Peatlands of Armenia

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Abstract: Armenia with an area of 29.743 km² is a mountainous country with a minimum altitude of 375 m and a maximum of 4.091 m a.s.l. (Mount Aragats). Depending on the character of origin, relief, hydrology and plant formations 7 types of wetlands are distinguished in Armenia. Of them mires, sloping fens, bogged meadows, ephemeral and suspended marshes that are situated between altitudes 1.400 and 2.400 m a.s.l. can be considered as peat producing wetlands. The presence of *Salvinia natans*, white water-lily *(Nymphaea alba, N. candida)*, banana lily *(Nymphoides peltata)*, bloder-worts *(Utricularia minor, U. intermedia)* is characteristic sign of these wetlands. At least 70 peat deposits with total surface 3.000 ha are known in Armenia. Three peat deposits: Gilli, Saratovka and Shahnazar are of commercial importance with total volume of peat 50 million m³. Armenian peat is of good agrochemical quality.
In the 1980s total peat output was ca. 100.000 m³ annually. Main use of peat was in agriculture (fertiliser, litter for cattle) and balneology (mud cure). At present estimated peat excavation is about 50.000 m³ annually mainly for fuel. Peat producing wetlands are widely used for haying, grazing, especially during the dry season. Springs feeding wetlands are important for cattle watering. Wetlands are a source of pharmacological and edible plant species.
During the 1930-1950s all more or less large wetland areas were drained or the flow was regulated by dams and reservoirs. The estimated decrease of mire area is about 10.000 ha and the remaining mires are still threatened by overexploitation, pollution and other disturbances.
On July 6th, 1993, Armenia joined the Convention on Wetlands, assigning in the Ramsar List of Wetlands of International Importance Lake Sevan and Lake Arpi. The total area of peat producing wetlands under the Ramsar umbrella is about 1.700 ha. In spite of this mires are underrepresented in the protected area network of the country. Only 2 ha of unique mires surrounding small forest pond Parz-Litch are strictly protected in Dilijan National Park. No other mires/peatlands are under national protection. The remnants of the former famous Lake Gilli are situated in the economic zone of Sevan National Park and the surrounding land is under the crops. Recently the GEF agree to provide US$ 963.708 in addition to US$ 937.600 provided by Armenia for restoration of Lake Gilli system, including mire and peatland recovery.

Key words: Armenia, wetland types, wetland use, conservation.

Characterization of the country

Armenia is situated on the south-eastern part of Europe in the South Caucasus Region. The territory of the country covers the northern part of Armenian Plateau (400.000 km²), which is 0.5 km higher than the neighbouring Asia Minor and Iranian Plateau. Armenia is surrounded with Georgia from the North on 164 km, Azerbaijan from the East and South-West (Nakhichevan enclave) on 787 km, Iran from the South on 35 km and Turkey from the West on 268 km, with the total length of border 1.254 km. The total area of the country is 29.743 km². Being a landlocked country, Armenia is located at 145 km to the East from the Black Sea and 175 km to the West from the Caspian Sea (Fig.1). The geographical coordinates of Armenia are 38°50' - 41°18' N and 43°27' - 46°37' E.

Armenia is a mountainous country with a minimum altitude 375 m (River Debed in the North) and maximum 4.091 m (Mount Aragats) above sea level (a.s.l.). The average altitude across the country is 1.850 m a.s.l. Absolute altitude range of the territory of the country is shown in Tab. 1.

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Tab. 1: Absolute altitude range of the territory of Armenia (source: AGRICULTURAL MAP OF ARMENIAN SSR 1984).

Altitude a.s l., m	Area, km²	%
< 1.000	2.920	9.9
1.000-1.500	5.430	18.3
1.500-2.000	9.300	31.3
2.000-2.500	7.290	24.5
2.500-3.000	3.800	12.6
> 3.000	1.003	3.4
Total	29.743	100.0

The mountainous relief have caused unique variety of natural conditions and resources.

In spite of small size, the country includes 11 climate zones: from dry subtropical to severe Alpine.

