

Contribution to the knowledge on spiders (Araneae) of the Veľká Fatra Mts.

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Abstract. The author deals with faunistic research of spiders (Araneae) of the Veľká Fatra Mts. He mentions 188 spider species from this territory that is considered to be little-known from arachnological point of view. Some of them rank among rare species with a high bioindicative value. It especially concerns *Dasumia carpathica*, *Evansia merens*, *Troxochrus nasutus*, *Alopecosa fabrilis*, *Phaeoedus braccatus*, *Zelotes puritanus* and *Synageles hilarulus*. Despite this mountain complex overtops upper forest boundary, the occurrence of many more-or-less thermophilic spiders in high altitudes is remarkable and sometimes surprising.

Key words: spiders (Araneae), faunistics, Veľká Fatra Mts.

Introduction and methods

The impressive mountain complex of Veľká Fatra is a famous destination of both summer and winter tourists. Despite this fact, the level of zoological research of this territory is not satisfactory. It also concerns a less popular order of spiders, of course. Excluding sporadic records of spiders from Veľká Fatra two papers (Svatoň 1983a, 1991) dealing with spiders of 'Čierny kameň' and 'Borišov' nature reserves are accessible. Because I have collected in another sites in the southern part of Veľká Fatra (see below), data from referred papers are not mentioned.

In this paper I summarise the results of my arachnological research in Veľká Fatra, that was especially carried out during the year 2001. I applied current methods of collecting, especially sifting the detritus, sweeping the spiders from the vegetation and individual collecting under stones, etc. The material was identified according the keys by Miller (1971), Heimer & Nentwig (1991), Roberts (1995) and Loksa (1969, 1972).

The research was carried out in the following sites (abbreviations are also used in the table 1):

TS → Turecká – Salašky (the middle of 7180)*: southern and SW slopes of Krížna (1574 m a. s. l.). Habitats: older beech and mixed forests, forest clearings, meadows and rocky pastures.

Ms → Majerova skala (7180b): the complex of old or up to primeval beech and mixed forests (Abieto-Fagetum) on the impressive mountain (1283 m a. s. l.) above the Staré Hory village.

Hjd → 'Hornojelenská dolina' valley (7180b): a narrow karst valley with adjacent

* the grid mapping code of the Databank of the Slovakian fauna, a letter indicates 1st, 2nd, 3rd or 4th quadrant of the mapping square

steep slopes. Habitats: littoral vegetation of the brook, older beech forest, open pine forest on the cliffs.

Sk → Skalná (7080c): a conspicuous rocky massif (1297 m a. s. l.) between Dedošova and Selenecká valleys, including lower parts of the ‘Padva’ NR. Habitats: older beech and mixed forests, pine forests on the cliffs, rocky grasslands.

Zv → Zvolen (7181a): a mountain above the Donovaly tourist centre (1402 m a. s. l.). Habitats: older beech and spruce forests, subalpine rocky grasslands.

Ks → Kozia skala (7079b): a steep rocky mountain (1202 m a. s. l.) above the Gaderská valley. Habitats: older open beech forest, shrubbery, rocky slopes and cliffs, screes and xerothermic grasslands.

Pek → Pekárova (7079b/7080a): a branch ridge of Kozia skala (1067 m a. s. l.), the site has similar relief and habitats as the preceding one.

Results (Systematic review of species)

Systematic review of spiders is available in the table 1. Ecosozological status of separate species in Slovakia (Gajdoš & Svatoň 2001) is also mentioned here. Some of them rank among infrequent or rare species, including *Dasumia carpathica*, *Theridion pallens*, *Robertus neglectus*, *Micrargus georgescuae*, *Araniella displicata*, *Alopecosa fabrilis*, *Dictyna civica* and *Phaeocedus braccatus*. The following four scarce species deserve special mention on their occurrence in the territory of Slovakia.

Evansia merens – Kozia skala, under the stone near the colony of *Formica fusca* 12th July 2001, 1 ♀, P. Gajdoš det. A sporadic and rare species with hidden way of life, occurring sporadically and rarely near ant nests in mountains. The further records: Malá Fatra Mts. – Nature Reserve (below only “NR”) Rozsutec (7680d) (Svatoň & Miller 1979), Malá Fatra Mts. – NR Suchý (6879b) (Svatoň 1985), High Tatras Mts. – Kriváň (6886a) (Svatoň 1983b). Unpublished record from Poľana Mts. (320), Prídavka et Svatoň lgt. (Gajdoš, Svatoň & Sloboda 1999) and old records from Oravská Magura Mts. (580) and the surroundings of the Žilina city (6778) (Kratochvíl & Miller 1937) are also available.

