CHAPTER 20

ECONOMIC DEVELOPMENT IN SIX REGIONS OF SNOW LEOPARD HABITAT IN THE U.S.S.R.

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The disappearance of traditional ungulate prey of the snow leopard may be contributing to its endangered status in the wild. Soviet biologists have noted that wild sheep are a primary prey of the snow leopard in the southern Russian union republic and the Central Asian union republics of the U.S.S.R. While poaching appears to have had some Impact on the status of these sheep, economic pressures may be contributing to their decrease. Evidence presented for Kazakhstan and three regions of the Russian republic demonstrates that commercial sheep and goat production appears to be growing at a very high pace in these areas, thus consuming habitat otherwise available for wild herds.

WILD SHEEP

Pokrovskiy and Sludskiy have described the snow leopard as an opportunistic predator, with the ability to kill large ungulates as well as birds and marmots.[1]" The preferred prey, however, appears to be mountain ungulates. In the U.S.S.R. snow leopard habitat (Figure 1) appears to coincide with that of several mountain sheep, including some endangered sub-species. This paper examines three sub-species of sheep: *Ouis* ammon ammon (inneaeus (argali). Ouis ammon coltium *severtzoui* (Kazakhstan mountain sheep), and *Ovis ammon karelini severtzoui* (Tien Shan mountain sheep, or arkhari).[2]

The biology of these sheep has been described by Soviet scientists.[3]

All three sub-species are listed in the national and republic level Red Books. In the 1985 Red *Book* of the U.S.S.R., the argali Ouis

* Numerically keyed references are listed at the end of the chapter.

ammon ammon are placed in the most severely endangered class, category 1. An estimated 1,000 remain, mostly in Southern Siberia: Tuva A.S.S.R. (Autonomous Soviet Socialist Republic), Southern Altay Kray, and Southeast Transbaikal. The Kazakh Mountain Sheep *Ovis ammon collium* is listed in category 3, rare and needed protection but not immediately in danger of extinction. Up to 7,000 are believed to exist in Kazakhstan's eastern mountain regions. The arkhari *Ouis ammon* Jcarefini, with an estimated population in southwest to central Kazakhstan and Kirgizia of 500. is placed in category 2: existing in high enough numbers now but subject to severe reduction in the future.[4] Because all three ungulates are prey species of the snow leopard, efforts to conserve snow leopard populations in the U.S.S.R. must take into account the pressures that are causing the reduction in numbers of these wild sheep.

FACTORS AFFECTING STATUS OF WILD SHEEP

Fedosenko has noted that predator-prey relationships need to be better established to determine the balance between sheep and predators, such as snow leopards and wolves.[5] Soviets feel that natural predation does not appear to be the factor which is causing a decline in numbers of the three sheep noted above.