Armenia has limited water resources. Of total received 18.4 km³ of water per year, 12.2 km³ is lost by evaporation. Rivers in Armenia belong to the basin of River Kura, which flows into the Caspian Sea. Of about 10.000 rivers and streams only 4 are over 100 km long (Arax, Debed, Hrazdan, Vorotan), 13 are over 50 km long and 300 are over 10 km long. There are over 100 lakes, ponds and reservoirs in Armenia. Of them Lake Sevan is the largest high-mountain fresh-water lake in Eurasia. Geographical coordinates of Lake Sevan are 40° 08' - 40° 49' N and 44° 58' - 45° 42' E. From 1933, outflow from the lake was artificially increased to provide water for irrigation and electricity. As a result the level of the lake dropped on 20 m (from 1.916 - 1.896 m a.s.l. in 2000), the surface decreased from 1.416 to 1.241 km² (12 %), the volume from 58.5 to 33.4 km³ (43 %). The second largest lake of Armenia, Lake Arpi is located in the north-western part of the country, at an altitude of 2.023 m a.s.l., close to the borders with Turkey and Georgia. While it remained undisturbed, the lake had a surface 4.5 km², volume 0.005 km³ and an average depth of 1.6 m. During 1946 - 1950 the dam was built, and the surface of the lake increased up to 20 km², the volume up to 0.090 km³.

Folded relief of Armenia has given rise to 5 principal natural landscapes: 1. Semi-desert with fragments of desert; 2. Steppe; 3.

Fig. 1: Map of Armenia.

Forest; 4. Sub-Alpine and Alpine; and 5. Azonal (mainly wetlands and rocks).

The land distribution of the territory of Armenia is given in Tab. 2.

High vulnerability of mountain ecosystems creates difficulties in the use of the land and requires constant realization of complex protective measures. At present the area of eroded lands or lands exposed to erosion is 12.250 km², exposed to water logging 4 km², salination 150 km², under flooding 430 km² (ARMENIA – COUNTRY STUDY ON CLIMATE CHANGE 1999).

Armenia is situated between two major floristic regions: Mediterranean and Boreal (Caucasian sub region). As a result of biogeographical position and variations in altitude, Armenia supports enormous diversity of plants and a wide range of animal species. The biodiversity of the country as well as wetland biodiversity is given in Tab. 3.

The population of Armenia is 2.991 thousands people (July 2004 est.), of them urban 67.5 %, rural 32.5 %. Average population density is 104 per km².

As part of the USSR, Armenia was distinguished with well-developed economy, high level of education and health care. Current situation, resulted from the effect of the disastrous earthquake in 7 December 1988 (more than 25 thousands deaths, 500 thousands homeless people), followed with the collapse of the Soviet Union, economic and energy crisis, is very different. The Gross Domestic Product (GDP) fell from 4.5 billion US $ in 1989 to 0.45 billion US $ in 1994. Now Armenian economy is in a process of recovery. In 1999 the GDP was $11.79 billion, GDP per capita $ 3.500 (ANNUAL STATISTICS REPORT 2004; KHUDAVERDYAN & SARGSYAN 1999).

Regional division and subdivision of Armenia varies in large scale depending from author and data considerate. According to geographic/geological/geobotanical conditions (TAKHTAJYAN 1954; CLIMATIC MAP OF ARMENIAN SSR 1975; AGRICULTURAL MAP OF ARMENIAN SSR 1984), five main regions can be recognised within Armenia for wetland purposes:

Northern Region (NR) in the East includes small valleys surrounded with ridges,

Tab. 2: The land distribution of the territory of Armenia (source: ARMENIA – COUNTRY STUDY ON CLIMATE CHANGE 1999).

Categories of land		Surface, km²	%
Agricultural		13.914	46.78
	Including: arable,	4.835	16.25
	perennial plantations	747	2.51
	fallow	9	0.03
	grasslands	6.935	23.32
	pastures	1.388	4.67
Forests		3.341	11.23
Wetlands		42	0.14
Open Water		1.640	5.51
Under buildings		500	1.68
Under roads		350	1.18
Other		9.958	33.48
Total		29.743	100.00

Tab. 3: The number of species from different taxonomic groups represented in Armenia and in Armenian wetlands (source BARSEGHYAN 1990, PIPOYAN & TIGRANYAN 1998, ADAMIAN & KLEM 1999, JENDEREDJIAN et al. 1999, BIODIVERSITY OF ARMENIA: FIRST NATIONAL REPORT 1999, BIODIVERSITY STRATEGY AND ACTION PLAN OF ARMENIA 1999).

Taxonomic group	Number of species	Number of wetland species
Plants:		
Algae	388	245
Fungi	4166	~ 200
Lichens	290	?
Moss	395	135
Vascular	3555	622
Animals:		
Invertebrates	~ 17.000	~ 1.000
Fish	38	38
Amphibians	8	8
Reptiles	53	4
Birds	357	135
Mammals	83	7

which are subject of extensive erosion. In the West huge highland areas are covered with lava of relatively recent origin. From the eastern lowland valleys (up to 500 m a.s.l.) to the western plateau (2.000 - 2.200 m a.s.l.) the climate changes from dry subtropical to severe, with long cold winter (with absolute minimum temperature for Armenia – 46° C) and short cool summer. The NR includes Akhuryan, Shirak, Ara-

Fig. 2: Mire Aparan.