Troxochrus nasutus – Zvolen, in the debris of an open beech forest 27th June 2001, 1 ♀. A very rare species, occurring sporadically in older deciduous and mixed forests of Europe. Only three further records are accessible: Balocké vrchy Mts. – Tlstý javor (7383b) 17th July 1993, 1 ♀; Bystrická vrchovina Mts. – Urpín (7280d) swept from the vegetation during a warm evening 26th May 1995, 1 ♀; and Hrochoť – NR Jelšovec (7381b) in the wet leaf litter of a bog 4th June 1995, 1 ♀ (Franc & Hanzelová 1996).

Zelotes puritanus – Pekárova, under the stone in xerothermic rocky grassland 16th June 2001, 1 ♀. The third finding of this utmost rare species of dealpine rocky slopes in the territory of Slovakia! Recorded also from Veľká Fatra Mts. – Tlstá (7079d) (Gajdoš & Svatoň 1993) and Pieniny Mts. (600) (Svatoň 1990).

Synageles hilarulus – Zvolen, xerothermic rocky pasture 27th June 2001, 1 ♀. A scattered and rare species of warm habitats, known from several further records: NR Starý hrad (6879a) (Bartoš 1938), NR Devínska Kobyla (7867b/7868a) summer 1978, 9 individuals! (Gajdoš, Svatoň & Krumpál 1984); NR Zobor (7674d) (Gajdoš & Sloboda 1995), the bank of the Malý Dunaj river (7869) (Gajdoš, Svatoň, Žitňanská & Krumpálová 1992). Unpublished records are available from Slovak Karst Reserve

(060), Svatoň lgt., NR Kováčovské kopce (8178d), Buchar lgt. and Zemplínske vrchy (7596), Gajdoš lgt. (Gajdoš, Svatoň & Sloboda 1999).

Table 1. Review of spiders (Araneae) of the Velká Fatra Mts.

Family/Species	Locality							ESS
	TS	Ms	Hjd	Zv	Sk	Ks	Pek	
Pholcidae								
<i>Pholcus opilionoides</i> (Schrank, 1781)								-/1+
Segestriidae								
<i>Segestria senoculata</i> (Linnaeus, 1758)	1/-	-/1	1/+	-/1				-/1+
Dysderidae								
<i>Dasumia carpathica</i> (Kulczyński, 1881)						-/1	1/-	LR
<i>Dysdera erythrina</i> (Walckenaer, 1802)	1/1						-/1	
<i>Harpactea hombergi</i> (Scopoli, 1763)						1/-	1/+	
Theridiidae								
<i>Achearana lunata</i> (Clerck, 1757)							1/1	
<i>Crustulina guttata</i> (Wider, 1834)							-/3	
<i>Dipoena melanogaster</i> (C. L. Koch, 1837)							1/1	
<i>Enoplognatha ovata</i> (Clerck, 1757)		-/1	-/1					
<i>Enoplognatha thoracica</i> (Hahn, 1833)						-/2	-/1	
<i>Episinus truncatus</i> Latreille, 1809						2/1		
<i>Neottiura bimaculata</i> (Linnaeus, 1767)				2/-	1/-	-/2		
<i>Pholcomma gibbum</i> (Westring, 1851)				1/-				
<i>Robertus arundineti</i> (O. P.-Cambridge, 1871)				-/1				
<i>Robertus lividus</i> (Blackwall, 1836)	2/5	-/2	2/1					
<i>Robertus neglectus</i> (O. P.-Cambridge, 1871)						1/-		LR
<i>Steatoda albomaculata</i> (De Geer, 1778)				-/2				
<i>Steatoda phalerata</i> (Panzer, 1801)	1/1					1/-		
<i>Theridion impressum</i> L. Koch, 1881				3/-		2/-		
<i>Theridion mystaceum</i> L. Koch, 1870	-/1							
<i>Theridion pallens</i> Blackwall, 1834			-/1					
<i>Theridion pinastri</i> L. Koch, 1872			1/-					
<i>Theridion sisyphium</i> (Clerck, 1757)	2/-		-/3	-/2		-/1		
<i>Theridion tinctum</i> (Walckenaer, 1802)						-/1		
Linyphiidae								
<i>Bathypantes nigrinus</i> (Westring, 1851)	-/3							
<i>Centromerus sellarius</i> (Simon, 1884)		-/2						
<i>Centromerus sylvaticus</i> (Blackwall, 1841)	-/2							
<i>Ceratinella brevis</i> (Wider, 1834)						1/1		
<i>Ceratinella scabrosa</i> (O. P.-Cambridge, 1871)		-/1						
<i>Ceratinopsis stativa</i> (Simon, 1881)	2/-							LR
<i>Dicymbium nigrum</i> (Blackwall, 1834)				-/3				
<i>Diplocephalus cristatus</i> (Blackwall, 1833)		-/2			-/1	1/-		
<i>Diplocephalus latifrons</i> (O. P.-Cambridge, 1863)				1/-				
<i>Diplocephalus picinus</i> (Blackwall, 1864)	-/1	1/1						
<i>Diplostyla concolor</i> (Wider, 1834)		1/2		1/2				