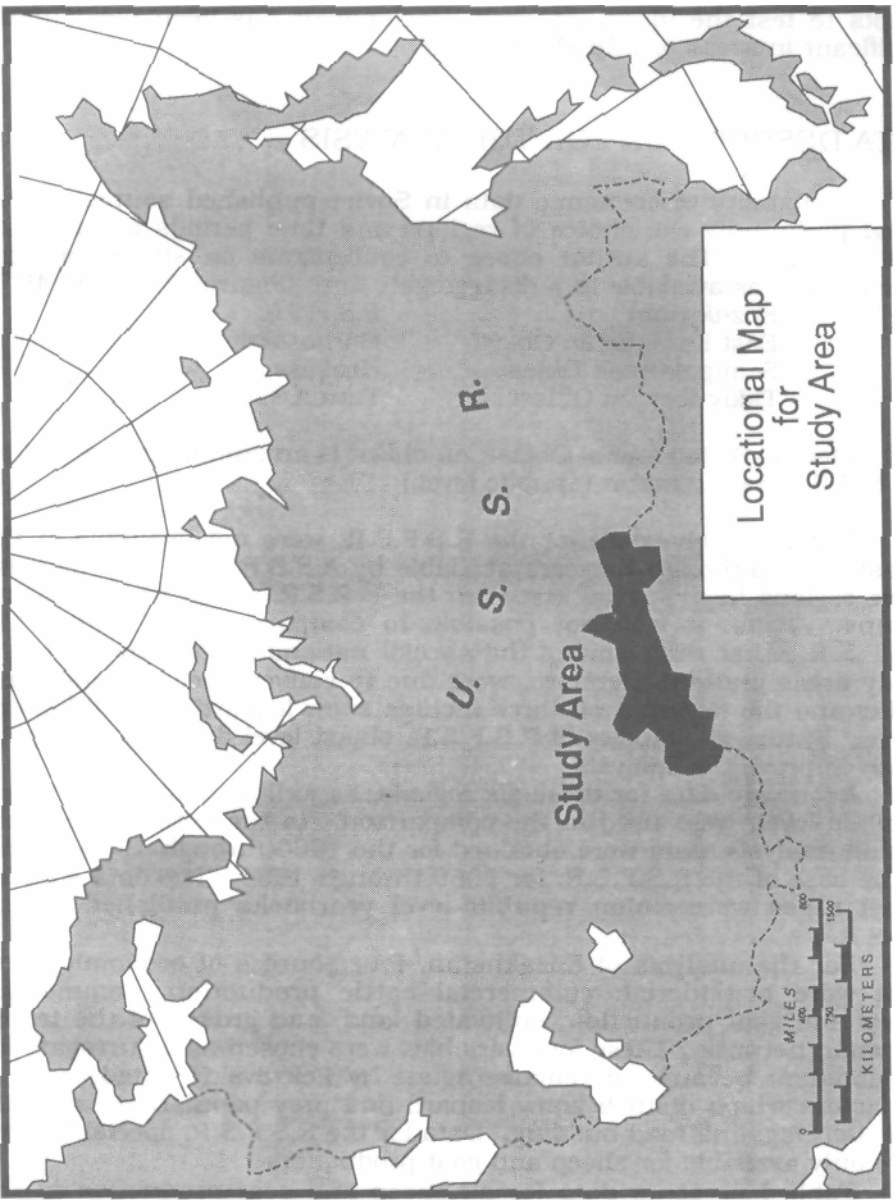
Poaching has been cited as a problem in maintaining the numbers of wild sheep, despite both national and republic-level penalties.[6]

The factor which may have the greatest negative impact on population of sheep is economic development. In the *Red Book* of the Russian union republic (R.S.F.S.R.). the passage on the Altai mountain sheep notes:

> The largest damage to population of mountain sheep is the development of animal husbandry, coinciding with the opening of new pastures, which drives the mountain sheep to slopes outside their typical environment.[7]

The U.S.S.R. national *Red Book* points out that the increasing numbers of commercial livestock in areas of wild sheep range are placing pressures on the population. The Kazakhstan union republic *Red Book* blames a rise in human population in the region and an Increase in domestic herd size for reductions in arkhari numbers.[8] In conjunction with the change in natural ranges due to expansion of commercial herds, some authors such as Fedosenko, claim that wild sheep are forced to move to more remote and inhospitable environs in the mountains. Harsh winters, poorer pasturages, and deep snows take a toll on the young in particular. The Kazakh *Red Book* notes that the winter of 1968-69 was especially hard on the arkhari. causing a drastic seasonal decline.

While Soviet biologists would appear to be in agreement that economic pressure is a prime enemy of wild ungulate conservation in



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snow leopard territory of the U.S.S.R.. actual economic growth in these regions has not been explored. Material presented below attempts to test the idea that such development has been particularly significant in areas of wild sheep range.

DATA DESCRIPTION FOR THE ANALYSIS

Availability of economic data in Soviet published sources influenced profoundly the choice of regions and time periods for analysis in this paper. The author chose to concentrate on six regions for which data was available in a disaggregate form (Figures 2, 3. and 4):

Kazakhstan	*R.S.F.S.R.*
East Kazakhstan Oblast	Gorno-Altai A.O.
Semipalatinsk Oblast	Khakass A.O.
Taldy-Kurgan Oblast	Tuva A.S.S.R.