Tab. 4: Average climatic characteristics in different regions (source CLIMATIC MAP OF ARMENIAN SSR 1975).

Region	Solar hours per year	°C in January	°C in July	°C in year	Precipitation, mm year^{-1}	Snow cover, days
NR lowlands	1.800	0	22	10	500	30
highlands	2.400	-13	13	1	600	150
SB lowlands	2.700	-6	15	5	350	100
highlands	2.000	-14	8	-2	700	200
AV	2.900	-4	27	12	220	50
SR lowlands	2.000	1	26	14	250	10
highlands	2.400	-12	11	0	750	130
Alpine zone	2.400	-15	6	-4	900	250

gats, Aparan (Figs. 2-4), Lori (Fig. 5) and Ijevan floristic districts. The total area of NR is 14.016 km^2, population 1.408.1 thousands, population density 100 per km^2.

Sevan Basin (SB) besides the basin itself includes opposite slopes of Geghama Ridges. Near the shoreline of Lake Sevan (1.900 - 2.100 m a.s.l.) the climate is moderate, with cold winter and continuous warm summer. Higher the climate is severe, with long cold winter and short cool summer. The SB includes Sevan and Geghama floristic districts. The total area of SB is 5.348 km^2, land area 4.107 km^2, population 277.6 thousands, population density 68 per km^2.

Ararat Valley (AV) in the lowest part (up to 1.000 m a.s.l.) of Ararat depression covered with alluvial and prolluvial sediments. The climate is dry, with cold winter and hot summer (with absolute maximum temperature for Armenia 42 °C). The AV includes Yerevan floristic district. The total area of AV is 3.565 km^2, population 1.879.8 thousands (including the population of the capital city, Yerevan), population density 527 per km^2.

Southern Region (SR) is the most folded region in Armenia. In the lowlands the climate is subtropical, higher (above 1.000 - 1.200 m a.s.l.) is moderate, with comparatively hot summer and soft winter. In the mountains Includes Meghri, Zangezur and Vaik floristic districts. The total area of SR is 6.814 km^2, population 230.2 thousands, population density 34 per km^2.

Alpine zone (altitudes higher than 2.200 - 2.500 m a.s.l) covers around 20 % of the total territory of Armenia. Here the climate is cold with long snowy winter and short cool summer. The constant population in Alpine zone is absent.

Some typical climatic characteristics for each region are given in Tab. 4.

Wetland characteristics, typologies, and terminology

The Armenian word '*Tchahitch*' refers to an area of land with a vegetation cover that has developed under water logging conditions and may or may not have a peat layer. If a thick peat layer is present, and the peat is currently being formed, the area is called Torfatchahitch, if the area is currently dry and peat is present but not being formed, the area is called Torfavayr.

Depending on the character of origin, relief, hydrology and plant formations BARSEGHYAN (1990) distinguishes seven types of wetlands in Armenia:

Peatland/mire, '*Torfatchahitch*', in Russian '*Torfyanik*'. 'Torfatchahitch' forms on the more or less flat bottom of the former lakes and former lake coves at the altitudes of 1.400-2.400 m a. s. l. and usually is roundish-lens shape. Peat layer is up to 6(7) m thick, usually not more than 1.5 m. The main peat forming plants are reed (*Phragmites*), sedge (*Carex*), bulrush (*Scirpus*), reed-mace (*Typha*) and moss (*Sphagnum*). Peat decomposition degree is 5-50 %.

Sloping fen, in Armenian '*Lanji Tchahitch*', in Russian '*Boloto sklonov*'. 'Lanji Tchahitch' forms on the slopes of eroded mountains at the altitudes of 1.600 - 2.400 m a.s.l. and feeds with mineralised or deluvial water. Peat layer is in average 1.5 m thick, usually with the streaks of clay or sand. The main peat forming plants are sedges (*Carex* spp.), tussock-grass (*Deschampsia caespitosa*), *Luzula pseudosudetica*. Peat decomposition degree is 30 – 40 %.

Wet or bogged meadow, in Armenian '*Tchahtchacats Marg*', in Russian '*Zabolochenniy lug*'. 'Tchahtchacats marg' forms at the altitudes of 2.000-2.600 m a.s.l. on depressions of the overgrazed mountain meadows. 'Tchahtchacats marg' feeds by precipitation, springs, infiltered river and snow water. Water mineralisation is 100-400 mg l^{-1} (LACHINOV 1969). The main peat forming plants are sedges (*Carex* spp.), spike-rush (*Eleocharis palustris*). Peat layer is very thin (up to 0.04-0.08 m) and often absent.