Table 1. (continued)

Family/Species	Locality							ESS
	TS	Ms	Hjd	Zv	Sk	Ks	Pek	
<i>Entelecara acuminata</i> (Wider, 1834)	3/-			2/-				
<i>Erigone atra</i> Blackwall, 1833	-/1							
<i>Erigone dentipalpis</i> (Wider, 1834)	1/-			1/-	1/-			
<i>Evansia merens</i> O. P.-Cambridge, 1900						-/1		VU
<i>Gonatium rubellum</i> (Blackwall, 1841)					1/1	2/-		
<i>Gongylidiellum latebricola</i> (O. P.-Cambridge, 1871)							-/2	
<i>Kaestneria torrentum</i> (Kulczyński, 1881)						-/1		
<i>Lepthyphantes mughi</i> Fickert, 1875						-/1		
<i>Lepthyphantes obscurus</i> (Blackwall, 1841)				4/-	1/-			
<i>Lepthyphantes pallidus</i> (O. P.-Cambr., 1871)	1/1					-/1		
<i>Lepthyphantes pulcher</i> (Kulczyński, 1881)	-/3					-/1		
<i>Lepthyphantes tenebricola</i> (Wider, 1834)	-/1	2/1				-/1		
<i>Linyphia hortensis</i> Sundevall, 1829	2/-							
<i>Linyphia triangularis</i> (Clerck, 1757)			4/-		4/-	1/-		
<i>Macrargus rufus</i> (Wider, 1834)							-/2	
<i>Maso sundevalli</i> (Wider, 1851)		1/1	3/1	2/1	3/3	-/2		
<i>Meioneta rurestris</i> (C. L. Koch, 1836)							2/-	
<i>Micrargus georgescuae</i> Millidge, 1975			-/1		1/1			DD
<i>Micrargus herbigradus</i> (Blackwall, 1854)	1/2	1/-		-/3				
<i>Microneta viaria</i> Simon, 1897					-/4			
<i>Minicia marginella</i> (Wider, 1834)							-/2	
<i>Neriene emphana</i> (Walckenaer, 1841)		-/1	-/1	2/-				
<i>Neriene peltata</i> (Wider, 1834)	-/1				2/3			
<i>Oedothorax agrestis</i> (Blackwall, 1853)	1/-	1/-						
<i>Oedothorax apicatus</i> (Blackwall, 1850)	-/1			2/-				
<i>Pityophantes phrygianus</i> (C. L. Koch, 1836)					1/-			
<i>Porrhomma convexum</i> (Westring, 1861)		-/1						
<i>Porrhomma pygmaeum</i> (Blackwall, 1834)						-/1		
<i>Tapinocyba affinis</i> (De Lessert, 1910)	4/1							
<i>Tapinocyba insecta</i> (L. Koch, 1869)					-/1			
<i>Thyreosthenius parasiticus</i> (Westring, 1851)	1/1	-/2			-/1			
<i>Tiso vagans</i> (Blackwall, 1834)				-/6				
<i>Trichoncus affinis</i> Kulczyński, 1894							1/-	DD
<i>Troxochrus nasutus</i> Schenkel, 1925				-/1				CR
<i>Walckenaeria corniculans</i> (O. P.-Cambridge, 1875)	1/-							
<i>Walckenaeria furcillata</i> (Menge, 1869)				-/1		1/-		
<i>Walckenaeria obtusa</i> Blackwall, 1836						-/1		
<i>Walckenaeria vigilax</i> (Blackwall, 1853)						-/1		
Tetragnathidae								
<i>Meta menardi</i> (Latreille, 1804)			-/2		-/1+			
<i>Metellina mengei</i> (Blackwall, 1869)		-/1	1/1	2/-				
<i>Pachygnatha clercki</i> Sundevall, 1823	-/1				2/-			
<i>Pachygnatha listeri</i> Sundevall, 1830					1/1			
<i>Tetragnatha pinicola</i> L. Koch, 1870	3/-		2/-	2/-	1/-			
Araneidae								
<i>Aculepeira ceropegia</i> (Walckenaer, 1802)		1/-		-/3	1/1			