[A.O. refers to Autonomous Oblast; an oblast is an administrative unit of the U.S.S.R. below union republic level.)

Unfortunately, data for the R.S.F.S.R. were not available at the oblast level, although they are available by A.S.S.R. and A.O. because these regions have special status in the U.S.S.R. based on nationality groups. Thus, it was not possible to compare trends within the R.S.F.S.R. other than among the special nationality regions. The six study areas chosen, therefore, were due to convenience of data availability and the fact that all three include snow leopard and wild sheep range. Future availability of R.S.F.S.R. oblast level data would significantly improve the analysis.

Economic data for these six regions, as well as data at the union

republic level, were used in the comparison. In the case of the Kazakhstan analysis, data were obtained for the 1960 through 1980 period: in the case of the R.S.F.S.R. for 1960 through 1984. The data sources in all cases were union republic-level yearbooks published in the U.S.S.R.9

For the analysis of Kazakhstan, four sources of economic pressure were considered: commercial cattle production, commercial sheep and goat production, cultivated land, and growth of the transportation network. These four variables were chosen as a surrogate for development because of remarks made by Pokrovskiy (cited, note 1) on factors which disturb snow leopard and prey populations: agriculture, herding, and road building. Data for the R.S.F.S.R. special regions were only available for sheep and goat production.

Table I presents data for all sheep and goat production in the U.S.S.R. from 1940 through 1984 for selected years. Union republic shares of the national production are shown in Table II. Kazakhstan, Azerbaidzhan, Kirgizia, Tadzhikstan, and Armenia were the only union

FIGURE 2. Distribution of *Ovis* ammon ammon (argali).

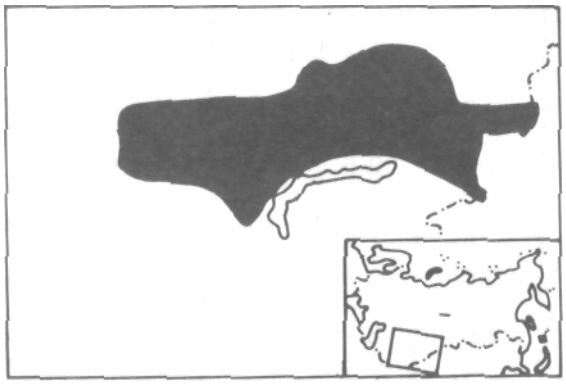


FIGURE 3. Distribution of Oyis ammon collium [Kazakh Mt. Sheep).

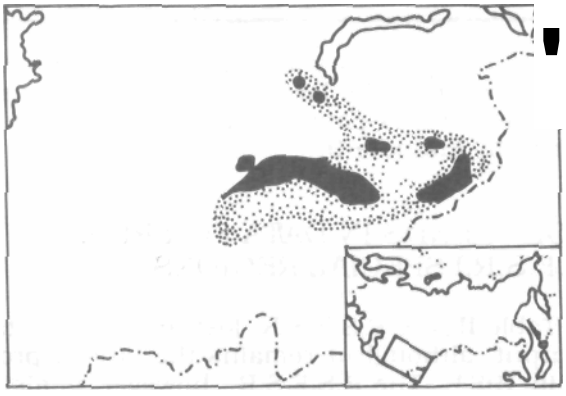


FIGURE 4. Distribution of Outs ammon *karelini* (arkhari).

republics which gained in percentage share of national output of commercial sheep and goats. Two of these, Kazakhstan and Kirgizia, with snow leopard populations, showed the largest gains.

TABLE I. U.S.S.R. Sheep and Goat Output by Union Republic. Selected Years, 1940-1984 (million head).