Pond or river pool covering with overgrown vegetation, in Armenian '*Busatsatskvǒgh Jravazan*', in Russian '*Zarastayushchiy vodoyǒm*'. 'Busatsatskvǒgh jravazan' occurs everywhere and sometimes proceed to mire. In the latest ones productive processes are higher than mineralisation, and the bottom sediments contain peat. Such peat containing 'Busatsatskvǒgh jravazan' are situated at the altitudes of 1.400-2.200 m a.s.l. Here occurs strong temperature and oxygen stratification. In summer the temperature of surface water reaches 23 – 27 °C, oxygen content 8.5 mg l^{-1} while near the bottom at the depth of 6 m only 12 °C and 0.14 mg l^{-1}, respectfully. The pH is 6.5 (MESHKOVA 1968). Peat containing ponds and river pools characterized with plant formations formed with bulrush (*Scirpus lacustris*), floating-heart (*Nymphoides peltata*), White Water-lily (*Nymphaea alba*).

Seasonal saline marsh, in Armenian '*Aghut*' when dry, '*Aghatchahitch*' or '*Shorr*' when covered with water, in Russian '*Solonchak*', '*Zasolenoe boloto*'. 'Aghatchahitch' with total surface 10.000 ha are located in the central part of AV and in the SB, where the heavily mineralised ground water table is close to the land surface. The mineralisation of ground water is 1.0-5.5 g l^{-1}, in particular cases 30-50 g l^{-1} (LACHINOV 1969). Main plant formations are formed with rush (*Juncus*), Pagoda-tree (*Sophora alopeculi*), *Halocnemum strobilaceumi*, *Halostachus caspica*, glass-wort (*Salicornia europaea*). Under Armenian climatic conditions 'Aghatchahitch' never has a peat layer.

Ephemeral marsh, in Armenian '*Zhamanakavor Tchahitch*', in Russian '*Efemernoe boloto*'. 'Zhamanakavor Tchahitch' usually is located in the Alpine zone on the relief formed by glacier, avalanche or floodwater. Water mineralisation is 13-67 mg l^{-1} (LACHINOV 1969). Main plant formations are formed with sedges (*Carex dacicae*,*C. canescens*), tussock-grass (*Deschampsia cespitosa*). Due to strong erosion processes peat accumulation in 'Zhamanakavor Tchahitch' has local and mosaic character.

Suspended marsh, in Armenian '*Kachvats Tchahitch*', in Russian '*Visjachee boloto*'. 'Kachvats Tchahitch' occupies small areas on the slopes around weak mountain springs. Water mineralisation is 30-200 mg l^{-1}. In spite of unfavourable topographic conditions, 'Kachvats Tchahitch' exist and develop due to presence of permanent water, although peat accumulation sometimes breaks off by alluvium. Main plant formations are formed with club-rush (*Blysmus compressus*), sedges (*Carex dacicae*), peat-mosses (*Sphagnum* spp.).

Of abovementioned wetland types 1. 'Torfatchahitch', 2. 'Lanji Tchahitch', 3. 'Tchahtchacats marg', 6. 'Zhamanakavor Tchahitch', and 7. 'Kachvats Tchahitch' can be considered as peat producing wetlands. Only a small part of 4. 'Busatsatskvǒgh jravazan' can be considered as peat producing wetland, and 5. 'Aghatchahitch' cannot be considered as peat producing wetland.

Vertical distribution of wetland vegetation

Depending on the specific flora and vegetation, as well as peat sedimentation BARSEGHYAN (1990) distinguishes three vertical districts of wetland plants in Armenia:

Freshwater and saline marshes of AV, NR and SR lowlands. The most characteristic signs of these marshes are hygrohalophyl structure of plant formations, absence of mosses and peat layer. Typical plant species are common reed (*Phragmites australis*), bulrush (*Scirpus tabernaemontani*), *Bolboschoenus maritimus*, reed-mace (*Typha lacsmannii*), sedge (*Carex diluta*), stonewort (*Chara contraria*), etc.

Freshwater mires, ponds and river pools situated in NR, SB and SR at the altitudes 1.400–2.400 m a.s.l. The most characteristic sign of these wetlands is presence of well-developed peat layer. Only in this district occurs *Salvinia natans*, white water-lily

Fig. 3: Mire Aparan.