Table 1. (continued)

Family/Species	Locality							ESS
	TS	Ms	Hjd	Zv	Sk	Ks	Pek	
<i>Araneus alsine</i> Walckenaer, 1802			-1					
<i>Araneus diadematus</i> Clerck, 1757	-1+		1/+					
<i>Araneus marmoreus</i> Clerck, 1757	-2			-1		-1		
<i>Araneus quadratus</i> Clerck, 1757	-1		-2+					
<i>Araneus sturmi</i> (Hahn, 1831)	1/-				-3			
<i>Araniella alpica</i> (L. Koch, 1869)	-1				-2			
<i>Araniella cucurbitina</i> (Clerck, 1757)				1/1			1/1	
<i>Araniella displicata</i> (Hentz, 1847)					-1			LR
<i>Cyclosa conica</i> (Pallas, 1772)	2/-							
<i>Gibbaranea omoeda</i> (Thorell, 1870)					-1			
<i>Hypsosinga sanguinea</i> (C. L. Koch, 1844)	-1		-1	1/1		-1		
<i>Larinioides cornutus</i> (Clerck, 1757)			1/-					
<i>Mangora acalypha</i> (Walckenaer, 1802)			1/-	1/-	1/-	1/-		
Lycosidae								
<i>Acantholycosa lignaria</i> (Clerck, 1757)	-1							
<i>Alopecosa accentuata</i> (Latreille, 1817)				1/-			-1	
<i>Alopecosa aculeata</i> (Clerck, 1757)				2/-	1/1			
<i>Alopecosa cuneata</i> (Clerck, 1757)	1/+							
<i>Alopecosa fabrilis</i> (Clerck, 1757)					1/-	-2		DD
<i>Alopecosa pulverulenta</i> (Clerck, 1757)						-1		
<i>Alopecosa trabalis</i> (Clerck, 1757)	1/1							
<i>Arctosa maculata</i> (Hahn, 1822)	-1				2/1			
<i>Aulonia albimana</i> (Walckenaer, 1805)	-1		2/-					
<i>Pardosa amentata</i> (Clerck, 1757)	2/-				1/-			
<i>Pardosa lugubris</i> (Walckenaer, 1802)	2/1	2/-			2/1			
<i>Pardosa riparia</i> (C. L. Koch, 1833)	2/-			1/-	1/-			
<i>Pirata hygrophilus</i> Thorell, 1872					3/1			
<i>Trochosa robusta</i> (Simon, 1876)						-1		
<i>Trochosa terricola</i> Thorell, 1856					-2	-2	-1	
<i>Xerolycosa nemoralis</i> (Westring, 1861)	3/+			1/-		-1		
Pisauridae								
<i>Pisaura mirabilis</i> (Clerck, 1757)			1/1+				-2+	
Agelenidae								
<i>Agelena labyrinthica</i> (Clerck, 1757)			-1			-2+		
<i>Histopona torpida</i> (C. L. Koch, 1834)	-1	1/1						
<i>Tegenaria agrestis</i> (Walckenaer, 1802)			1/-					
<i>Tegenaria ferruginea</i> (Panzer, 1804)			1/1					
<i>Tegenaria silvestris</i> (L. Koch, 1872)					2/-			
Cybaeidae								
<i>Cybaeus angustiarum</i> L. Koch, 1868			1/-		4/1			
Hahniidae								
<i>Antistea elegans</i> (Blackwall, 1841)	4/-							
<i>Cryphoeca silvicola</i> (C. L. Koch, 1834)	1/-			2/5	-1			
<i>Hahnia helveola</i> Simon, 1875			1/1					LR
Dictynidae								
<i>Dictyna civica</i> (Lucas, 1850)			1/-					
<i>Dictyna pusilla</i> Thorell, 1856						1/-		
<i>Dictyna uncinata</i> Thorell, 1856							1/-	

