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CONSERVATION AND FURTHER RESEARCH OF DISTRIBUTION OF THE CRITICALLY ENDANGERED DAREVSKY'S VIPER (VIPERA DAREVSKII) IN ARMENIA

FINAL REPORT

Darevsky's viper
Vipera darevskii Vedmederja, Orlov & Tuniyev, 1986

Study area: Javakheti Ridge, Mt. Legli, Ashotsk region, Shirak Province, Armenia

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1. SUMMARY

This species has very limited distribution and is listed in the IUCN Red List of Threatened Species as critically endangered (category CR C2b), and is under full disappearance. The range of the Darevsky's viper (*Vipera darevskii*) spreads over the southeastern part of the Javakheti Ridge in the Shirak Province, north-western Armenia, up to the border with Georgia and in the northeast of Turkey (Geniez, 2005). .

This project was consiststed of 2 stages: (1) investigations to reveal and determine the status of new ranges and habitats, including detailed GIS mapping and description of range patches; (2) specific conservation activities focused in previously known and newly discovered ranges and habitats, including film-making and educational campaigns. We have captured 28 individuals of *V. darevskii* and marked them by identification system (AVID FriendChip™, USA), for radio-tracking to study their movements, distribution and habitat use.

The key determinant of viper existence is availability of flat stone plates which create optimal microclimate for vipers living in harsh highland conditions. Land use for agriculture (hay grounds, crop lands and animal husbandry) and high selectivity of the species for habitats (subalpine meadow on elevations 2300-3000 m) are the principal threats to survival of the Darevsky's viper. We have obtained the first-hand information essential for assessment and development of conservation measures aimed at mitigating the conflicts with local land-users. The awareness-raising campaigns were carried out with local people and conservation organizations and the local communities were involved in conservation efforts. The documentary, brochures and booklets were produced. New watering points for livestock were established and fenced off the viper habitats so that to prevent livestock damage to viper haunts. The key habitats were mapped, studied and proposed for inclusion to the Arpi Lich National Park which is to be established in the Shirak Province due to financial support provided by KfW Development bank of behalf of German Ministry of Cooperation and Development (BMZ).

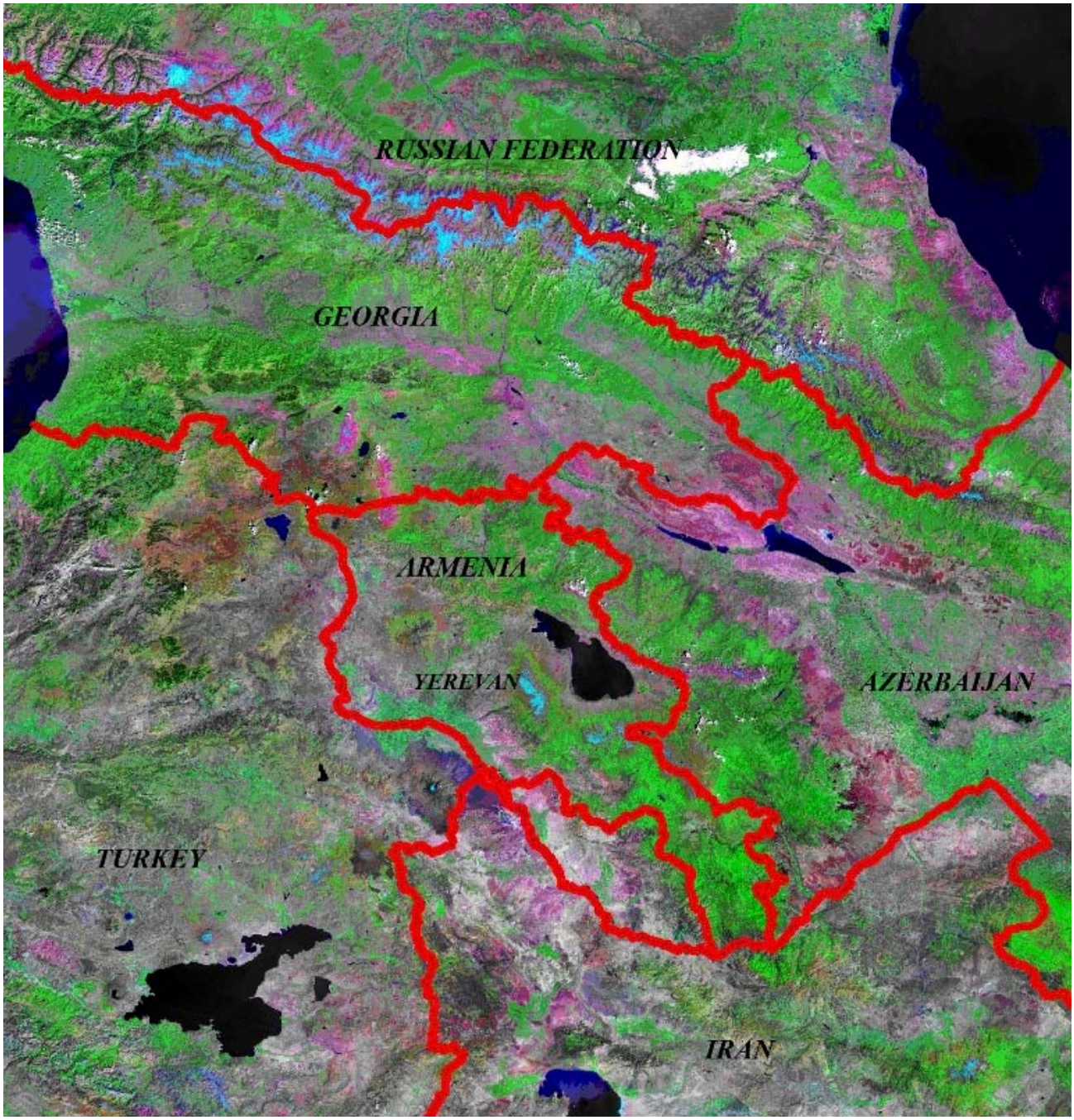
2. INTRODUCTION

The Caucasus is globally recognized as a Biodiversity Hotspot and a vulnerable Ecoregion, located on the crossroads of Europe and Asia. Republic of Armenia is located in north-eastern part of Armenian Highland above the adjoining Iranian and Asia Minor highlands and occupies the area 29743 km^2. Armenia shares its borders with Georgia in the north, Azerbaijan in the north-east, east, south-east and south-west, Iran in the south and Turkey in the west. Extraordinary faunistic diversity of the Caucasus can be well illustrated on an example of Armenia which, despite its small area (29743 km^2), accommodates 23 out of 35 species of snakes recorded in the Caucasus which belong to 4 families and 13 genera. Of them, 3 species are listed in Red Data Book of the USSR (*Vipera raddei, Elaphe hohenackeri, Rhynchocalamus melanocephalus),* 4 – in Red Data Book of Armenia (*Vipera raddei, Elaphe hohenackeri, Rhynchocalamus melanocephalus, Telescopus fallax),* and 1 (Darevsky's viper *Vipera darevskii*) in the IUCN Red List of Threatened Species. The last known review of reptiles of Armenia was published over 45 years ago (Darevsky, 1957), and the last review of the snakes of Armenia was published in 1996 (Aghasyan, 1996), so there is a desperate need to update the existing information about the status, ecology, distribution and conservation of these animals.

This project pursues the principal objective to assess in details the current status of the critically endangered Darevsky's viper (*Vipera darevskii*), develop the effective, specific and cost-efficient conservation measures, and propose them to the government of Armenia, stakeholders and donors. Particularly, it fits ideally with the plans of the government of Armenia and the German foundation KfW to establish in the transboundary (Armenia/Georgia) Arpi Lich National Park which would also include the key habitats of this snake. The preliminary measures for this program began in 2005.

Economic development, land use for urban expansion (construction, privatization) and agriculture (pastures, hay grounds, animal husbandry), on the one hand, and optimal management and preservation of biological resources, on the other hand, require comprehensive investigations of all biotic components, including reptiles. As economic development makes an increasingly heavy impact on the environment, studies of reptile diversity in Armenia become important as never before as related to disappearing habitats and range shrinkage. A substantial portion of species with restricted ranges and narrow adaptability thresholds are confined to certain habitats and are thus threatened with extinction. One of such species is the Darevsky's viper (*Vipera darevskii*) which is listed in 2008 IUCN Red List of Threatened Species (category CR C2b) as a species with restricted range, found in sub alpine zone of the south-eastern part of Javakheti Ridge in Armenia

(Mt. Achkasar, Ashotsk region of Shirak Province) on elevations 2300-3000 m (Vedmederja et al.,1986).



3. PROJECT MEMBERS

Team Leader: Levon Aghasyan, Armenian, age 24

Email. agaslev@yahoo.com

Team role: Coordination of all activities within the project. Participation in field studies, participation in development of the species action plan.

Educational level: B.S.c Degree of Biology - 2000-2004, Faculty of Biology, Yerevan State University; M.S.c Degree of Biology- 2004-2006, Faculty of Biology, Yerevan State University, Armenia;

Professional experience: 2006 to present scientific researcher, Scientific Center of Zoology and Hydroecology of the National Academy of Sciences, Yerevan, Armenia. Experience in implementation of conservation project, in developing species conservation action plan. Involvement in WWF and CEPF projects in Armenia as an expert herpetologist.

Name: Dr. Natalia Ananjeva, Russia, age 60

Email: ananjeva@yahoo.com

Team role: Overall project consultant

Education, Experience: Vice-Director, Zoological Institute, Russian Academy of Sciences. Vice-Chair of North Eurasia Specialist Group SSC/IUCN. President of European Herpetological Society "Societas Europaea Herpetologica". Head of Department of Herpetology and Ornithology Curator of Herpetology Associate-Editor of Russian Journal of Herpetology Zoological Institute, Russian Academy of Sciences.

Name: Alexander Malkhasyan, Armenian, age 36

Team role: Participation in field studies, and data analysis, photo.

Education, Experience: 1992-1996 Faculty of Biology, Yerevan State University, 1996-present Department of Science, Reserve-park complex, Ministry of Nature Protection; 2002-present expert, WWF Caucasus Programme Office, Armenia. Participation in the international project, skils in developing conservation action plan.

Name: Dr. Nikolai Orlov, Russia, age 54

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Team role: Project consultant, participation in field studies, leader of the group for development of the species conservation action plan.

Education, Experience: 1984-present researcher, Department of Herpetology, Zoological Institute of the Russian Academy of Sciences, Russia.

Name: Dr. Aram Aghasyan, Armenia, age 51

Email: agasaram@yahoo.com

Team role: Participation in public awareness activities and data analysis, consulting on Nature Protection Programs in Armenia and particularly in investigated Shirak Province. Production of packet of recommendations to the Ministry of Nature Protection and other parties responsible for establishment of Arpi Lich National Park

Education, Experience: 2002-present Head of Protected Area Management Department, Agency for Biological Resources Management, Ministry of Nature Protection, Armenia. 2000–2002 Senior specialist, Division of Specially Protected Natural Areas, Ministry of Nature Protection, Armenia. 1986 to present Junior Scientific Researcher of the Laboratory of Vertebrates, Scientific Center of Zoology and Hydroecology, National Academy of Sciences, Armenia. 1998–2000 Deputy head, Department of Specially Protected Natural Areas, Ministry of nature Protection, Armenia. 1996- 1998 Director, Scientific center of Applied Zoology and Botany, Department of Specially Protected Natural Areas, Ministry of nature Protection, Armenia.

Name: Gor Qaloyan, Armenia, age 25

Team role: Participating in the field studies, participation in development of the species conservation action plan.

*Education, Experience: Armenian State Agrarian University Specialization (veterinary medicine) .*Yerevan Armenia.

Name: Hovhannes Hakobyan, Armenian, age 43.

Email: hovontv@rambler.ru, www.jacobyan.com

Team role: Production of film, Film maker.