Tab. 5: Estimated area (ha) of peat producing wetlands in the past (beginning of 20th century) and at present (end of 20th century) in different regions (source AGRICULTURAL MAP OF ARMENIAN SSR 1984; BARSEGHYAN 1990; ARMENIA- NATIONAL ENVIRONMENTAL ACTION PROGRAM 1999; JENDEREDJIAN et al. 2000)

Region	Peatland/ mire	Sloping fen	Bogged meadow	Peat forming pond	Ephemeral marsh	Suspended marsh	Total peat containing wetlands
NR in past	4.000	1.000(?)	4.000	2.000	100(?)	100(?)	11.200
at present	1.500	200(?)	3.000	600	80(?)	70(?)	5.950
SB in past	8.000	0	4.000	2.000	80(?)	100(?)	14.180
at present	1.500	0	2.000	200	30(?)	10(?)	3.740
AV in past	0	0	0	0	0	0	0
at present	0	0	0	0	0	0	0
SR in past	1.000	0	0	100	20(?)	0(?)	120
at present	0	0	0	0	10(?)	0(?)	10
total in past	13.000	1.000(?)	8000	4.100	200(?)	200(?)	26.500
at present	3.000	200(?)	5.000	800	120(?)	80(?)	9.200

(*Nymphaea alba*, *N. candida*), banana lily (*Nymphoides peltata*), bloder-worts (*Utricularia minor*, *U. intermedia*), pondweeds (*Potamogeton alpina*, *P. nodosus*), *Hippurus vulgaris*, *Elatine alsinastrum*. Here absolute dominant plant species are reed (*Phragmites australi*), reed-mace (*Typha latifolia*, *T. angustrifolia*), bulrush (*Scirpus lacustris*), *Puccinellia sevangensis*, *P. distans*, *Scolochloa festucacea*, sedges (*Carex vesicaria*, *C. gracilis*, *C. caucasica*), spike-rushes (*Eleocharis palustris*, *E. quinqueflora*).

Ephemeral and suspended marshes situated in the Alpine zone. Peat layer is absent or almost absent. Alpine wetlands characterised with abundance of moss species: *Aulacomnium palustre*, *Desmatodon latifolius*, *Philonotis caespitosa*, *P. fontana*, sickle-moss (*Drepanocladus uncinatus*), peat-moss (*Sphagnum girgensohni*). On the Alpine lakes situated above 3.000 m a.s.l. Thread-moss (*Bryum weigelii*) forms often monodominant carpet layer. Of flowering plants the most typical are sedges (*Carex dacica*, *C. canesces*), *Luzula pseudosudetica*, tussock-grass (*Deschampsia cespitosa*), *Alopecurus armenus*, *Callitriche hermaphroditica*, *Limosella aquatica*.

History, extent and distribution of peat producing wetlands

The studied history of wetland plants on the territory of Armenia is going back to Eocene (LEYE & LEYE 1960). The modern wetland flora had been formed under the strong influence of invasion of boreal species soon after the glacial epoch. At present the glacier migrants (*Menyanthes trifoliata*, *Scolochloa festucacea*, *Glyceria plicata*, *Veronica scutellata*, *Catabrosa aquatica*, etc.) retain better in the relict Alpine lakes, high mountain river valleys and canyons (BARSEGHYAN 1966). The most ancient peat had been formed at the very beginning of Holocene soon after retreat of glaciers (ZAKHARYAN 1955).

Armenia is one of the centres of origin of civilization. During the historical period the wetlands for a long time (till the 1930-es) remain undisturbed on the background of heavily exploited forests, steppes and meadows.

During the 1930s - 1950s all more or less large wetland areas of AV had been crossed with drainage canals or drainage pipes. The flow of many rivers is regulated by building a dams and reservoirs. The main reason of draining the wetlands in Armenia was combat against malaria, dysentery and cholera. The artificial water level drop of Lake Sevan caused serious influence on the water balance of wetlands and peatlands/mires particularly. Estimated area of peat producing wetlands decreased approximately on three times (see Tab. 5). Many Armenian ('Torfavan' – Peat Village, 'Metsamor' – Great marsh, 'Yeghegnadsor' – Reed Canyon, 'Urut' – Osier-bed) and Turkish ('Ghamishtala' – Reed Field, 'Hamzachiman' – Dense Marsh) geographical names remind that till recently the area was wetland.

Mire/peatland use

At least 70 peat deposits with total surface 3.000 ha are known in Armenia. Most of them are less than 0.5-1.0 ha and are of local importance. They had been used as fuel during the difficult war years. Three peat deposits: Gilli (SB, 1.500 ha), Saratovka (NR, 300 ha) and Shahnazar (NR, 400 ha) are of regional commercial importance with total volume of peat 50 million m^3 (ZAKHARYAN 1960).

Armenian peat is of good agrochemical quality. Depending of excavation, the pH varied from 5.0 to 7.0, contain of organic matter 55 – 82 %, ashes 18 - 45%, total nitrogen (N) 2.0-2.4 %, calcium (CaO) 1.3-3.4 %, phosphorus (P_2O_5) 0.12-30 %, potas-

sium (K_2O) 0.05-0.22 %, iron (Fe_2O_3) 0.5-4.2 % (VARDANYAN 1965).