Table 1. (continued)

Family/Species	Locality							ESS
	TS	Ms	Hjd	Zv	Sk	Ks	Pek	
Amaurobiidae								
<i>Amaurobius fenestralis</i> (Stroem, 1768)	1/+	-1+	1/2+	2/-		-2+		
<i>Amaurobius ferox</i> (Walckenaer, 1830)				-1				
<i>Callobius claustrarius</i> (Hahn, 1831)	2/4	-4				-1		
<i>Coelotes atropos</i> (Walckenaer, 1802)	-1	-1		-4				
<i>Coelotes inermis</i> (L. Koch, 1855)		1/2	-1	-2	-1			
<i>Coelotes terrestris</i> (Wider, 1834)					1/-		-1	
Titanoecidae								
<i>Titanoeca quadriguttata</i> (Hahn, 1833)						-1+	1/1+	
Anyphaenidae								
<i>Anyphaena accentuata</i> (Walckenaer, 1802)	1/1		1/-					
Liocranidae								
<i>Agroeca cuprea</i> Menge, 1983	-1							
<i>Apostenus fuscus</i> Westring, 1851	-1	1/-		-1		-2		
<i>Phrurolithus festivus</i> (C. L. Koch, 1835)	1/1					-2		
Clubionidae								
<i>Clubiona caerulescens</i> L. Koch, 1867	2/3							
<i>Clubiona compta</i> C. L. Koch, 1839	1/2			-1	-1			
<i>Clubiona lutescens</i> Westring, 1851		1/1			-2			
<i>Clubiona neglecta</i> O. P.-Cambridge, 1862				1/-				
<i>Clubiona saxatilis</i> L. Koch, 1866 (= <i>dvoraki</i> Miller, 1947)				1/-				LR
<i>Clubiona terrestris</i> Westring, 1851						-1		
Zodariidae								
<i>Zodarion germanicum</i> (C. L. Koch, 1837)			-1					
Gnaphosidae								
<i>Callilepis schuszeri</i> (Herman, 1879)							1/2	
<i>Drassodes lapidosus</i> (Walckenaer, 1802)						-1+	2/-	
<i>Drassodes pubescens</i> (Thorell, 1856)				1/2		-1	1/-	
<i>Gnaphosa bicolor</i> (Hahn, 1833)						-1		
<i>Haplodrassus silvestris</i> (Blackwall, 1833)	-1							
<i>Micaria fulgens</i> (Walckenaer, 1802)							1/-	
<i>Phaeoedus braccatus</i> (L. Koch, 1866)						1/-		LR
<i>Zelotes latreillei</i> (Simon, 1878)	-1							
<i>Zelotes pedestris</i> (C. L. Koch, 1839)	-1							
<i>Zelotes petrensis</i> (C. L. Koch, 1839)						-1		
<i>Zelotes praeficus</i> (L. Koch, 1866)	-1		-1					
<i>Zelotes puritanus</i> Chamberlin, 1922							-1	CR
<i>Zelotes subterraneus</i> (C. L. Koch, 1833)						-2		
Zoridae								
<i>Zora nemoralis</i> (Blackwall, 1861)		-1			-1			
<i>Zora spinimana</i> (Sundevall, 1833)	1/1	-1		-1	-1			
Heteropodidae								
<i>Micrommata virescens</i> (Clerck, 1757)			2/+					
Philodromidae								
<i>Philodromus aureolus</i> (Clerck, 1757)			1/-	1/1		1/-		
<i>Philodromus collinus</i> C. L. Koch, 1835					-1			
<i>Philodromus emarginatus</i> (Schränk, 1803)					-1			

Table 1. (continued)