Republic	1940	1950	1960	1970	1980	1984
RS.F.S.R	51.2	46.2	65.4	67.0	65.0	64.5
Uzbekistan	5.8	7.1	9.2	8.0	9.0	9.5
Kazakhstan	8.2	17.6	28.3	31.8	35.2	36.1
Kirgizia	2.5	4.5	6.3	9.4	10.0	10.5
Tadzhikstan	2.2	2.8	2.6	2.6	2.9	3.1
Subtotals	69.9	78.2	111.8	118.8	152.1	123.7
Ukraine	7.3	6.7	10.6	9.0	9.0	9.3
Bclorussia	2.6	1.4	1.2	0.7	0.6	0.7
Georgia	2.2	2.5	2.1	1.9	2.0	1.9
Azerbaidzhan	2.9	3.4	4.9	4.4	5.4	5.5
Lithuania	0.6	0.4	0.4	0.1	0.1	0.1
Moldania	1.5	1.0	1.7	1.4	1.2	1.2
! atvia	0.6	0.5	0.5	0.3	0.2	0.2
Armenia	1.2	1.3	2.0	2.1	2.2	1.9
Turkmenia	2.6	3.2	4.9	4.5	4.5	4.5
Estonia	0.3	0.3	0.3	0.2	0.2	0.2
U.S.S.R. TOTAL	91.7	98.9	140.3	143.4	147.5	149.2

Subtotals are for union republics with snow leopard populations, alth portion of the large R.S.F.S.R. contains snow leopards. As with all tables in were national economic yearbooks referenced in Endnote 9.

DESCRIPTION OF TRENDS IN DATA FOR RUSSIAN UNION REPU (R.S.F.S.R.) SPECIAL REGIONS

As noted in Table II. the R.S.F.S.R. lost in its percentage share of goat although it remains the largest producer, with 64.9 million head in 19 however, is also the largest union republic in area (76% of U.S.S.R. terri other fourteen republics. On a density measure of sheep and goats per km^2 less well: 3.8 head per km^2 versus 13.2 for Kazakhstan and 51.4 for Kirgizia. Fr R.S.F.S.R. experienced a decline of 1.4% in actual numbers of commercial she on its territory, while a geographic shift in herding occurred toward Ce Caucasus. The three study areas of snow leopard and wild sheep population ar did not show the decline experienced by the entire Russian union r demonstrates that, while for the R.S.F.S.R. as a whole, the 1980 productio 1960 level, for the three study areas production of sheep and goats rose fro counter to the union republic trend. While data is not available for c R.S.F.S.R., one can compare the three focus regions with nineteen other "Spe union republic. Only three other regions demonstrated similarly high Figure 5). and all three are outside snow leopard range. Density increases in co goats in each of the three areas of snow leopard populations were: Gorno-A goats per km^2 1960 to 12.7 1984; Khakass. 13.3 to 25.4; Tuva, 5.1 to 6.9. T sheep and goats herded in the three areas in 1984 were: Gorno-Altai, 1.17 1.575 million; Tuva. 1.180 million.

The growth trend in special regions as a whole was only 11.8% ("A.S.S III). In terms of share of total R.S.F.S.R. herding, Figure 6 shows that onl regions achieved higher growth in regional share than did the three study ar

DESCRIPTION OF TRENDS IN DATA FOR KAZAKHSTAN

Better data availability allowed a more complete picture of tre
Tables IV through VII compare cattle, cultivated lands, a transporta
sheep/goat production respectively for the oblasts of Kazakhstan for 1960 and

The first three oblasts listed in each table are the study areas where
mountain sheep occur; East Kazakhstan. Semtpalatinsk, and Taldy Kurgan. V
has grown in all three regions, regional shares have diminished. This is
growth to 506.000 head in Eastern Kazakhstan might not be a severe sourc
landscape, but the growth is not disproportionate to a general growth in c
(from 7.3% of U.S.S.R. total in 1960 to 7.6% in 1980).