In the 1980s total peat output in the country was close to 100 thousands m^3 annually. Main use of peat was in agriculture (fertiliser, litter for cattle) and balneology (mud cure). At present peat excavation is out of control. Most of small peat deposits had been completely expired. Estimated peat excavation from greatest peat deposits is about 50 thousands m^3 annually mainly for fuel. It is obvious that this is the less effective way of peat use. Anyway, current low prices for agricultural products often make peat use as fertilizer unprofitable.

Bogged meadows are widely used for haying, especially in the NR and SB. Although the quality of hay here is lower than on the surrounding mountain meadows, the productivity is incomparable higher.

The areas of ephemeral and suspended marshes, sloping fens are of great importance for grazing, especially during the dry season (second half of summer, beginning of autumn). The springs feeding suspended marshes and sloping fens are used for cattle watering.

Wetlands are a source of pharmacological plants, such as *Althaea officinalis*, *Bidens tripartida*, *Gnaphalium uliginosum*, *Glycyrrhiza glabra*, *Menyanthes trifoliate*, *Mentha longifolia*, *Nuphar luteum*, *Ononis arvensis*, *Polygonum hydropiper*, *Plantago major*, *Tussilago farfara*, *Valeriana* sp. Wetlands are also a source of edible plants used in Caucasus cousin, such as *Butomus*, *Nymphaea*, *Nasturtium*, *Rumex*, *Falcaria* and *Asparagus*.

Peat forming relict ponds of the SR has regional importance for fish breeding and fishery: carp (*Cyprinus carpio*), silver crucian (*Carassius aurita*). Rivers crossing bogged meadows and springs feeding suspended marshes and sloping fens often are breeding areas for commercial fish, especially for endemic Sevan Barbel (*Barbus goktschaikus*) and 'Koghak' (*Varicorhinus capoeta sevangi*) in the SB and Chub (*Leuciscus cephalus*) in the NR.

Threats

The total area of lost wetlands in Armenia extends 20.000 ha. Of them about 17.000 ha was peat producing wetlands. By regions peat producing wetlands loss is 47 % in NR, 74 % in SB, and 92 % in SR. As it has been mentioned earlier, peat producing wetlands were completely absent in AV (Tab. 5).

The motives for wetlands loss in different regions were different. In NR the main reason was wetland cultivation for haying meadows and peat excavation; in SB Lake Sevan's artificial water-level drop with the purposes to obtain water for irrigation and cheap electricity; in AV combat against wetland producing diseases and wetland change into agricultural land; in SR building a dams and filling reservoirs in the wetland areas.

At present the following can be considered as the major current threats to different types of wetlands (JENDEREDJIAN 1997; HAKOBYAN 1998):

- Peatland/mire, 'Torfatchahitch'- peat-excavation, building a dams and filling reservoirs.
- Sloping fen, 'Lanji Tchahitch'- haymaking, grazing.
- Wet or bogged meadow, 'Tchahtchacats marg' - haymaking, grazing.
- Pond or river pool covering with overgrown vegetation, 'Busatsatskvogh jravazan' - sewage water pollution, factor of disturbance (fishing, hunting, recreation).
- Seasonal saline marsh, 'Aghut', 'Aghatchahitch'- canalisation and drainage, grazing.
- Ephemeral marsh, 'Zhamanakavor Tchahitch' - haymaking, grazing.
- Suspended marsh, 'Kachvats Tchahitch' - haymaking, grazing, hunting.

Mire conservation and restoration

In 1978 Sevan National Park was established "to protect Lake Sevan's shoreline, water and aquatic life" (Decision of the Government of the Armenian SSR No 125). The Park area is 150.100 ha, of which 125.300 ha is open water, 24.800 ha is land.

Fig. 4: Mire Aparan.

Sevan National Park has three types of zones: fully protected, recreational and economic. No any types of peat producing wetlands are included in the fully protected zone, and only a small part of the former Gilli lake system is in the economic zone. Since 1959 the area is drained and at present is mainly under the crops. Lake Sevan Action Program (1999) financed by World Bank envisage US $ 400.000 for pilot project "Restoration of Gilli Lake" in its final IV Phase. In June 2000 three months long GEF project "Restoration of Lake Gilli" is launched implemented by UNDP. On the basis of the output of this project the GEF agrees to provide US$ 963.708.- in addition to US$ 937.600.- provided by Armenia for restoration of Lake Gilli system, including mire and peatland recovery.