Family/Species	Locality							ESS
	TS	Ms	Hjd	Zv	Sk	Ks	Pek	
<i>Philodromus praedatus</i> O. P.-Cambridge, 1871							1/-	DD
<i>Thanatus formicinus</i> (Clerck, 1757)						1/-		
<i>Tibellus oblongus</i> (Walckenaer, 1802)				-/1	-/1	3/1		
Thomisidae								
<i>Coriarachne depressa</i> (C. L. Koch, 1837)			-/1					
<i>Diaea dorsata</i> (Fabricius, 1777)	1/-			1/-	1/1	-/3		
<i>Misumena vatia</i> (Clerck, 1757)	2/-			1/1+				
<i>Ozyptila rauda</i> Simon, 1875				-/1				
<i>Xysticus audax</i> (Schrank, 1803)	4/-				2/-	1/1		
<i>Xysticus bifasciatus</i> C. L. Koch, 1837			1/3		-/1			
<i>Xysticus cristatus</i> (Clerck, 1757)	4/-	1/-	1/-	-/1	2/-			
<i>Xysticus erraticus</i> (Blackwall, 1834)						1/-		
<i>Xysticus gallicus</i> Simon, 1875	1/-			1/-	1/-			
<i>Xysticus lanio</i> C. L. Koch, 1845				2/-				
<i>Xysticus striatipes</i> L. Koch, 1870					-/1			
<i>Xysticus ulmi</i> (Hahn, 1831)	2/-				1/-			
Salticidae								
<i>Aelurillus v-insignitus</i> (Clerck, 1757)							1/-	
<i>Bianor aurocinctus</i> (Ohlert, 1865)				-/1				
<i>Euophrys erratica</i> (Walckenaer, 1826)					1/-			
<i>Euophrys frontalis</i> (Walckenaer, 1802)				1/3		1/1		
<i>Evarcha arcuata</i> (Clerck, 1757)	1/-				1/-			
<i>Evarcha falcata</i> (Clerck, 1757)	1/1		2/2	2/4	4/1	1/-		
<i>Heliophanus cupreus</i> (Walckenaer, 1802)	2/-	1/-	3/-		1/-			
<i>Heliophanus flavipes</i> C. L. Koch, 1848		-/1		-/1				
<i>Neon reticulatus</i> (Blackwall, 1853)	-/2							
<i>Phlegra fasciata</i> (Hahn, 1826)							2/1	
<i>Salticus scenicus</i> (Clerck, 1757)			-/1					
<i>Sitticus rupicola</i> (C. L. Koch, 1837)	1/1				1/-	-/1		
<i>Synageles hilarulus</i> (C. L. Koch, 1836)				-/1				
<i>Synageles venator</i> (Lucas, 1836)						-/1	-/1	
<i>Talavera</i> (= <i>Euophrys</i>) <i>aequipes</i> (O. P.-Cambridge, 1871)			1/-					

1/2 – 1 male and 2 females; + I have observed more individuals which remained alive

ESS – ecosozological status; DD – data deficient, LR – lower risk, VU – vulnerable, CR – critically endangered

Conclusions

I have documented the occurrence of 188 spider species in Velká Fatra during approximately 25 excursions in this mountain area. This review is only preliminary, of course, and will be supplemented by the further investigation. Some of documented species are rare, occurring in well-preserved habitats especially. *Troxochrus nasutus* and *Zelotes puritanus* rank among very scarce species, known only from a few

scattered records. The presence of several thermophilic species in high altitudes is very remarkable from both zoogeographical and ecological points of view; it especially concerns *Trichoncus affinis*, *Zodarion germanicum*, *Callilepis schuszteri*, *Phaeoecelus braccatus*, *Synageles hilarulus*, *Talavera aequipes*, etc. They occur in temperate enclaves in mountains owing to:

- warm limestone substratum,
- southern (SW and SE) exposition and closed microclimate of the warmest sites,
- climatic and ecological inversion,
- global warming.

By the way, the habitats of Veľká Fatra remained so well-preserved because they are hardly accessible and unsuitable for intensive agriculture or/and commercial wood production. Nevertheless, effective nature conservation management of this territory will not be simple, because it is necessary to control:

- development of intensive forestry in less-extreme slopes with all the consequences, mainly clean-cutting wood exploitation and degradation of natural forests towards monocultures;
- afforestation of “sterile” rocky-and-scrree slopes;
- inappropriate pasture, especially large-number bovine pasture in mountain grasslands with shallow unstable soil.

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