Education, Experience: "Armenian Viper" documentary film (2000 to present) Film Director and Cameraman. "American Military as perceived by Armenian Journalists" (2006) Film Director and Cameraman. "Unknown Deserted Pathways" film series (2003-2005/ being shot in the cities all over the world, where Armenian Diaspora exists) Director of photography. Russian NTV Channel (2001- to present/ Yerevan, Armenia) Correspondent in Armenia. Russian NTV Channel (1995-2001/Yerevan, Armenia) Cameraman. AR TV (1994-1995/ Yerevan, Armenia) TV program Director.

2002 Bars Media documentary film studio, Armenia. 1990 "ZDF" "RTL" (Germany), "NHK" (Japan), "BBC" (Moscow office), "APTN" (Moscow office).
Director and Photography Director for 15 documentary films. Cameraman form more than 1000 TV news reports. Correspondent for about 80 TV news reports. Director and Photograophy Director for over 50 advertisement and music videos. Participation in a Documentary Film Festival in France, 1994 (prize of festival)

Name: Alexan Gabrielyan, Armenian, age 58
Team role: Organization of the seminars in Achotsk region, distribution of booklets and other communication materials among local communities.
Education, Experience: Veterinary in Chirak provance, Bavra Village. Work in the Ministry of Agriculture.

Name: Armen Gevorkyan, Armenian, age 34
Team role: Organization of the seminars in Achotsk region, distribution of booklets and other communication materials among local communities.
Education, Experience: Geography, Specialist in mapping in the Ministry of Nature Protection.

4. BACKGROUND, PLANNING AND AIMS

The Darevsky's viper has very limited range confined to the south-western Javakheti Ridge in Armenia. It was first discovered by Darevsky in 1956 during his field-works. It has managed to change three names since that time. First it was called Vipera kaznakowi dinniki, later, in 1984 – Vipera kaznakowi darevskii. Its final name - Darevsky’s Viper - the snake has got only in 1986, scientific name- Vipera darevskii- in the honour of its inventor. So, the principal objective of the previous project *“Development of conservation measures for the Darevsky's viper in the Caucasus” 2005-2006* was to clarify its range, study the issues of snake morphology and reproduction, conduct population census, investigate its distribution across the landscapes and habitats, daily and seasonal activity, carry out the GIS mapping of the key areas and assess the principal threats. Although during the implementation of the project it was found out that the rare species of snake - Darevsky’s

viper – distribution area is wider, than it was supposed before, and is represented by patches of screes with big stone slabs scattered on the slopes and the fragmented habitats are wholly located in the south-western slope of Javakheti Ridge among pasture hits. So, it has become essential to continue the work to further evaluate the status of the range areas (snake abundance, vulnerability and threats), search for new areas, delineate the boundaries and estimate the size of range patches, description and mapping of the habitats of this species in more details.

The aims of current project was following

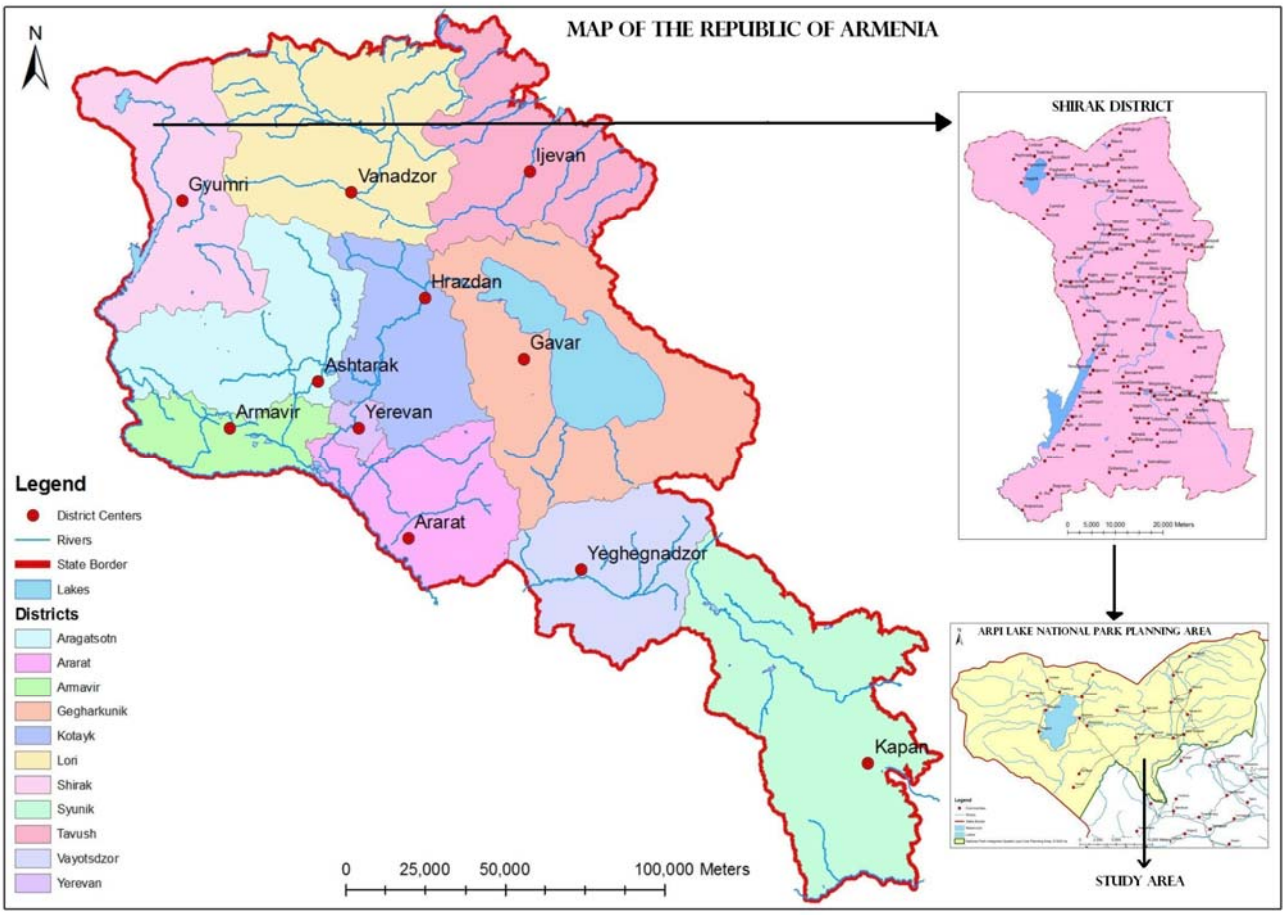
The project goal is to study conservation issues and initiate conservation activities targeted at preservation of the Darevsky's viper which include:

- Continuation of field research on identification of scattered habitat patches inside the viper range, delineation and description of boundaries, size definition, GIS mapping of habitats
- Boundary demarcation and fencing of concrete habitat patches (setting up the wood and metallic posts, fencing off by metallic wire, roadblocks and signs)
- Construction and recovery of pumped watering sites for livestock to minimize the conflicts with local land users
- Research of habitat use, population size, human activities and pressures on viper habitats
- Awareness-raising in conservation (documentary shooting, production of brochures, booklets and posters, holding workshops and lectures in local communities)
- Selection of core habitats for setting them aside as protected areas and inclusion to pending Arpi Lich National Park
- Preparation of documents on Darevsky's viper conservation to be submitted to WWF Armenia, a responsible entity for establishment of Arpi Lich, for inclusion to the area's protected areas.
- Preparation and submission to the Ministry of Nature Protection of materials to be included in the new edition of Armenia's Red Data Book of Animals which will be worked out in 2007-2009.

5. PROJECT IMPORTANCE

Theoretical importance of the project lies in broader implications for morphological and ecological research, as well as conservation of other snakes and reptiles: daily and seasonal activity patterns, breeding, diet, range structure, population size and status, effect of natural and man-caused factors, habitats use and other issues.

Practical importance is confined to the project results which were presented at many workshops organized by KfW and WWF and underlain a number of conservation decision, particularly on inclusion of viper habitats to Arpi Lich National Park. As agreed with WWF, the project's package of documents will be submitted for inclusion to the park's management plan.



6. METHODS: FIELDWORK AND FOLLOW-UP

Original research activities were carried out by us from May 2007 to May 2008 in Shirak Province. Field surveys were undertaken from May to October 2007 and from March to May 2008. The study area encompassed all south-western part of the Javakheti Ridge, including communal lands (Ashotsk, Mets Sepasar, Kazanchi, Sizavet and Saragyugh villages) and reserve lands outside of communal lands. Elevations ranged from 2000 to 3600 m above sea level, the most intensively visited of them varied from 2200 to 2700 m. The off-road vehicles of NIVA and UAZ models were used. Different habitats changing from mid-hill mountain grassland to highland alpine meadow were surveyed, but most attention was paid to meadows and grasslands fringing subalpine zone, including the man-dominated agroecosystems. Stationary research was conducted in 7 separate sites. Survey directions were chosen on a basis of viper records and location of non-surveyed areas. We recorded all survey sites and routes (morning, day and evening), weather and air temperatures in them. Weather conditions in the study area are very variable even within a day, reaching 15-20°C in a summer day and accompanied by wind blows, dounpours and thunderbolts (Aghasyan A. L. 1996; Aghasyan A, Aghasyan L. 2004).

Surveys tasks were shared equally between all trip participants so that to survey different sites, elevations and habitats at the minimum of time, under mutual communication through walkie-talkies. Usually we surveyed the areas which looked suitable for vipers in compliance with their requirements to elevations and habitat characteristics.

The captured snakes were marked by cutting abdominal scutes and making headtop marks by black polish, as well as by AVID/SUDS electronic radio chips. Each snake was individualized, weighed, sexed, recorded for physiological condition, body temperature and behavior (basking, hunting, mating etc.) and then released.

All sites of viper captures were measured by GARMIN-60Cx and Magellan Medirian Platinum GPS devices and plotted onto the handy maps. We also recorded slope exposure, habitat characteristics, weather, and air temperature by ACU-RITE thermometer (precision of 0.1^{o}C), (EXTECH IR201) InfraRed laser Thermometer -50 to 518°F, -50 to

270 °C and (Raytek MiniTemp) thermometer and air humidity. We used the walkie-talkies of BT Freeway FM and Uniden models.

We also studied the effects of habitats on vipers, referring to the Atlas of Climate of Armenian SSR (Bagdasaryan, 1975) for plotting of climate diagrams. In total we captured and marked 124 individuals of *V. darevskii* of which 28 large individuals were additionally tagged by electronic radio chips (AVID FriendChip™) USA. Identification of individuals was done by AVID Mini Tracker Reader. We also gathered plants and prepared herbaria for habitat descriptions.

Viper census was carried out as described elsewhere (Kashkarov, 1927; Andrushko, 1936; Korotkov, 1977) with some modifications dictated by rough terrain.

Thermobiological studies (thermal regulation, behavioral responses, thermoreception, heat redistribution in body etc.) were conducted as described by V.A. Cherlin and A.Yu. Tsellarius (1981).

To study some features of breeding vipers were kept in terrariums of size 50x60x45 cm, with waterbodies and shelters **(Fig 1).** Three lamps (daylight, nighttime and additional heating) connected to thermal regulator TL-2 “Akvaret” and automatically monitored by 2-RVM were used in terrariums to create near-natural conditions.

Diet was used non-invasively by palpation and disgorge stimulation (Verzhutsky, Zhuravlev, 1977), as well as in captivity in terrariums. All recorded events and vipers were shot by camera NIKON F100 and NIKON Coolpix 8700.

Daily activity of snakes and microclimatic conditions were studied with measurements made by thermo- and hygrographs of M-16 AN model. Fluctuations of air and soil temperatures were measured by maximum and minimum thermometers.

Computer database was created and regularly updated from field diaries.