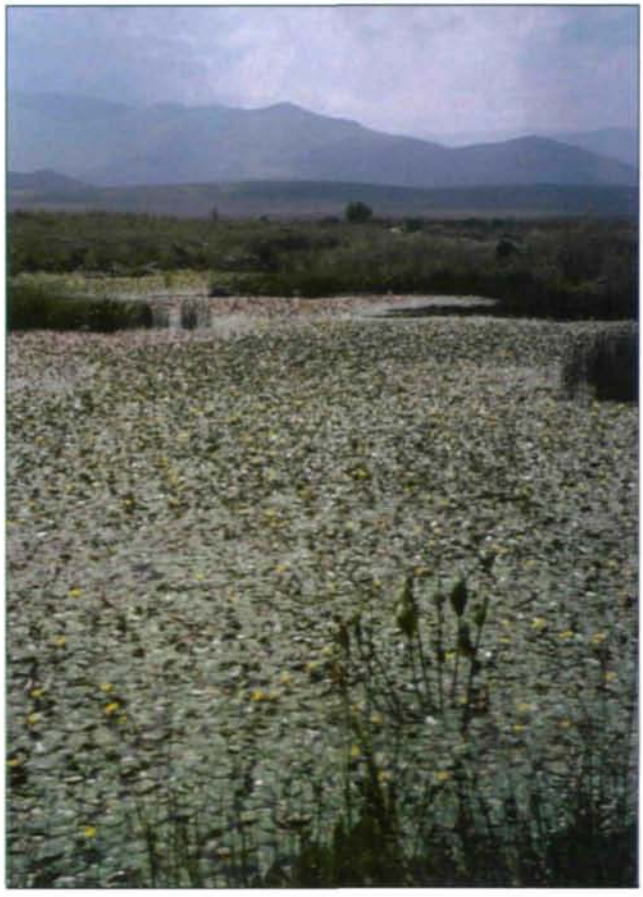

Fig. 5: Lori Relict Pond with significant peat layer around in Lori marz at 1.505 m a.s.l.

From other especially protected natural areas of Armenia DilijanNational Park should be mentioned with approximately 2 ha of unique mires surrounding small forest pond Parz-Litch. No other mires/peatlands are under national protection.

In July 6, 1993, Armenia joined the Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar, Iran, 1971), assigning in the Ramsar Convention's List of Wetlands of International Importance 2 sites, the Lake Sevan within its basin (489.100 ha) and Lake Arpi and surrounding bogs (3.149 ha). Total area of peat producing wetlands under the Ramsar umbrella is about 1.700 ha (1.500 ha in Lake Sevan Ramsar site and 200 ha in Lake Arpi Ramsar site).

It is obvious that peat producing wetlands are underrepresented in the network of especially protected natural areas of Armenia. BARSEGHYAN (1990) brings the following arguments for mire/peatland conservation in Armenia:

- Mountain mires have a unique property to keep precipitation during the dry season.
- Wetland vegetation supported to a number of waterfowl, game and fish.
- Armenian peatlands reflect the history of vegetation development in the region.
- Wetland fauna is rich in pharmacological, edible, tannin and ether-bearing species.
- Wetland vegetation plays important role in biological purification of wastewater.
- Mires are of great importance for agriculture and balneology.
- Many wetland species of plants (and animals) are endangered.

The following peat producing wetlands is important to include in the network of especially protected natural areas (BARSEGHYAN 1990, JENDEREDJIAN et al. 2001):

Relict lakes and ponds of Lori (Fig. 5), NR, total 400 ha, 1.500 m a.s.l. The area is refugium for boreal wetland flora of Minor

Caucasus with such kind of post glacier relicts as *Salvinia natans*, *Nymphaea alba*, *N. candida*, *Nymphoides peltata*, *Carex bohemica*, *C. vaginata*, *C. appropinquata*, *C. elata*, *Scolochloa festucacea*, *Utricularia intermedia*, *U. minor*, *Elatine alsinastrum*, *Veronica scutellata*, *Peplis alternifolia*, *Sparganium minimum*, *Scrpus supinus*.

Pond Ardenis (Fig. 6) and ephemeral marshes 5 km to the north-east from Lake Arpi, NR, total 20 ha, 2.040-2.090 m a.s.l. Unique abundance of wetland and aquatic vegetation formations in limited area. This is the only known breeding area for Horned Grebe (*Podiceps auritus*) in Armenia. The area supports to number of duck and wader species.