Land under cultivation has likewise grown in all three study areas,
between regional shares of total in 1980 and

TABLE II. 1984 Union Republic Shares of Sheep and Goat Herds In the U.S

	1960	1984	Change
RSFSR	46.6	43.7	-2.9%
Uzbekistan	6.5	6.4	-0.1
Kazakhstan	20.1	24.0	+3 9
Kirgizia	4.5	6.9	+2.4
Tadzhikstan	1.8	2.1	+0.2
Ukraine	7.6	6.0	-1.6
Belorussia	0.9	0.4	-0 5
Georgia	1.5	1.3	-0.2
Azerbaidzhan	3.5	3.6	+0.1
Lithuania	0.3	0.1	-0.2
Moldavia	1.2	0.8	-0.4
I-atvia	0.3	0.1	-0.2
Armenia	1.4	1.5	+0.1
Turkmenla	3.5	3.0	-0.5
Estonia	0.2	0.1	-0.1

**TABLE III. Percentage Growth in Sheep and Goat Production for RSFS
1984 Versus 1960.**

Rep.	1984/60	Rep.	1984/60
RSFSR Total	98.6%	Dagestan ASSR	115.1%
U.S.S.R.	106.3%	Kabar-Bald ASSR	112.0%
ASSR Subtotal	111.8%	Kalmyk ASSR	168.8%
		Karachaev- Cherk	149.6%
Gorno-Altai	•148.9%	Karelian ASSR	100.0%
Khakass	-189.0%	Komi ASSR	55.7%
Tuva	*131.2%	Korni-Perm	75.4%
Adygeiskiy	108.2%	Mariy ASSR	87.5%
Agin. Buryat	91.3%	Mordov. ASSR	72.1%
Bashkir ASSR	88.6%	N. Osetian	101.2%
Buryat ASSR	107.2%	Tatar •	76.8%
Chechen-Ing.	119.6%	Udmurts Ust	60.5%
Chuvach	70.9%	Ordynski	151.3%

- Regions of snow leopard's habitat.

passengers) is shown in Table VI for each region. Two of the three grown faster than the Kazakh average from 1960 to 1980: Eastern K kilorneter transport record for freight increased 4.5 times, against for the whole republic; the Taldy-Kurgan growth was 4.8 times and i was 3.6. However, regional shares again seemed to fail to indicate a burden of overall growth in these three areas.

A disproportionality does seem to arise in terms of sheep a however, as seen in Tables VII and VIII. The union republic as a wh 23.5% increase in total herd size between 1960 and 1980, while the t witnessed increases from 44.6 to 64% for the same period (Table VIII).

FIGURE 7. Share of RSFSR-ASSR sheep and goats. By region 1984 - I960. Cha share - ASSR total.

TABLE IV. Cattle Production in Kazakhstan (Thousand Head).

Oblast'	1960	1980	1960 share	1980 share	1980-60 Differ.	T
E. Kazakhstan*	352.4	505.8	6.4%	5.8%	-0.5%	
Semipalatinsk*	405.9	578.9	7.3%	6.7%	-0.7% -	
Taldy Kurgan*	276.3	335.4	5.0%	3.9%	1.1% -	
Aktyubinsk	363.8	491.4	6.6%	5.7%	0.9%	
Alma-Atinsk	253.3	394.0	4.6%	4.5%	.0%	
Chimkent	279.7	333.7	5.0%	3.8%	-1.2%	
Dzhambul	244.4	284.9	4.4%	3.3%	-1.1%	
Dzhezkazgan	132.9	164.9	2.4%	1.9%	-0.5% -	
Gur'evsk	126.0	114.6	2.3%	1.3%	1.0%	
Karaganda	245.3	388.6	4.4%	4.5%	.0%	
Kokchetavsk	401.1	724.5	7.2%	8.3%	1.1%	
Kustanaysk	528.9	1134.7	9.5%	13.1%	3.5% -	
Kyzyl-Ordinsk	169.5	182.8	3.1%	2.1%	1.0%	
Mangyshlak	1.2	3.1	.0%	.0%	.0%	
N.Kazakh	334.3	689.8	6.0%	7.9%	1.9%	
Pavlodar	372.0	682.4	6.7%	7.8%	1.1%	
Tselinograd	429.2	763.9	7.7%	8.8%	1.0%	
Turgay Urals	150.4	291.9	2.7%	3.4%	0.6% -	
	476.4	627.7	8.6%	7.2%	1.4%	
Total Kazakh	5543.0	8693.0				2
U.S.S.R. Total	75780.0	1 15057.0				
Kazakh % U.S.S.R	7.3%	7.6%				