Clarification, mapping and demarcation of habitat boundaries was done with the use of Leika TC-605 and TC-305 tachometers, GPS units (GARMIN-60Cx and Magellan Meridian Platinum) and rangefinder. The GIS and Autocad software products were used in mapping and boundary delineation, with additional inputs from hard copies of topographic, land use, landscape and cadastre maps. Metallic posts were set up for surveillance and demarcation. Fencing was done by metallic wire of diameter 2-3 mm stretched between the metallic posts.

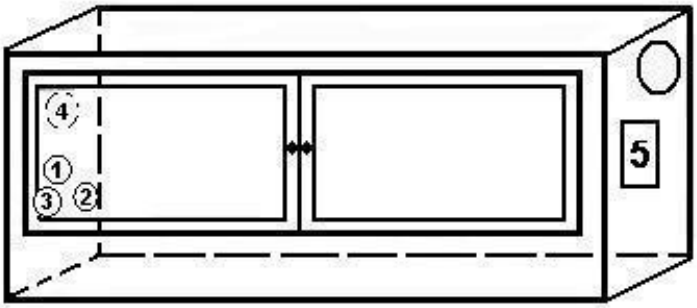
Watering sites for livestock (pits of 5x3 m and levee of 10.5x3x4 m) were dug by Belarus tractor and workers. Only local stones and other materials were used in this process so that to avoid habitat destruction.

Roadblocks made from pipes and signs produced in a local advertising agency were mounted near the entrances to core habitats and along the fenced boundaries.

Documentary shooting was done by professional cameramen and directors (NTV company) in all seasons and also in terrariums by means of professional SONI equipment and accessories. The film included the interviews with professional zoologists, local people and representatives of WWF Germany and WWF Armenia. Brochures, booklets and posters were printed in Asogik Printing House. Lectures and workshops among the stakeholders included PowerPoint presentations and dissemination of published materials.

Fig 1

Standard scheme of the terrarium for the snake keeping



1- Day illumination lamp

2- Day heating lamp

3- Night heating Lamp

4- Ventilating window

5- Timer

7. RESULTS

7.1 DESCRIPTION

Morphologically, the Darevsky's viper is very similar to the mountain grassland viper (*Vipera eriwanensis*) which is widely distributed in Armenia. The Darevsky's viper is a small snake. Total body length, including tail, is 460-480 mm. The head is slightly flattened on the top and is covered by big scutes and small scales. The frontal part of the head is slightly rounded. The head is narrow and less distinct from the neck. The tail is short and its tip is sharp.

Maximum body length is longer in females than in males, but males have longer tails.

The eye is similar to the cat's eye and has vertical pupil. Body coloration is brown, grayish or yellow-gray on the back, with zigzag-shaped band of dark brown or black color, sometimes broken into strongly elongated transverse spots. The belly is gray or blackish with numerous black speckles. The head top is clearly marked with X-like pattern.

7.2 DISTRIBUTION

The cadastre with delineated boundaries of the viper range was developed which covered the south-western slopes of the Javakheti Ridge and other areas to be incorporated to Arpi Lich National Park.

The species range is located on the south-western Javakheti Ridge within Armenia (Mt. Achkasar, Ashotsk district, Shirak Province) at 2300-3000 m above sea level. The northern boundary reaches the state border with Georgia and is stretched along the south-western Javakheti Ridge. The southern boundary goes through the north-eastern part of Lake Childir and Erzerum (Ardagan) in Turkey. New sites of occurrence were found from the vicinities of Ashotsk village to the Saragyugh village on the border with Georgia. They form a line of approximate length of 15 km in the south-western Javakheti Ridge. Suitable screes are scattered and form a much wider distribution area than it was previously supposed. The entire range is fragmented, consisting of patches of suitable habitats. Some suitable patches which are located far away from settlements are least affected by human pressures. The zone of sympatric co-existence with the Armenian mountain grassland viper *V. eriwanensis* is not found.

7.3 HABITATS

The key habitats of the Darevsky's viper are screes, mountain moraines and rocky outcrops with flat stone slabs at 2300-2500 m within the subalpine meadows. Vipers live beneath the slabs all year-round, including wintering. Thickness of slabs is 0.5-2 m what allows snakes to freely move between them and stay active for a long time without coming to the surface. In the summer vipers live along the edges of screes where vegetation gives space to orthopteran insects and lizards fed upon by vipers.

Almost all viper habitats are exposed to the south-east. Similar habitats with screes and plenty of food are available also in other parts of the Javakheti Ridge, but vipers are absent because of lacking stone slabs. So, availability of slabs has been a primary determinant of the Darevsky's viper existence.

Such a structure of screes allow vipers to maintain high body temperature beneath the slabs in local harsh climatic conditions.

The range extends along the boundary of highland subalpine and mid-hill meadow grassland zones. Subalpine vegetation is represented by cereal and cereal-forbs meadows dominated by *Bromopsis variegata, Hordeum violaceum, Anemonastrum fasciculatum, Betonica macrantha виды родов Veronica, Gentiana, Cephalaria, Inula, Myosotis*. Vegetation of mid-hill meadows comprises *Festuca versicolor, F. ovina, F. valesiaca, Phleum pratense, Hordeum violaceum, Carex humilis, Trifolium ambiguum*.

The reptiles sharing with vipers their habitats are the Valentine's lizard *Darevskia valentini*, Armenian lizard *Darevskia armeniaca* and green toad *Bufo viridis*. The lizards *Lacerta agilis* and *Anguis fragilis* occur in the lower meadow grasslands. The Asia Minor frog Rana macrocnemis is common near permanent streams. Rodents , such as the common vole *Microtus arvalis* and snow vole *Microtus nivalis*, are widespread.

7.4 ACTIVITY AND PECULIARITIES OF THERMOREGULATION

The Darevsky's viper is the only snake in Armenia which is adapted well to living in cold climate and on high elevations. Therefore, it has gained certain features which optimize its thermoregulation through changes in feeding, activity patterns, reproduction and other ecological issues.

Weather conditions in viper habitats are very variable and air temperature can vary by 12-13°C during a day. In conditions of heavy precipitation and strong winds, vertically located stone slabs insulate the spaces of stable and relatively high temperatures.

Orientation and structure of screes and also peculiar behaviors of vipers allow them to make free movement between the flat stones and maintain quite high body temperature for a long time (25-27oC) during their activity periods in unfavorable weather condition.

Temperature under the slabs stays high even in evening (18-20oC). Vipers leave their wintering dens and stay active at air temperatures 10-12oC. For example, in May when air temperature varied from 4 to 8oC in morning hours, rectal temperature of the snake was 25oC. To increase body temperature and maximize heat accumulation, vipers correct their position in relation to solar rays. They also flatten their bodies, thus increasing body surface. Dark body color also contributes to increased heat accumulation.

Nocturnal activity is not recorded even in August due to low air temperature.

Darevsky's vipers are active from early May to mid-September. The timing of snake exit from the wintering places and leave for hibernation, duration of activity period and breeding season in different elevations on mountain are different and vary from site to site and depend on snowmelt. Depending on microbiotopic peculiarities, when in the one site vipers already starts feeding and reproduction process in another site which is far no more than 300-500m the vipers still in the hibernation places. This type of differences of activity and reproduction increasing adaptability and live hood of this species.

7.5 MOVEMENTS

Vipers are mostly distributed over the grassy habitats covered by flat stone slabs and shrubs which give them the chance to feed (insects and lizards) not far from the shelters. Snakes live here all year round and use the spaces between slabs for wintering (hibernation) and shelters.

Studies of movement of 124 marked vipers /from which 28 additional by radiochips/ show that the between seven existing isolated populations connection practically are not present, even though separated by only 500-2000m from each other. Vipers cannot creep over the longer distances for the lack of suitable hideaways where the moving snakes could stay during the extremes of daily weather. Besides that the one worry thing is also livestock grazing between the isolated sites.

7.6 FEEDING

The Darevsky's viper feeds mainly on invertebrates, numerous orthopterous insects and lizards of subgenus Archaeolacerta (*Darevskia armeniaca, D. valentini*). Big individuals may also eat rodents, such as voles (*Microtus arvalis, M. nivalis*). Newborn vipers consume small insects and newborn lizards appearing at the same period as vipers, but later born vipers going to hibernation without eat.

7.7 REPRODUCTION

The Darevsky's viper is ovoviviparous. Mating begins in early May. According to our observations, from 4 to 8 offspring were born in September-October. Their body length was 114-157 mm and body mass was 3400-4070 mg. Molting took place immediately after birth and last 1 hour. After the second molt the newborns started to eat insects and newborn lizards.

7.8 POPULATION SIZE

Population size density of vipers in different areas are differs from each other. In the sites N1 and N 3 it's a quite high, we could find 10-12 vipers per hectare of habitats in different season but in the sites N2 and N6 in per hectare we could meet 3-5 individuals in different season. This difference depends on size of the sites and spreading of vipers in that sites which is also depends on the account of preferable taxons in that sites. However, total number of snakes in those 7 known areas is 600-700 individuals. Taking into account all areas of suitable habitats, we can extrapolate the size of the Daversky's viper population as 900-1200 individuals.

8. MAPPING

FIELD WORK ON CLARIFICATION OF BOUNDARIES OF THE DAREVSKY'S VIPER RANGE IN THE SOUTH-WESTERN JAVAKHETI RIDGE

Clarification, demarcation and mapping of boundaries of the viper range were done during the field work with involvement of geodesists, land planners and major project participatnts. Preliminary botanical and zoological surveys were carried out to reveal reliable patches of viper occurrence and to search for other rare and endangered species. Description of each site included information about slope exposure, weather conditions, floristic composition, viper numbers, human activities and pressure on viper habitats, area vulnerability and proposed conservation measures. Maps of distribution of rare and endangered plants and animals were produced.

After obtaining this background information, we organized longer trips to delineate each site, measure its size and plot onto the map. Elevations and coordinates of all boundary points were recorded. Land inventory in terms of ownership, land use patterns and mapping were done within the viper range and its vicinities. Official boundaries of communal lands and state-reserved lands and their target use were documented. All this information was uploaded to the GIS and AutoCad programs, with supplementary support from topographic, landscape and cadastre maps. Data analysis resulted in production of thematic GIS maps of study areas.

Metallic posts were set up for demarcation of the areas which should be isolated as viper habitats and assigned the protected status.

Information on socio-economic situation in local communities was obtained and analyzed for further enhancement of viper conservation activities.

The viper range was found out to consist of 7 isolated patches of habitats, all located in the south-western Javakheti Ridge. They are not used in agriculture, being the screes and rocky lands.

LOCATION AND DESCRIPTION OF DAREVSKY'S VIPER HABITATS IN THE SOUTH-WESTERN JAVAKHETI RIDGE (ARMENIA, SHIRAK PROVINCE, ASHOTSK DISTRICT).

Site No.	Size in hectares	Location	Slope exposure	Elevation, m
N I	2.65	Ashotsk district, administrative boundaries of the village of Mets Sepasar	S	2300-2320
N II	12.31	Ashotsk district, above Mets Sepasar. Lands fall beyond the administrative boundaries of rural communities of the Shirak Province and represent the state-reserved lands	SE	2400-2450
N III	5.58	Ashotsk district, administrative boundaries of Mets Sepasar	S, SW	2310-2360
N IV	23.65	Ashotsk district, above the village of Kazanchi. State-reserved lands	S	2450-2500
N V	41.96	Ashotsk district, above the village of Sizavet. State-reserved lands.	S	2450-2550
N VI	111.33	Ashotsk district, small part is located within the administrative boundary of the village of Saragyugh and is mostly state-reserved	SE, S	2410-2500
N VII	3.30	Ashotsk district, administrative boundaries of the village of Saragyugh	SE	2410-2430

Slopes of quit volcano with western and south-western exposition at altitude from 2000 up to 2400 m above sea level. Relief in the 7 known biotopes is plain at foothill of volcano and it becomes steep upward by slopes till 40-15°.

