* responsible for state control of pasture use and protection. *Jamoats* are supposed to grant pasture use rights to citizens with livestock from reserve land, forest land, urban land, and agricultural land, though need to gain consent of various organizations that are responsible for that land	*The Jayit* establishes a list of pasture users based on pasture use plans
Pasture use fees	
Payment for pasture use is made yearly in the form of a flat land tax. The proceeds of the land tax are distributed according to the tax laws of the country. Tax proceeds for use of pastures and hayfields are used for the protection and rehabilitation of pastures, for maintenance of soil fertility, for monitoring of pastures, etc.	*The Jayit* fixes and collects pasture use fees and manages pasture revenue for pasture improvement. A portion of pasture use fees are transferred to local budgets

Sources: Tajikistan: *Land Code of the Republic of Tajikistan* (2008), Kyrgyzstan: *Law on Pastures* (2008)

Box 9.3 Policies to Increase Availability of Livestock Feed

Goal	Policies	Short run results	Longer run results
Raise milk and meat yields through increased supply of cultivated feed and concentrates	*Good agronomic practice policies*		
	Reintroduce cotton-lucerne crop rotation cycle in Tajikistan widely following proper agronomic practices	Supply of forage crops increased, lowering prices for livestock farmers. Cotton yields increase due to decrease of cotton wilt and better soil management	More sustainable production of cotton and increased supply of forage crops
	Raise forage crop yields to 1991 levels	Increase in domestic production of forage crops	Demand for forage crops better satisfied
	Increase domestically raised wheat yields through crop rotation following good agronomic practices	Increased supply of wheat	Allows increased area for forage and cotton
	Freedom to farm policies		
	Eliminate informal controls on cotton sown area	Farmers are free to make their own decisions on what crops to produce	As feed demand increases, farmers will be able to produce feed crops to meet demand
	Marketing and investment policies to improve feed access		
	Raise forage and mixed feed availability by making land and business permits easily available for mixed feed storage and production plants and for forage and mixed feed sales points operated by farmer cooperatives in rural areas	Farmers have easy access to forage and mixed feed for their animals	Increased demand for forage crops from farmers. Decreased demand pressure on nearby pastures, allowing them to be rehabilitated
	Trade policies		
	Eliminate any barriers on wheat flour imports from Russia and Kazakhstan	Increases availability of domestic soft wheat for feed use	Higher milk and meat yields from feeding increasing rural incomes

Table 9.11 Effects of implementation of policies for a sustainable livestock-feed balance in Tajikistan

	2007 base	Scenario after 10 years of policy change
1. Milk production, cow inventories, and milk yield		
Total milk production (1,000 tons)	584	1,402
Total cow inventories (1,000)	864.3	864.3
Milk yield (liters/cow/year)	675	1,622
2. Feed adequacy (%)		
Summer pastures	406	406
Fall-spring pastures	45	73
Winter pastures	31	51
All-year pastures	6	10
Forage crops and concentrates	33	70

Sources: Calculations based on input-output tables underlying previous tables

Feed mills in the state-controlled Uzkhlebprodukt system are to be allowed to purchase grain directly from peasant farmers ("fermerskie khozyaistva") as a raw material for concentrated feed production.

A last area of policy is trade barriers on wheat flour imports which can influence availability of domestic soft wheat for feed use. Higher milk and meat yields can come from better feeding, and this leads to increasing rural incomes.

6 Effects of Policies to Support a Sustainable Livestock-Feed Balance in Tajikistan

A sustainable livestock development policy should aim toward implementing all the policies suggested here: (1) introduce an institutionally viable pasture management system to limit the number of animals authorized to graze in fall-spring, winter, and all-year pastures; (2) raise cultivated feed crop yields through crop research; (3) expand the area of cultivated feed crops through introduction of proper crop rotation for cotton and wheat; (4) eliminate informal controls on cotton sown area; (5) raise forage and mixed feed availability by making land and business permits easily available for mixed feed production facilities and forage and mixed feed sales points operated by farmer cooperatives in rural areas; and (6) eliminate trade barriers for imported wheat flour from Russia and Kazakhstan, thus making more domestically grown soft wheat available for feed use.

Table 9.11 illustrates the combined effects that could be expected if these policies were enacted over 10 years. The specific assumptions of the scenario are:

1. Increases in pasture yields each year for 10 years at 5% per year
2. Raising cultivated feed crop yields to their 1991 level
3. Expanding cultivated feed crop area by 10% through increased rotation with cotton crops

4. Raising wheat flour imports by 2.5% per year
5. Raising Tajik wheat yields by 10%

Even under these quite conservative assumptions, there are dramatic improvements in livestock feeding and milk yields in Tajikistan over baseline levels of 2007 (Table 9.11). It should be emphasized that Table 9.11 illustrates *only* the effects of the implementation of the policies discussed under the assumptions indicated independent of growth in livestock inventories and productivity increases due to other causes.