Oblast	1960	1980	% share 1960	% share 1980	Difference 1980-60	Term.
E. Kazakhstan	762.6	918.4	2.7%	2.5%	-0. 1%	97.3
Semipalatinsk	1394.2	2031.9	4.9%	5.6%	0.7%	179.6
Taldy Kurgan*	693.7	871.2	2.4%	2.4%	0.0%	118.5
Aktyubinsk	1580.5	2928.4	5.5%	8.0%	2.5%	298.7
Alma-Atinsk	653.7	895.8	2.3%	2.5%	0.2%	104.7
Chimkent	841.9	1138.9	2.9%	3.1%	0.2%	116.3
Dzhambul	907.7	927.1	3.2%	2.5%	-0.6%	144.6
Dzhezkazgan	279.1	539.8	1.0%	1.5%	0.5%	313.4
Gur'evsk	29.8	97.2	0.1%	0.3%	0.2%	112.0
Karaganda	1380.7	1703.4	4.8%	4.7%	-0.2	85.4
Kokchetavsk	3258.7	3745.6	11.4%	10.3%	-1.1%	78.1

Oblast	1960	1970	1975	1980	1960	1970	1975	1980	Reg. share 1980-60
E. Kazakhstan*	125.2	265.3	377.6	572.6	3.7%	4.5%	4.4%	4.2%	0.6%
Sernipalatinsk*	180.9	348.5	468.5	668.0	5.3%	6.0%	5.4%	4.9%	-0.3%
Taldy Kurgan*	142.8	321.9	425	687.7	4.2%	5.5%	4.9%	5.1%	0.9%
Aktyubinsk	99.7	163	314.2	425.3	2.9%	2.8%	3.6%	3.1%	0.2% 2.
Alma-Atinsk	363.1	1010.6	1343.8	1715.8	10.6%	17.3%	15.5%	12.7%	1%
Chimkent	263.6	547.8	855.7	1321.5	7.7%	9.4%	9.9%	9.8%	2.19/o
Dzhambul	136.3	331.6	460.6	782.4	4.0%	5.7%	5.3%	5.8%	1.8%
Dzhezkazgan	47.2	71.7	172.4	344.9	1.4% 1	1.2%	2.0%	2.6%	1.2%
Gur'evsk	54.0	89.9	153.6	262.5	.6%	1.5%	1 .8%	1.9%	0.4%
Karaganda	221.6	357.6	552.4	860.4	6.5%	6.1%	6.4%	6.4%	-0.1% -
Kokchetavsk	275.3	274.5	389.2	633.6	8.0%	4.7%	4.5%	4.7%	3.4%
Kustanaysk	443.6	599	867	1426.3	13.0%	10.2%	10.0%	10.5%	-2.4%
Kyzyl- Ordinsk	46.6	104.6	168.2	318.6	1.4% 1	1.8%	1.9%	2.4%	1.0% -
Mangyshlak N.	54.2	91.3	160.3	290.0	.6%	1.6%	1.8%	2.1%	0.6% -
Kazakh	158.6	196.4	323.2	589.8	4.6%	3.4%	3.7%	4.4%	0.3%
Pavlodar	331.9	494.5	667.1	1092.1	9.7%	8.4%	7.7%	8.1%	-1.6%
Tselinograd	318.3	325.0	444.2	733.7	9.3% 1	5.6%	5.1%	5.4%	-3.9% ••
Turgay	53.3	65.7	215.2	352.7	.6%	1.1%	2.5%	2.6%	1.1% .>,•
Urals 108.6	108.6	194.4	311.6	442.0	3.2%	3.3%	3.6%	3.3%	0.1%
Total Kazakh	3424.8	5852.9	8666.5	13519.9					

TABLE Vn. Sheep and Goat Production — Kazakhstan Regions.