The landscape is represented by sub alpine meadows some of them in a high degree of degrading because of livestock grazing and haymaking. In some meadows areas are changes by talus slope and rock outcrops. Souls are mountain-meadow, close to andesols.

Vegetation represented by medium-grass sub alpine meadows. Along the talus slopes and rock outcrops are small parts of not-associative shrubs vegetation.

Among grass species dominate Cephalaria gigantean, Ranunculus caucasicus, Trifolium canescens, Stachis macrantha, Astrantia major, Anemonastrum facsiculatum, Ajuga orientalis, Plantago atrata, Primula macrocalex, Ornithogalum balansae, Alchemilla sp. Near snow crops are common Scilla armena, Pushkinia scilloides, Corydallis emanueli, Ficaria ficarioides and much rare are Gagea sp. and Colchicum szovitsii.

Shrub species almost in all biotopes are represented by Daphne glomerata, Rubus bushii and Rosa sp. Rubus bushii is distributed (covering) in a large territory in biotopes located in Saragyugh village.

As described above, all sites are quite similar in floristic composition, weather conditions, structure of screes, hydrology and other parameters. They mostly differ in sizes and elevations.

Viper census shows sharp difference in viper numbers across the sites. Site vulnerability is also different which should be taken into account in conservation activities. For example, 70-80% of key screes in the sites I and III and only 20-30% in the sites V and VI should be fenced because of low viper density, but larger areas, in the last sites. The site VI contains larger areas of suitable habitats where destruction of shelters by livestock makes vipers easily switch to other shelters. Situation in the site I is much worse. Seasonal activity patterns are also site-specific depending on exposures and elevations which affect snowmelt rates on screes.

So, there are certain environmental characteristics which allow at certain confidence levels predict viper occurrence. They are the following:

1) Elevations within 2300-2500 m above sea levels in subalpine meadows

2) Areas of screes, rocky outcrops and mountain moraines with flat stone slabs. Thickness of slabs should be at least 1.5-2 m to allow vipers maintain optimal body temperatures when living beneath the slabs.

3) Slope declivity 30-45 degrees

4) Presence of food base (orthopteran insects, rock lizards, small rodents)

5) Slope exposure, mainly to the south-east

6) Hydrological conditions – presence of permanent or temporary waterbodies, streams or wetlands

A detailed description with the maps of habitats boundaries are given in appendix N 1.

9. HABITAT FENCING

Construction of watering sites and installation of signs.

Habitat fencing, construction of watering sites and installation of information signs were aimed at mitigation of adverse human impacts (haying, animal husbandry etc.) and preservation of main habitats which should then be included to Arpi Lich National Park.

For some activities (fencing of some areas, construction of some watering sites etc.) in the village of Kazanchi we have rented a house where we stockpiled construction and other materials (pipes, wires, cement etc.), as well as tools. Trip participants (cameramen, cartogra-phers, land planners, zoologists and others) also used this house as a temporary camp site.

Habitats were fenced with wires of width 2-3 mm stretched between the metallic posts to prevent livestock trespassing.

Information signs were installed along the boundaries of all 7 habitat patches and near their entrances. The storage basin was created in the Artashen and Chair rivers in a left tributaries of the Akhurian River upstream from the village of Saragyugh as agreed with local community. The pits of size 5x3 m and levee of size 10.5x3x4 m were dug. Because of hard accessibility of this area we had to lease a tractor.

For construction we used only natural materials (stones and other substrates) so to leave the environment as intact as possible.

10. DOCUMENTARY SHOOTING

DOCUMENTARY SHOOTING, PREPARATION AND PUBLICATION OF BROCHURE, BOOKLETS AND POSTERS ON ECOLOGY AND CONSERVATION OF THE DAREVSKY'S VIPER.

To educate local people and raise their awareness, we have shot a documentary about ecology, distribution and conservation of the Darevsky's viper. The processes of mapping, clarification and demarcation of boundaries, construction of watering sites, implementation of conservation activities (lectures and workshops among local people and other stakeholders) were filmed. The plans to establish a transboundary Armenian-Georgian Arpi Lich National Park under financial support provided by German Bank of Development and Reconstruction (KfW) since May 2008 are also narrated in the film.

Documentary shooting was done in all seasons and also included interviews with representatives of WWF, TJS, KfW and other organizations.

The film also tells about different issues, activities and measures related to conservation. The initial screenplay was then amended because of some factors (see the appendix N2). The total duration of the documentary is 6.5 hours and 35 minutes after its montage. The film is dubbed into Armenian and English.

THE INITIAL SCREEN PLAY INCLUDED

1. Holding meetings and interviews with representatives of regional administration and community leaders, regional service of state conservation inspection, local land users, shepherds and other stakeholders
2. Holding workshops and trainings in local schools and for general public
3. In situ conservation activities (mapping, demarcation, installation of posts, fencing, digging the pools for livestock etc.)

4. Habitats, mountains, villaes, economic activities of local people, grazing livestock, crop fields, households
5. Weather, landscapes in different seasons.

ON ECOLOGY OF THE DAREVSKY'S VIPER

1. Hibernating behavior
2. Viper activity, thermal regulation, movements on ground surface
3. Feeding, mating behavior and breeding
4. Coloration and other physical features of males, females and juveniles

FILM CREW

1. Scriptwriter
2. Director
3. Cameraman
4. Sound director
5. Editor
6. Engineer
7. Writer
8. Narrator
9. Translator

To further promote general knowledge about the Darevsky's viper, the documentary will be broadcast on local and central TV channels of Armenia, as well as during the trainings and workshops among the stakeholders.

11. EDUCATION AND COLLABORATION

In the framework of this project the brochures, booklets and posters on Darevsky's viper were prepared and published for ecological up-bringing and awareness raising of local people and wide public.

Meetings and seminars in local communities with local people and heads of communities were organized in the schools of the villages Ghazanchi, Mets Sepasar and Saragyugh of Shikar Marz. Explanatory and ecological-elucidatory activities were implemented with locals. During the meetings and seminars the brochures and booklets on Darevsky's viper were distributed, as well as other publications which were kindly provided by WWF and TJS regarding biodiversity protection and specially protected nature areas of Armenia with the aim of environmental awareness raising, ecological up-bringing and implementation of nature protection activities. In schools explanatory ecological lessons on biodiversity protection in Shirak Marz were conducted and together with the published materials on the viper the stationary items (exercise books, pens and others) were distributed. During the meetings and seminars was also mentioned the importance of implementation of the project on establishment of a transboundary (with Georgia) specially protected nature area - Arpi Lake National Park in Shirak Marz of Armenia as having significant role in the protection of biodiversity of the wetland ecosystem as one of the sites under the Ramsar Convention.

It was highlighted the importance of using new ways of management, pasture use, alternative ways of nature use in Shirak Marz, the improvement of social-economic situation in the region after establishment of Arpi Lake Natioanal Park, perspectives of ecotourism development, provision of new employment opportunities, involvement of local self-governing bodies in organization and implementation of nature protection activities in the region. Lectures were delivered with use of didactic materials on biodiversity of Lake Arpi and Javakheti Ridge (photos and maps) with use of power-point presentations.

Since September 2007 in the framework of the project on Transboundary Joint Secretariat (TJS) for the Southern Caucasus the activities on establishment of the transboundary National Park Lake Arpi were started. International organization WWF Germany was awarded this task on the basis of a tender as the consultant for the project implementation. Active collaboration with WWF Germany has started since 2007. During the meetings and seminars organized by WWF Germany and Armenia, as well as TJS we had numerous presentations on the materials of our project and highlighted the need to exclude the typical habitats of Darevsky's viper from economic use and include them in the structure of Arpi Lake National Park as well as the need for monitoring of this species.

Joint field trips with representatives of KfW and WWF Germany and Armenia as well as TJS to the planned territory of Arpi Lake National Park were implemented and

the issues on protection measures and involvement of Darevsky's viper areals in the structure of the reserve zone of the national park were discussed and agreed upon. The project teem leader Levon Aghasyan as an expert-herpetologist was involved in the research working group dealing with the research and status assessment of biodiversity within the project on establishment of Arpi Lake National Park.

Our proposals on protection and rehabilitation of ecosystems/territories important from herpetofauna protection perspectives were accepted and at present WWF carries out active preparatory activities on the mentioned territories with the aim to include them in the structure of the National Park.

The data obtained by us on the ecology, distribution and protection of Darevsky's viper were presented to the Ministry of Nature Protection of the Republic of Armenia in the framework of the project on "Publication of a new Red Data Book of Animals of Armenia" being implemented by the Scientific Center of Zoology and Hydro-Ecology of the National Academy of Sciences (NAS) of the Republic of Armenia (RA). These data's will be used for the new Red Data Book of Armenia on animals.

As a winner of a Follow-up Award for the project "Conservation and Further Research of Distribution of the Critically Endangered Darevsky's Viper (*Vipera darevski)* in Armenia" project team leader Levon Aghasyan has been invited to attend in a conference (Society for Conservation Biology) 21st Annual Meeting "One World, One Conservation, One Partnership" in Port Elizabeth, Republic of South Africa, 27June – 10th July 2007, where Levon Aghasyan made poster presentation titled "New Data's of Conservation and Distribution of the Critically Endengered Darevsky's viper (Vipera darevskii) in Armenia.

Also team leader Levon Aghasyan has got (CLP) Alumni Grant and participated in a ninth Student Conference for Conservation Science from 25-27 March 2007, at the Department

of Zoology, University of Cambridge, UK, where he made poster presentation titled “Mapping of fragmented habitats, ecological education and conservation of the Darevsky’s viper” On September 22-26, 2008 the project participants N.Ananyeva, N.Orlov and A.Aghasyan participated in the IUCN Reptile and Amphibian Conservation Workshop organized by IUCN, Subject: “IUCN\SSC Red-Listing workshop for the reptiles and amphibians of the Caucasus region and review of the conservation status of the reptiles and amphibians of Europe” in Turkey, Antalya.

The materials on research of Darevsky’s viper implemented in the framework of our project were presented during the workshop. Our proposal based on expert evaluations about changing criteria of this species within the category of Critically Endangered (CR) from C2b to CR B2ab (ii, iii) was accepted. The research results show that the viper’s distribution areal makes less than 100 square km, it is severely fragmented and there is continuous shrink of its habitats and their quality. This definition corresponds to IUCN criteria. The issues on the perspectives of Darevsky’s viper protection and involvement of their biotopes on the south-western slopes of Javakheti ridge in the structure of the transboundary National Park Lake Arpi were discussed on the seminars of the Laboratory of Vertebrates of the Scientific Center of Zoology and Hydro-Ecology of the NAS of RA (Yerevan, 21 June, 2007), Department of Zoology of Yerevan State University (Yerevan, 16 August) and in the office of the project on implementation of the project on establishment of the transboundary Arpi Lake National Park (Gyumri, Shirak Marz, 14 May 2008).The materials prepared and published include the brochure titled “Must be Conserved” (1000 copies), calendar (500 copies) and booklet titled “Darevsky’s viper in Armenia” (500 copies) with the text on Darevsky’s viper protection and illustrations/photos.