The most direct and largest effects on milk yields in Tajikistan are to be gained by improving cultivated feed crop yields, increasing their area, and raising flour imports and wheat yields. Pasture rehabilitation has considerably less impact on milk yields because cows feed predominantly on mixed feed and forage crops.

7 Conclusions

The imbalance between feed demand and supply is perhaps the most important limiting factor on the sustainable development of the livestock sector in Tajikistan. The purpose of this study is to analyze the feed supply-demand balance and to suggest policies that may support a return to a sustainable livestock-feed balance in Tajikistan. The study described the transformation of the livestock husbandry system in Tajikistan after independence from one based on intensive livestock farming to one based on extensive livestock husbandry. It then went on to describe some of the crop policies in Tajikistan that limit feed resources in Tajikistan, followed by a calculation of feed demand and supply in Tajikistan by feed type. The study then suggested a number of policies to support a return to a sustainable livestock-feed balance in Tajikistan, followed by an estimate of the possible effects on the supply-demand balance for livestock feed in the country.

The study concludes that the policies suggested could, if implemented, substantially reduce the pressure on some pastures if consistently implemented over the next 10 years. Moreover, livestock production and productivity could be significantly increased. A vital part of the policies suggested is the management of pastures through an improved management incentive system of pasture user associations.

The feed-livestock nexus is only one of a number of issues that should be addressed under a sustainable livestock development policy. Other issues such as the establishment of a viable plan for supplying livestock advisory and health services and a livestock breeding policy should also be part of such a policy. However, this study has concentrated on a first-level constraint on rural incomes that, unfortunately, has not received the attention it deserves. It is hoped that this study has shed some light on this issue and provided some basis for beginning a dialogue between the government of Tajikistan and donors on a sustainable livestock strategy for the country.

References

Academy of Sciences of Tajik SSR (1974) Encyclopedia of the Tajik Soviet Socialist Republic (in Russian). Academy of Sciences of Tajik SSR, Dushanbe

"Agriculture" in Academy of Sciences of Tajik SSR (1974)

Bravo H (2005) Livestock value chains in Tajikistan. Consultant report (World Bank, processed)

FAO (2009) Strategicheskoe issledovanie sektora zhivotnovodstva (Policy study on the livestock sector). Prepared by Fund Biotechnology, Tajikistan (processed)

Halimova N (2012) Land tenure reform in Tajikistan: implications for land stewardship and social sustainability: case study In: Squires VR (ed) Rangeland stewardship in Central Asia. Springer, Dordrecht, pp 239–274 (Chapter 11, this volume)

Land Code of the Republic of Tajikistan (2008) (Zemel'nyi kodeks Republiki Tadzhikistan, Dushanbe)

Law on Pastures (2008) (Zakon Kyrgyzskoi respubliki, "O pastbishchakh," 18 Dec 2008)

Lerman Z, Sedik D (2008) The economic effects of land reform in Tajikistan. FAO Regional Office for Europe and Central Asia. Policy studies on rural transition no. 2008-1

Narodnoe khoziaistvo Tadzhikskoi SSR: statisticheskii ezhegodnik (Dushanbe: Gosudarstvennyi komitet Tadzhikskoi SSR po statistike, 1961, 1965, 1971, 1972, 1976, 1977, 1978, 1979, 1980, 1981, 1984, 1985, 1988)

Nolan T (2005) The animal/vegetation relationships component of Rangeland management. Consultant report for Republic of Tajikistan Livestock Sector Review (processed)

O'Mara F (2006) Animal nutrition and livestock productivity in Tajikistan. Consultant report for Republic of Tajikistan Livestock Sector Review (processed)

Official Statistics of the Commonwealth of Independent States (2008) (CISSTAT) CD-ROM 2008-13. Statistical Committee of the CIS, Moscow

Presidential Decree of the Republic of Uzbekistan PP-308 (2006) On measures for increasing cattle inventories in household, dehkan and family farms, 23 March 2006

Resolution of the Cabinet of Ministers of the Republic of Uzbekistan no. 67 (2006). On measures for implementation of the cattle inventories development program in household, dehkan and family farms for the period 2006-10, 21 April 2006

Safaraliev (2009) September 2009 personal correspondence

Sel'skoe khoziaistvo respubliki Tadzhikistan: statisticheskii sbornik (Dushanbe: Gosudarstvennyi komitet statistiki respubliki Tadzhikistan, 2001, 2002, 2003, 2004, 2005, 2006, 2007)

World Bank (2007) Republic of Tajikistan: priorities for sustainable growth: a strategy for agriculture sector development in Tajikistan. World Bank, Washington DC