Oblast'	**1960**	**1965**	**1970**	**1975**	**1980**
E. Kazakhstan*	**1359.7**	**1645.5**	**1684.8**	**1935.7**	**2064.2**
Semipalatinsk	**2320.5**	**2948.8**	**3375.5**	**3782.0**	**3814.6**
" Taldy	**2229.1**	**2885.1**	**2688.5**	**3113.5**	**3222.9**
Kurgan*	**1914.9**	**1953.6**	**2689.0**	**2707.2**	**2838.7**
Aktyubinsk	**2618.0**	**3105.0**	**2583.9**	**2991.5**	**3139.0**
Chimkent	**3265.6**	**3720.5**	**3300.9**	**3634.2**	**3768.3**
Dzhambul	**2941.4**	**3317.6**	**2879.7**	**3288.9**	**3205.7**
Dzhaezkazgan	**893.2**	**916.0**	**1205.9**	**1297.0**	**1180.6**
Gur'evsk	**1134.8**	**1043.1**	**1217.8**	**1154.0**	**1153-1**
Karaganda	**742.2**	**480.2**	**708.0**	**775.0**	**890.5**
Kokchetavsk	**768.0**	**602.6**	**688.8**	**800.3**	**819.5**
Kustanaysk	**788.3**	**499.9**	**644.8**	**684.4**	**761.1**
Kyzyl -Ordlnsk	**1537.1**	**1425.0**	**1486.5**	**1427.6**	**1299.2**
Mangyshlak	**481.9**	**471.0**	**367.1**	**504.5**	**579.3**
N. Kazakh	**423.0**	**271.4**	**333.4**	**334.6**	**354.0**
Pavlodar	**961.4**	**989.8**	**1474.4**	**1678.2**	**1562.9**
Tselingrad	**895.4**	**691.1**	**782.7**	**1023.9**	**1096.7**
Turgay	**700.1**	**659.0**	**857.5**	**1062.9**	**1018.0**
Urals	**2542.4**	**2495.7**	**2807.4**	**2383.9**	**2439.2**
Total Kazakh	**2817.0**	**30120.9**	**31776.6**	**34579.3**	**35207.5**
U.S.S.R.	**140.3**	**135.3**	**143.4**	**147.1**	**147.5**
Kaz/U.S.S.R	**20. 3°/**	**22.3%**	**22.2%**	**23.5%**	**23. 9^**

Regions of snow leopard habitat.

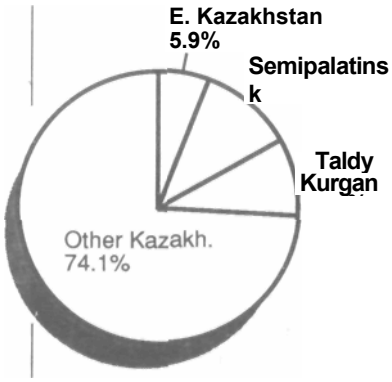
The burden is demonstrated further by examining

Region	1980/1960	Region	1980/1960
E. Kazakhstan*	151.81%	Karaganda	1 19.98%
Semipalatinsk*	164.39%	Kokchetavsk	106.71%
Taldy Kurgan*	144.58%	Kustanaysk	96.55%
Aktyubinsk	148.24%	Kyzyl-Or din sfc	84.52%
Alma-Atinsk	1 19.90%	Mangyshlak	120.21%
Chirnkent	115.39%	N.Kazakh	83.69%
Dzhambul	108.99%	Pavlodar	162.57%
Dzhezkazgan	132.18%	Tselinograd	122.48%
Gur'evsk	101.61%		
		Kazakh Total	123.48%

* **Regions of snow leopard habitat.**

Kazakhstan Sheep and Goat **Production**

Share for Study Areas 1980 ***Figure 8A***



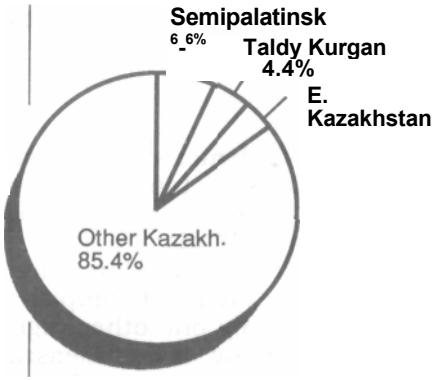
Kazakhstan **Territory**

Share for

Study Area

19BO

Figure 88



FIGURES. Kazakhstan.