12. CONCLUSIONS AND RECOMMENDATIONS

1. The results of conducted research are important for clarification of the ecology, distribution and protection of Darevsky's viper.
2. The key determinant of viper existence is availability of temporary and permanent shelters in the form of mountainous moraine with large flat stony plates on stony screes. The quantity of individuals first of all depends on the size and structure of stony screes.
3. The key biotopes of viper are located within state lands out of administrative borders of communities. The stony screes on the pastures of sub-alpine zone have no agricultural value. However, they have certain value from biodiversity protection point of view and can be easily excluded from agricultural use without damage to economy.
4. In almost all known biotopes the main factors of threat are hay-making and livestock-breeding and especially over-grazing. Grazing during summer and autumn was one of the most threatening factors.
5. In case the ecological balance of biotopes is disturbed the number of Darevsky's viper will significantly drop, which is connected with narrow adaptation capacities of the species.
6. Strong selectivity of vipers in terms of living conditions, narrow adaptability (sub-alpine meadows at the altitudes 2300-2500 m above sea level), strong fragmentation of and far distances between typical biotopes make the species rather vulnerable. Incorporation to Therefore, designation of the status of specially protected nature areas to of the Viper habitats must be the fundamental issue for conservation of the Darevsky's viper.
7. The results and their analysis were important for justification and establishment of the protected area, particularly, in selection, zonation and mapping of the territory of Arpi Lake National Park in Shirak Marz.
8. Developed and implemented measures on protection of biotopes of Darevsky's viper can be considered as a positive beginning of nature protection activities connected with the planned Arpi Lake National Park.

9. All known territories/biotopes (stony screes) of Darevsky's viper were selected, mapped, studied and were provided to WWF for implementation of conservation measures focused on the mentioned territories.

10. New watering points for livestock were established and fenced off the viper habitats so that to prevent livestock damage to viper haunts.

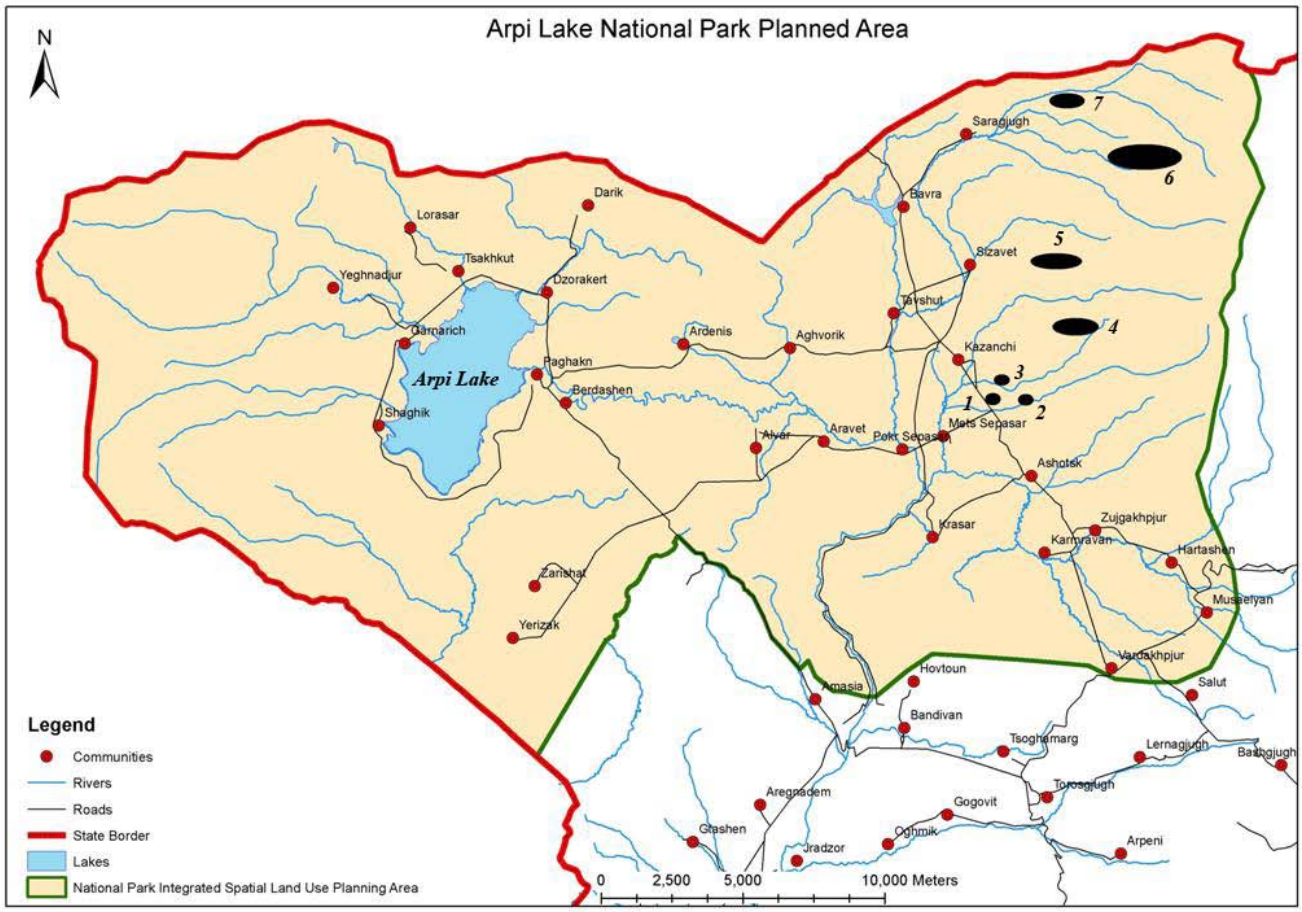
11. The activities implemented in the framework of the previous project on ecological up-bringing and awareness raising of local population on necessity to exclude typical biotopes/territories of Darevsky's viper from economic activities, were strengthened by this project through publication of a brochure, booklets and posters as well as organization of seminars and meetings.

12. The broadcasting of the film about Darevsky's viper in future will also contribute to ecological up-bringing and awareness raising of local people. There is agreement with a central and local TV companies for its broadcasting.

13. The data's obtained during the project were provided to the Ministry of Nature Protection of RA and will be used for preparation of a new Red Data Book of Animals of Armenia and for IUCN data-base on reptiles.

14. In further, it is necessary to implementation of monitoring of the state of Darevsky's viper habitats.

13. THE SEVEN SITES OF DAREVSK'S VIPER



ARPI LAKE

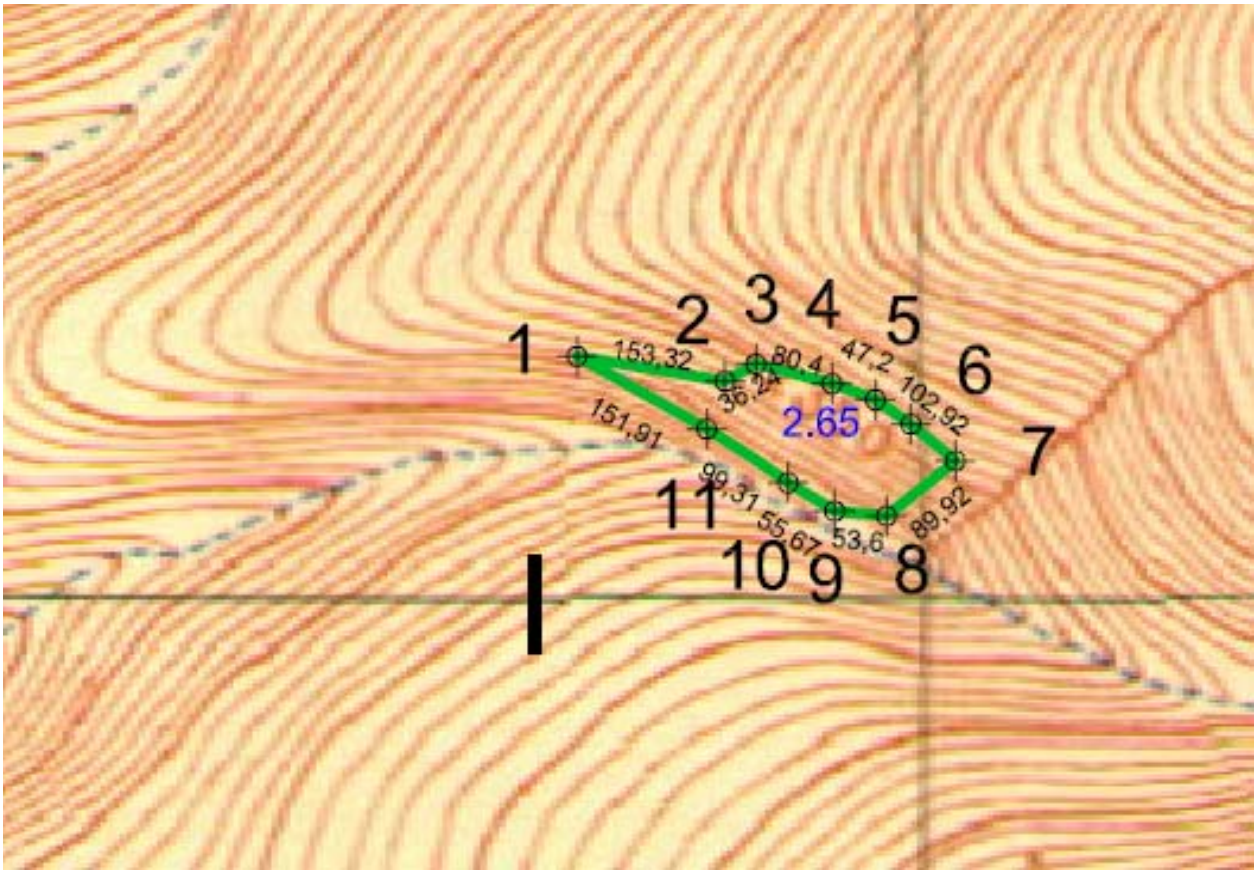
ARPI LAKE

14. APPENDIX N 1
DESCRIPTION OF HABITAT BOUNDARIES IN THE ASHOTSK DISTRICT, SHIRAK PROVINCE

Area 1 (2.65 ha)

From the picket 1 the boundary stretches to the east, passes 153.0 m, reaches the picket 2, then turns over the slope to the north-east, passes 36.0 m, reaches the picket 3, then over the slope horizontally turns to the east, passes 231.0 m through the pickets 4-6 and reaches the picket 7. From the picket 7 the boundary turns to the south-west, passes 144.0 m through the picket 8, reaches the picket 9, then in parallel with the catchment turns to the north-west, passes 307.0 m through the pickets 10 and 11 and reaches the picket 1.