Remnants of mires and peatlands of Gilli, Tsovinar and Zolakar along the southern shoreline of Lake Sevan, SB, total 1.500 ha, 1.900 - 1.920 m a.s.l. The area is important for conservation of *Puccinellia sevangensis*, *Peucedanum zedelmeyeranum*, *Eleocharis transcaucasica*, *Senecio fluviatilis*, *Swertia aucheri*, *Ligularia sibirica*, *Carex secalina*, *Ranunculus strigilosus*. In the past the Gilli lakes system was the most important inland waterfowl area in Transcaucasus Region with total number of 60 breeding species (DAL 1954). At present the area needs serious restoration.

Bogged meadows of River Argichi, SB, total 100 ha, 2.100 – 2.150 m a.s.l. The bogged meadows as well as the River Argichi in its middle flow are important passage for ducks and waders during the spring and autumn migrations. At present the area is under the heavily pressure of unlimited haying and grazing.

Suspended marshes on the mount Tchgnavor, SR, 2.600 – 2.700 m a.s.l., total 10 ha. The area is important for such rare plant species as *Carex vaginata*, *C. siegertiana*, *Juncus alpigenus*, *J. filiformis*, *Parnassia pallustris*, *Orchis iberica*, *Sphagnum girgensohnii*.

Suspended sphagnum bog on the eastern slopes of Zangezur Ridges, SR, total 0.5 ha, 2.400 m a.s.l. Unique moss covered bog including *Sphagnum squarrosum*, *S. fuscum*, *Calliergon cordifolium*, *Aulacomnium palustre*, *Brachythecium rivulare*.

Fig. 6: Ardenis Mire in Northern Armenia (Shirak province/marz) close to the border with Georgia and Turkey at 2.050 m a.s.l.

Zusammenfassung

Moore in Armenien – Armenien ist ein Gebirgsland, das sich bei einer Fläche von 29.743 km² über 3.716 Höhenmeter erstreckt (von 375 m bis 4.091 m am Berg Aragats). In Abhängigkeit von Entstehung, Relief, Hydrologie und Vegetation können in Armenien sieben Feuchtgebietstypen unterschieden werden, von denen drei Typen, Hangmoore, vermoorte Wiesen und periodische Marschen in Höhen zwischen 1.400 m und 2.400 m als torfproduzierend betrachtet werden können. Das Auftreten von *Salvinia natans*, *Nymphaea alba*, *N. candid)*, *Nymphoides peltata*, *Utricularia minor* und *U. intermedia* ist ein Charakteristikum dieser Feuchtgebiete. Insgesamt sind 70 Torflagerstätten mit einer Gesamtfläche von 3.000 ha in Armenien bekannt, von denen drei, Gilli, Saratovka und Shahnazar mit einem Torfvolumen von insgesamt 50 Millionen m³ auch von wirschaftlicher Bedeutung sind. Der armenische Torf ist für die Humuswirtschaft gut geeignet.

In den 1980er Jahren betrug der jährliche Torfabbau etwa 100.000 m³ und wurde hauptsächlich als Dünger, als Stalleinstreu oder für medizinische Zwecke (Torfkuren) verwendet. Heute werden jährlich etwa 50.000 m³ Torf abgebaut und hauptsächlich als Brennmaterial verwendet. Traditioneller Weise werden die Moore- insbesondere während der Trockenperioden - als Weideland oder Mähwiesen genutzt, ihre

Quellen sind wichtige Wasserresourcen für das Weidevieh und sie beheimaten wichtige essbare und pharmakologisch nutzbare Pflanzenarten.

Zwischen 1930 und 1950 wurden alle größeren Moorgebiete entwässert oder ihr Abflussverhalten durch Dämme und Wasserspeicher reguliert, die geschätzten Verluste an Moorflächen während dieser Periode betragen 10.000 ha. Die verbleibenden Moore sind nach wie vor durch Übernutzung, Schadstoffeintrag und andere Störungen stark gefährdet.

Am 6. Juli 1993 trat Armenien der Ramsar Konvention zum Schutz von Feuchtgebieten bei und nominierte die Seengebiete Sevan und Arpi als Feuchtgebiete von internationaler Bedeutung. Damit stehen auch etwa 1.700 ha Moorflächen unter dem Schutz der Ramsar Konvention. Trotzdem sind Moore im bei den Naturschutzgebieten des Landes unterrepräsentiert; lediglich 2 ha Moore um den Waldsee Parz-Litch im Dilijan National Park stehen unter strengem Schutz.

Die Reste des früher berühmten Gilli Sees befinden sich in der Wirtschaftszone des Sevan Nationalparks und seine Umgebung ist heute Ackerland. Erst kürzlich genehmigte die GEF einen Betrag von US$ 963.708.- zusätzlich zu US$ 937.600.-, die von Armenien aufgebracht werden müssen, für die Renaturierung des Gilli Sees inklusive der Moore in seinem Umfeld.

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