FIGURE 9. Share of Kazakhstan sheep/goat production. Totals for 198O vs. 1960 - percentage change In share.

CONCLUSIONS

The six study areas all are within regions of general economic growth in the U.S.S.R. While further subdivisions of the data below oblast level are not available, and so it is not possible to pinpoint more precisely wild sheep areas affected by economic development, several ideas emerge from the data descriptions:

1. Commercial sheep and goat herd increases appear to have the strongest influence on the regions of the indicators examined.
2. In Kazakhstan growth is occurring in all indicators.
3. Most of the areas of focus have experienced population growth in concert with the general development (data are not given for Gorno-Altai A.O. separately) that is occurring in Central Asia.
4. As growth occurs in herds over large regions, more marginal mountain lands are thus exposed to heavier use by wild herds.

Soviet reserves, or *zapovedniki.* do occur within the regions discussed: Altay, Alma-Atinsky, Aksu-Dzhabagliy. Sayan Shushenskoye, and Markakol'. The trends discovered above appear to call for an

extension of reserves in the southern R.S.F.S.R., particularly in the Tuva A.S.S.R. Indications from Mongolia are that argali do not appear to be threatened there, and further study might determine to what extent Soviet economic growth on the northern fringe of argali range affects the herds throughout this part of Asia.

The exercise presented in this paper is only a first step to a more complete analysis which could bear out the opinions of Soviet environmentalists: that commercial development is a prime enemy of snow leopard conservation fn Soviet Central Asia. The economic geography of snow leopard ranges must be examined to provide decision makers the facts they will need for policies to preserve this cat and its prey.

ENDNOTES AND REFERENCES

[1] V.S. Pokrovskiy, "The Snow Leopard", in I, Shishkin, A. Sludskiy, and V. Pokrovskiy. *Kmpniye khisltchniki (Large Predators).* Moscow. Lesnaya promyshlennost'. 1976. pp. 82-98; A,A. Sludskiy, "The Snow Leopard or Irbia - *Panthera uncia ancia* Schreber (1776)". in *The Distribution and Population of Wild Cats in the U.S.S.R.*. Trudy institute zoologii AN K.S.S.R., vol. 34. 1973. pp. 74-83.

[2] Much confusion exists not only over identification of species from country to country, but also within the U.S.S.R. scientific com munity. Fedosenko. for example, reported recently that three sub species of argali exist in the U.S.S.R., *Ouis Amman polii, Ovis ammon nigrimontana. and* Ouis ammon *ammon.* He wrote that the first is the most numerous, and the third the most endangered. (A.K. Fedosenko, "Present Status of Argali Sheep Population in the U.S.S.R.", draft. 1986). In addition, "argali" and "arkhari'i are often used casually in Soviet writing about the snow leopard, making distinction difficult. The author here uses the Soviet classification system derived from the *Soviet Red Book of Endangered Species.*

[3] See. for example. A.K, Fedosenko. *Arkhar,* Alma Ata. Kainar, 1983; E.P. Koshkarev. "K kharakteristfke dikikh kopytnykh i khishchnykh miekopitavushchikh Tyan'-Shanya" (On Characteristics of Wild Ungualtes and Predatory Mammals of the Tien Shan) in *VzaimodeistDie bioticheskikh komponentov i sredy v nekotorykh ekosystemakh Tyan'-Shanya* (Interaction of Biotic Components and Environments in Several Ecosystems of the Tien Shan), Frunze. Him. 1983; V.A. Zhiryakov, "Redkie kopytnye Alma-Atinskogo zapovednika i ikh okrana" (Rare Ungulates of the Alrna-Atinksiy Reserve and Their Protection), in *Redkie mlekopitayushchie fanny S.S.S.R.* (Rare Mam malian Fauna of the U.S.S.R.), Moscow. Nauka. 1977. pp. 141-155; L.V. Sopin. "Sostoyanie sailyugemskoi populyatsii argali i problerna ego sokhraneniya v S.S,S.R." (Sustaining the Sailyugem Population of Argali

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