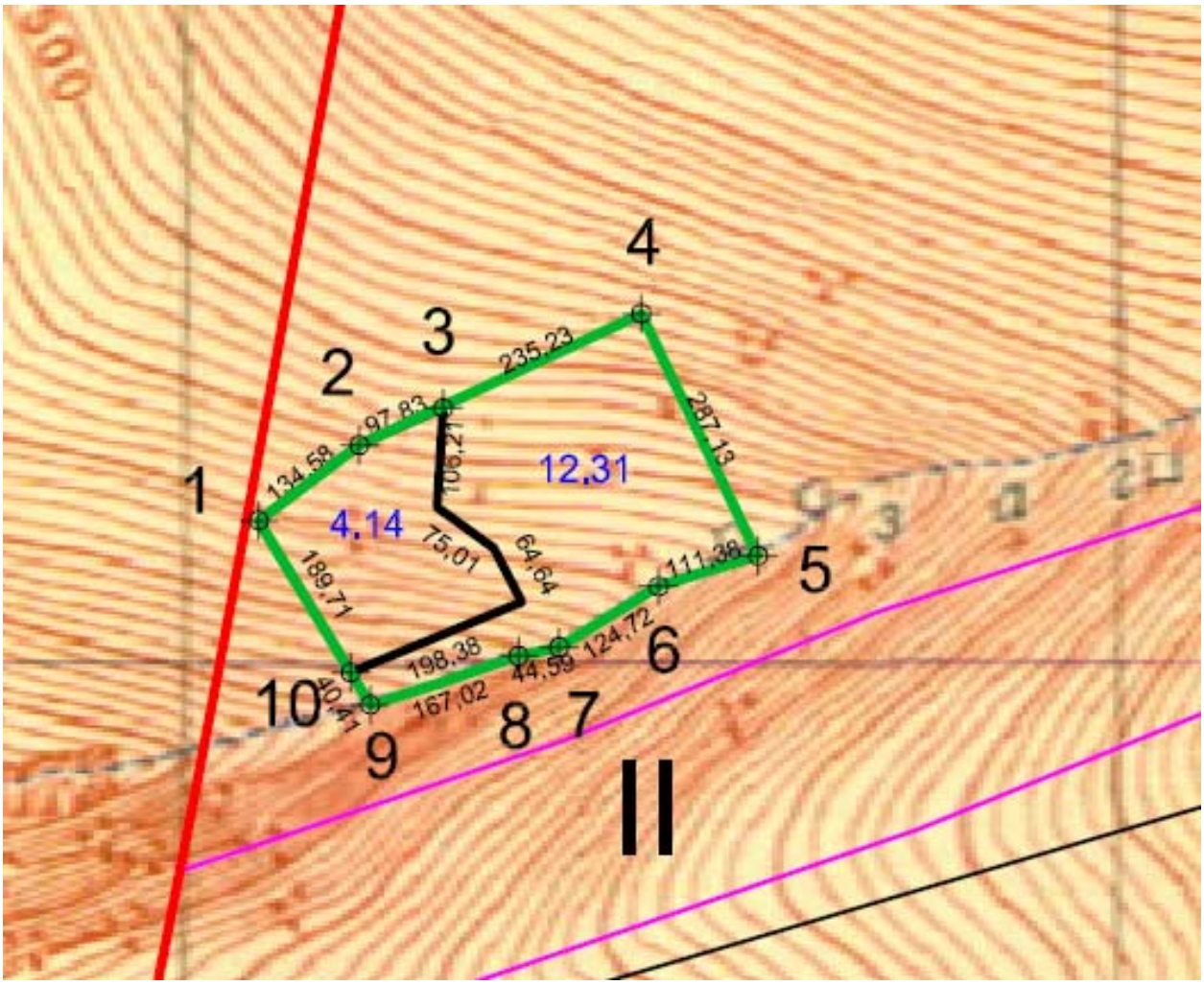
The total length of the boundary 1-1 is 871.0 m.



Area 2 (12.31 ha)

From the picket 1 the boundary over the slope turns to the north-east, passes 468.0 m through the pickets 2 and 3, reaches the picket 4, then over the steep slope turns to the south-east, passes 287.0 m and reaches the picket 5 on the edge of the catchment. From the picket 5 the boundary over the catchment turns to the south-west, passes 448.0 m through the pickets 6 to 8, reaches the picket 9, then over the slope turns to the north-west, passes 130.0 m through the picket 10 and reaches the picket 1.

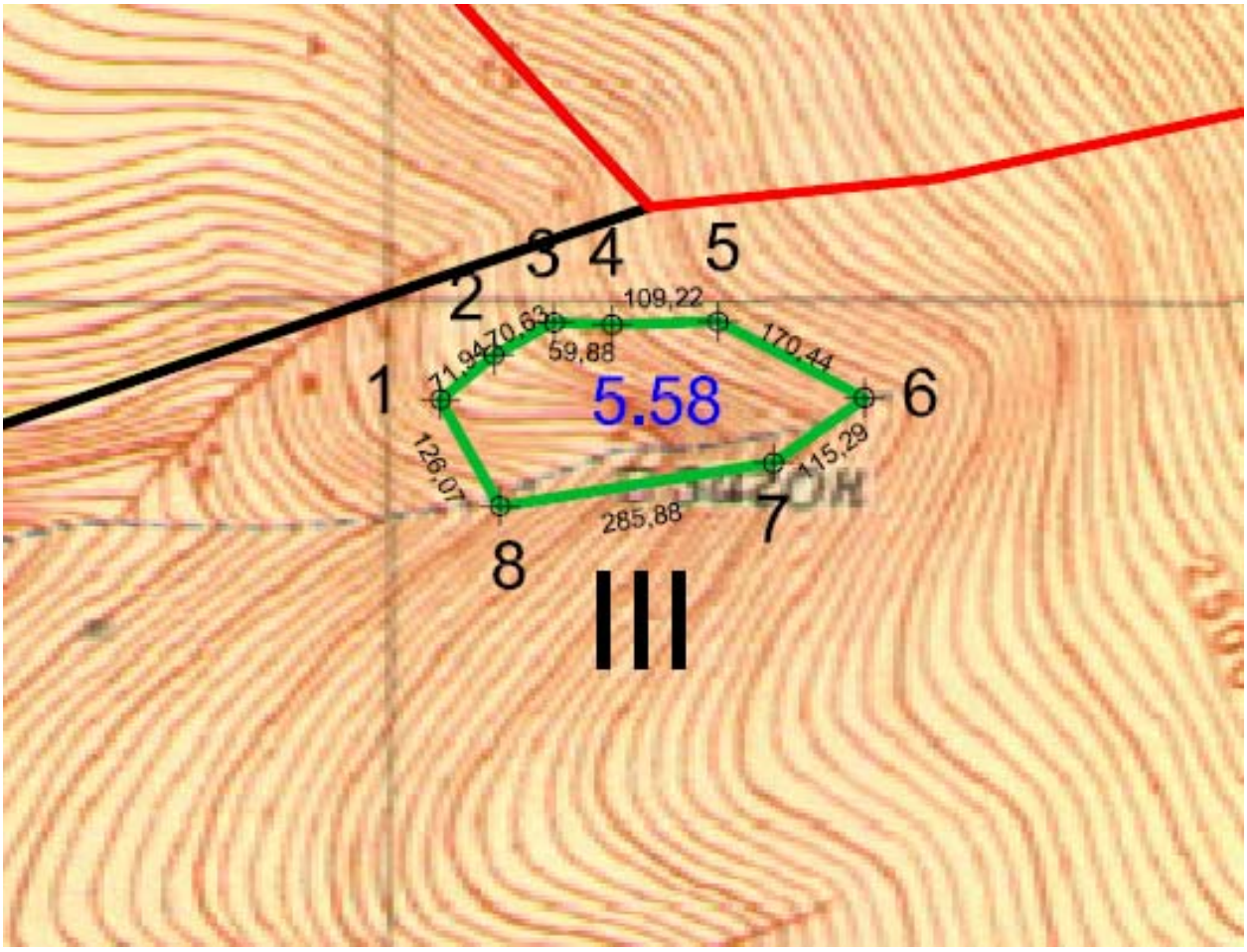
The total length of the boundary 1-1 is 1433.0 m.



Area 3 (5.58 ha)

From the picket 1 the boundary over the steep slope turns to the north-east, passes 143.0 m through the picket 2, reaches the picket 3, then over the slope turns to the east, passes 169.0 m through the picket 4, reaches the picket 5, then over the slope horizontally turns to the south-east, passes 170.0 m and reaches the picket 6 on the edge of the small gorge. From the picket 6 the boundary turns to the south-west, passes 115.0 m, reaches the picket 7, then turns to the west, passes 286.0 m and reaches the picket 8 on the edge of the same small gorge. From the picket 8 the boundary over the slope turns to the north-west, passes 126.0 m and reaches the picket 1.

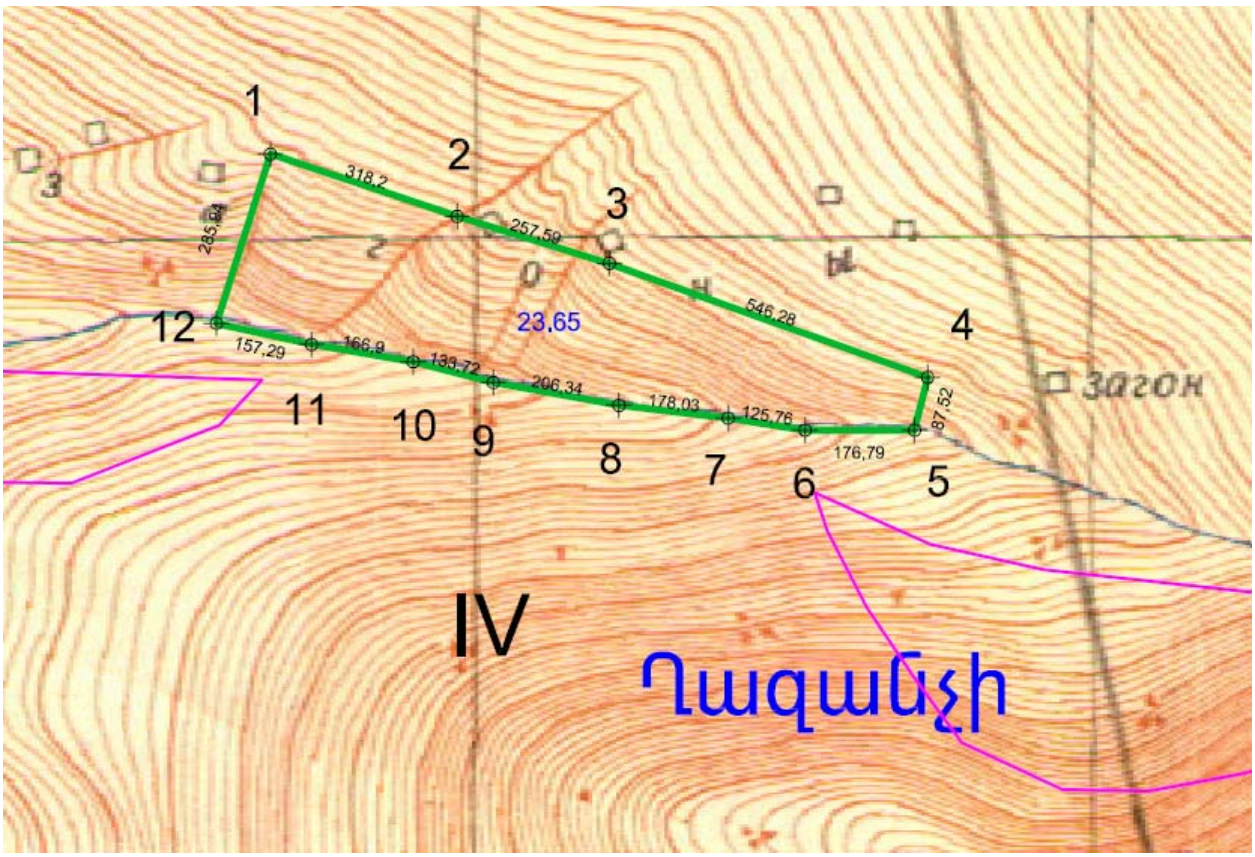
The total length of the boundary 1-1 is 1009.0 m.



Area 4 (23.65 ha)

From the picket 1 the boundary over the slope horizontally turns to the east, passes 318.0 m, reaches the picket 2 on the edge of the small gorge, then crossing the gorge turns in the same direction, passes 804.0 m through the picket 3, crossing the second gorge reaches the picket 4, then turns to the south, passes 88.0 m and reaches the picket 5 on the edge of the canyon. From the picket 5 the boundary turns to the north-west, passes 1145.0 m through the pickets 6 to 11, reaches the picket 12, then over the slope turns to the north, passes 286.0 m and reaches the picket 1.

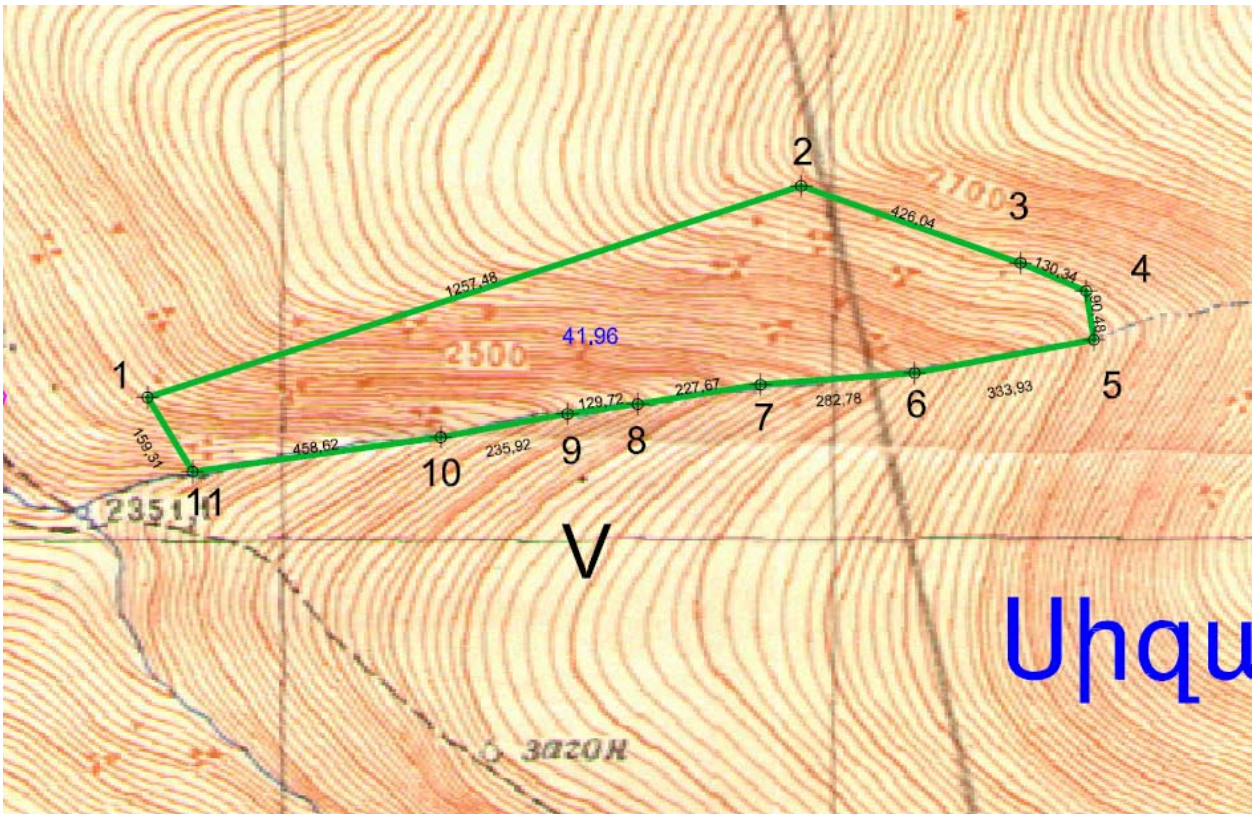
The total length of the boundary 1-1 is 2641.0 m.



Area 5 (41.96 ha)

From the picket 1 the boundary over the steep slope turns to the north-east, passes 1257.0 m, reaches the picket 2, then over the slope horizontally turns to the south-east, passes 556.0 m through the picket 3, reaches the picket 4, then turns to the south, passes 90.0 m and reaches the picket 5 on the edge of the canyon. From the picket 5 the boundary over the canyon turns to the south-west, passes 1669.0 m through the pickets 6 to 10, reaches the picket 11, then turns to the north-west, passes 159.0 m and reaches the picket 1.

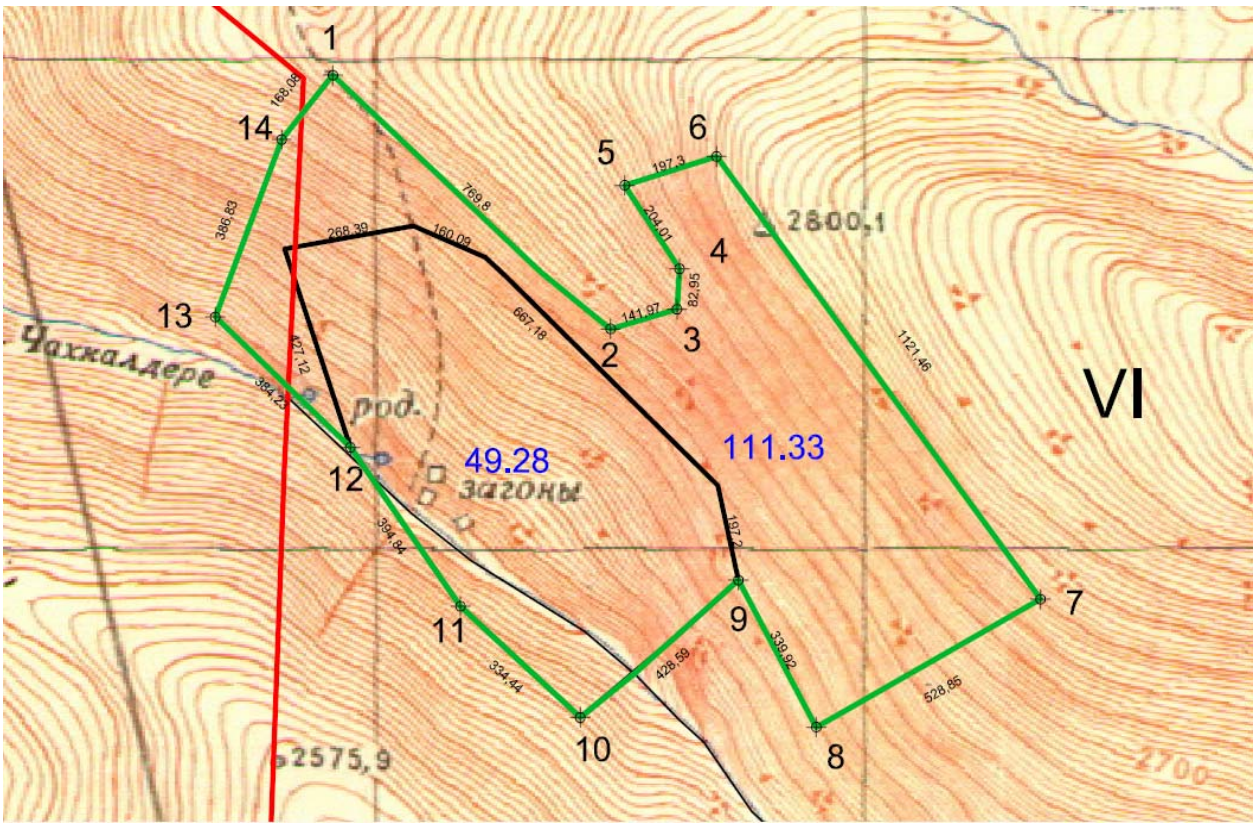
The total length of the boundary 1-1 is 3731.0 m.



Area 6 (111.33 ha)

From the picket 1 on the edge of the canyon the boundary over the slope horizontally turns to the south-east, passes 770.0 m, reaches the picket 2, then over the steep slope turns to the east, passes 142.0 m, reaches the picket 3, then over the steep slope turns to the north-east, passes 83.0 m and reaches the picket 4. From the picket 4 the boundary over the slope horizontally turns to the north-west, passes 204.0 m, reaches the picket 5, then over the steep slope turns to the east, passes 197.0 m and reaches the picket 6. From the picket 6 the boundary over the slope horizontally turns to the south-east crossing the elevation-measuring tower at 2800.1 m a.s.l., passes 1121.0 m and reaches the picket 7. From the picket 7 the boundary over the slope horizontally turns to the south-west, passes 529.0 m, reaches the picket 8, then over the slope horizontally turns to the north-west, passes 340.0 m, reaches the picket 9, then turns to the south-west crossing the river, passes 429.0 m and reaches the picket 10. From the picket 10 the boundary turns to the north-west, passes 729.0 m through the picket 11, reaches the picket 12 on the river bank, then follows the river course, reaches 384.0 m and reaches the picket 13. From the picket 13 the boundary over the slope horizontally turns to the north-east, passes 555.0 m through the picket 14 and reaches the picket 1.

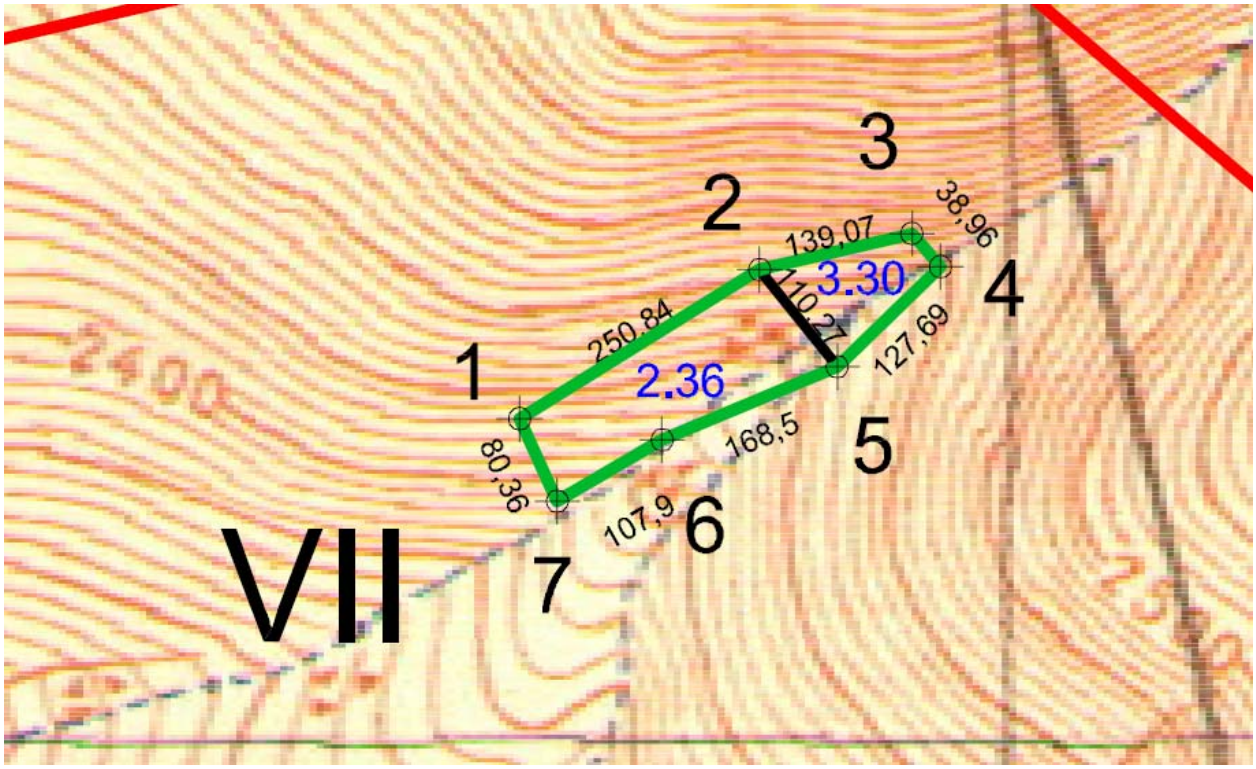
The total length of the boundary 1-1 is 5483.0 m.



Area 7 (3.3 ha)

From the picket 1 the boundary over the slope turns to the north-east, passes 251.0 m, reaches the picket 2, then turns to the east, passes 139.0 m, reaches the picket 3, then over the steep slope turns to the south-east, passes 39.0 m and reaches the picket 4 on the edge of the canyon. From the picket 4 the boundary along the edge of the canyon turns to the south-west, passes 128.0 m, reaches the picket 5, then turns in the same direction crossing two gorges, passes 276.0 m through the picket 6 and reaches the picket 7. From the picket 7 the boundary over the slope horizontally turns to the north-west, passes 80.0 m and reaches the picket 1.

The total length of the boundary 1-1 is 913.0 m.



15. APPENDIX N 2
SCREENPLAY OF THE FILM

Foreword

Each year the number of rare animals on the planet is going up, whereas the number of these animals in wild nature is going down. The Red Book is becoming thicker and thicker year by year. The Darevsky's viper would not avoid this grievous reality. As a species with limited natural habitat, Darevsky's viper is considered as a species with extremely high risk of disappearance in the wild nature and is listed in the Red List of International Union of Nature Conservation. This serpent received a special status.

Its natural habitat is highly confined, hardly reaching a small area of 3,500-4,000 ha located on the farthest North-West of Armenia, in the marz of Shirak, near the border with Georgia. However, according to the latest information, this type has been noticed on the territory of Turkey as well, to the South-East of Childir Lake. The total number of Darevsky's vipers reaches some 400-500 of senior snakes.

Starting from 2005, implementation of "Development of conservation measures for the Darevsky's viper in the Caucasus" program due to financial support provided by "(CLP) Conservation Leadership Programme" began. The objective of the program was exploring of environmental specifications of Darevsky's viper, landscape-zonal and biotope distribution, as well as expansion borders, as well as development of measures to preserve the viper.

This snake was first discovered by Darevsky in 1956 during field works. Since then, the snake has changed three names. Initially, it was named Vipera kaznakowi dinniki, a bit later- Vipera kaznakowi darevskii. Its current name as an individual species – Darevsky's viper, was only introduced in 1986, honoring the name of the scientist who revealed this serpent.

In the course of the studies the impact of biotic, abiotic and anthropogenic factors on natural life style of Darevsky's viper and the quantity of the species has been clarified, which served a basis for elaboration of environmental measures and their further implementation.

This was the reason for further studies in the frames of “Conservation and further research of distribution of the critically endangered Darevsky's viper (Vipera darevskii) in Armenia” (2007-2008) program with financial assistance of Conservation Leadership Programme, as well as implementation of previously elaborated environmental measures in the region of Ashotsk.

Natural habitat

In the course of the program implementation it turned out that the habitat of the serpent is a big broader than it was originally suggested.

Peculiar to vipers biotopes in the shape of rocky ruins, separated from each other, are centered all along southern-western slopes of Javakhk mountains, among pasture fields. This was the reason for necessity of most detailed description of the areas and mapping. This was done to clarify in detail what those lands constituted, under whose competence they were and what their target significance was. In this documentary you can see how the land-surveyors and zoologists are doing the mapping of Darevsky’s vipers’ biotopes. The result will be a digitalized map. This will provide opportunity to clearly separate biotopes from agricultural lands. With that, these small areas which represent stone wastes are not suitable for feeding the animals at all. In the first stage of project implementation, due to intensive field work, the specialists cleared out the habitat, studied therma-ecology, feeding issues, reproduction, as well as landscape-zonal and biotope distribution, implemented quantitative estimation of the species and carried out evaluation of current status of the population. As a result of all these researches it became clear that processing of the land with agricultural purposes is the key danger, in the first place – feeding of the animals and hay-making. Since it is necessary to stop feeding the animals and processing the lands in those areas to preserve the species, it was important to bring to minimum possible conflicts with the land-users. However, It turned out there not a single problem with the farmers ever aroused. It turned out that many of those farmers even never realized someone from the Red book lived in their neighborhood. The chief objective was avoiding of rocky areas. To achieve this, biotopes of Darevsky’s viper were bordered with a wire. Warning signs were placed along the area. The measures that were carried out are called in the specialists' language environmental conservation measures.

The project included educational component for school children, covering environmental problems and nature protection processes in Armenia. In the frames of this project the children and their teachers learned about Darevsky’s viper, the protection measures

focusing on preserving of the species in the frames of the program, that had been conducted since 2005 right in their community, as well as about the program to set up Arpi lake national park. With this purpose the group visited the school of Khazanchi village, where the members of the group met with the children and their teachers and spoke about the Darevsky's viper in detail.

There are small brooks in the gorges, most of which become dry in summer months. This was the reason the group dug special water-collecting basins, as well as repaired the old ones to secure the animals are provided with water.

Levon Aghasyan

The results of the research proved the agricultural animals are going up to reach the upper sections of the mountains to get water for themselves, whereas the path goes through the biotopes of Darevsky's viper. This is to say the animals are damaging those areas, which are quite limited. This is why it was decided to create water basins so the animals do not have to go up the hills to get water. This was beneficial for both the villagers and the snakes. The exact locations for the water basins were identified together with the villagers, special agricultural equipment was brought in to carry out the activity, and many experts including international specialists, were present while we were doing this. This activity was highly important for preserving of biotopes of the Darevsky's viper, since the most important in this aspect is not to damage.

In its external characteristics Darevsky's viper holds intermediate position between Vipera eriwanensis and Vipera Kaznakowi. According to herpetologists' suggestions, the viper has a hybrido-gene origin from the mentioned species. Compared to Vipera Kaznakowi, Darevsky's viper has smaller size, a narrower head and less articulated hood. In turn, it differs from Vipera eriwanensis in higher position of its head and roundness of front upper edge of the chin. Nostrils are usually cut in the middle parts of the nose. They can be recognized by the same color. The body is typically brown, grayish or yellow-gray on the back with zigzag-shaped band of dark brown or black colour, sometimes broken into strongly elongated transverse spots. The body is typically brown, grayish or yellow-gray on the back with zigzag-shaped band of dark brown or black colour, sometimes broken into strongly elongated transverse spots. Along the sides are marked with less clear lines of the same color against bright yellow background. The head top is clearly marked with X-

like pattern. The belly is gray or blackish with numerous black speckles. What relates to the size, then female snakes are larger in size than male.

The suitable habitats are located in the subalpine zone on the south-eastern slopes of the Javakheti Ridge some 2,300-3,000 m high. These vipers live under the piles of flat stone slabs, stocked on one another. These piles are 0.5-2 m thick, which allows the snakes to live here and maintain their activity even at unfavorable weather conditions. In cold climate conditions stone slabs keep sufficiently high temperature inside of them which in its turn allows the snakes to maintain necessary temperature for their activity. Hibernation period is also spent under these stone piles, which enables them to move between the vertically placed stones and to stay active for long time even in the periods of unfavorable weather conditions. That is to say, the vipers are using the same biotopes as both temporary shelters and location for permanent hibernation. The areas where the snakes live have particularly south-east disposition. It is of great interest that similar biotopes, as areas with rocky scrap, also exist on the bottom sections of the slope, but Darevsky's viper cannot be found there, though there is more than enough food for them. It is conditioned by the structure of the stones, particularly by lack of flat stone slabs.

Darevsky's viper belongs to the rare kind of serpents that are used to live in harsh climate conditions. In certain sense, they can be reckoned frost-resistant. However, in reality the wise nature has endowed them with flexible thermoregulation. Air temperature fluctuations are very high both during the day and night, and vary from 12 to 35oC. It is common knowledge for all of use from the school lessons of physics that to keep body thermoregulation high, it is necessary to reduce the heat irradiation and utilize solar rays to the maximum. To secure this, vipers position their bodies in relation with the sun rays. To absorb the sun rays to the maximum, they flatten their body to increase the contact area. Dark body color also contributes to increased heat accumulation. By doing so, the snakes manage to increase their temperature to the levels exceeding those of the air and the ground. Sensing a higher temperature of the body, they change their position in relation to the sun or just sneak into the shadow. The structure of the stones and their placement also contribute to preserving the optimum temperature (25-27oC). Here the vipers are actively moving, searching favorable for their lifestyle micro-climate conditions. At cold evening hours the temperature under flat stones remains quite high (18-20oC). The snakes are leaving their shelters and remain active even the air temperature goes down to 10-12oC.

For instance, in May, when air temperature varies from 4 to 8oC in morning hours, rectal temperature of the snake still reaches 25oC.

Darevsky's viper feeds mainly on lizards and invertebrates, basically – orthopterous insects and mountain lizards. Newly born and young vipers are eating small insects, for instance - orthopterous insects and newly-born mountain lizards, provided they came into the world simultaneously with the new-born snakes. They hunt with biting, rapidly thrusting the head forward and poisoning the victim. They usually swallow the prey from the head. Large vipers feed on rodents as well, partially on voles the number of which is very high in these areas. They digest them within approximately one week. During this period, the vipers reduce their activity and exercise highly quiet behavior. They prefer to spend this time under warm stones.

The Darevsky's viper differs from other Vipers with its sluggishness, discretion and caution. Mimicry abilities are also developed. For instance, frequently it is hard to notice them when they are sunning themselves on the rocks, probably this is the reason the local residents are not aware there is snake living beside them. In case of danger – be it an animal or a human, Darevsky's viper prefers to sneak away slowly and stealthily. Any rumor they can be dangerous for anyone are absolutely groundless, unless someone attempts to catch the viper.

Darevsky's vipers began their sexual games around mid-May. These snakes are vivaporous. Up to 7 snakes are born 114-117 sm long.
Herpetologists took 2 female vipers from isolated area above the village of Khazanchi to clarify the term of delivery of the snakes in the terrarium. Here we created conditions close to natural. It has to be said here that to preserve the Darevsky's viper in terrarium the frequency of ultra-violet ray has to be increased, compared to other snakes. Two generations were reproduced from 2 pregnant vipers. The first viper (body length L.422mm, tail - L.cd 47mm, weight prior to delivery 77 gr, after the delivery – 49 gr) delivered 6 vipers, while the second (body length L.427 mm, tail - L.cd 48mm, weight prior to delivery 82 gr, after the delivery – 39 gr) delivered 4 snakes. The size and weight of the new-born vipers vary a lot. Body length ranges from L. 138 mm to 157 mm, tail length - L.cd 16-22mm, weight – 3,400 mg to 4.070 mg.
The new-born vipers were kept in the terrarium, equipped with automated light and thermoregulation. The newly born snakes began to molt immediately after birth. In an hour

molting was over. After second molt the newborns began to feed on orthopterous insects and newly born mountain lizards. The new-born vipers and females after having been marked with shining paint were released into their habitat.
In high mountainous conditions later periods of deliveries of vipers were noticed. This provides reasons to believe that new-born vipers hibernate right after the delivery, and they start feeding only from the spring of the next year. It is also possible that females preserve viable sperm in reproductive organs, or the females hibernate in pregnant condition.

Starting from 2004, in the frames of the agreement signed between Institute of Zoology of the National Academy of Sciences of Republic of Armenia, the Saint-Luis Zoo USA and the Institute of Zoology of the National Academy of Sciences of Russian Federation, have been conducting herpetological researches in Armenia. The work group includes prominent scientists with international recognition from these institutions, as well as from animal exotarium of Tula. Due to financial supports provided by the Saint-Luis Zoo USA, in the frames of the project named “Ecology of Armenian viper, biotic distribution and movements around Armenia”, starting from May 2004 herpetological researches began in Armenia. Researches have been made in the sphere of observing ecological peculiarities of viper, where distribution of biotopes and movements of the Darevsky’s viper were studied, using the electronic chips method. Due to applying contemporary methods it was possible to research seasonal activity of the viper, and the radius of movements. In the frames of the given agreement, it is envisaged to continue ecological investigations of Darevsky’s viper.

Starting from May, 2007 due to financial support of German bank for reconstruction and development, the government of Armenia passed a decision to establish a specially protected natural area – lake of Arpi national park, which will cover Ardenis and Arpi lakes.

This proved to be a highly relevant program particularly in the context of the program to preserve Darevsky’s viper, as it is envisaged that biotopes of these types will also be included into the national park.

All that had to be done was to confine the direction of movements of the animals while feeding.

Arpi lich national park project

On October 11 the shootings of putting tents and releasing of new-born vipers were taken, as well as interview with Karen Manvelyan (head of Yerevan office of WWF), Magnus Sylvie (coordinator of the project for the establishment transboundary SPNA of the national park of "Arpi Lich").

Head of the local community. Question. Are you aware that very close to you the Darevsky's viper is settled, which is included into the Red Book?
Question Will you have any objections if these areas receive the status of specially protected areas?

Pause

The group also dug special water collection basins, repaired the old ones to supply water to the animals.

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