FINAL REPORT ON:

TRANSBOUNDARY ECOSYSTEM HEALTH IN THE PAMIRS

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Livestock herding is the principle livelihood for people across the Pamirs landscape. ©Beth Wald

Executive Summary

In a unique effort to improve the scientific knowledge on animal health in the Pamirs, a three-country international project involving the Wildlife Conservation Society, New York, USA and the University of Veterinary and Animal Sciences, Lahore, Pakistan, as principal partners was undertaken between March 2011 and May 2012. The project contributed to merging the technical capacities of the three leading veterinary diagnostic entities in Afghanistan, Tajikistan and Pakistan within one transboundary livestock screening initiative. After being introduced to the concept of ecosystem health and after agreeing on consistent methodologies, collaborators organized field missions in the Pamirs landscape within each of their three countries in the summer of 2011 and collected a total of 2,339 sera samples. These samples were successfully analyzed at respective national laboratories according to standardized methods. During a final workshop that took place in Dushanbe, Tajikistan, on 5-7 March 2012, results of these analyses were extensively discussed in order to help partners begin to consider and plan for health issues within a transboundary, One Health paradigm. During the workshop the opportunity was taken to expose regional participants to international experts in the field of infectious diseases and build their capacity through technical training in the field of serodiagnostics. At the end of the workshop a number of recommendations were offered by participants and a transboundary institutional collaboration was initiated.

Introduction

The borders of four countries—Afghanistan, Pakistan, China, and Tajikistan — meet within the Pamir mountain range, a confluence of stunning mountain peaks and deep valleys. Flanked by the Hindu Kush, Himalayan, and Karakoram ranges, the Pamirs' isolation and low human density offer a unique refuge for wildlife that has been severely persecuted in surrounding areas. Today, these mountains are still home to healthy populations of the endangered Marco Polo sheep (*Ovis ammon polii*), Siberian ibex (*Capra sibirica*), small and threatened populations of markhor (*Capra falconeri*) and urial (*Ovis vignei*), and provide a stronghold for the fast disappearing snow leopard (*Panthera uncia*).

In Central Asia livestock diseases are one of the greatest risk factors for the health of valuable wildlife resources. In the Pamirs and surrounding mountain ranges, the abundance of domestic animals leads to forced cohabitation between livestock and their wild counterparts (e.g., ibex, argali, markhor, urial). Domestic and wild herbivores are competitors for food, which results in pasture sharing and thus in the transmission of infectious agents through direct or indirect contact. The spillover of contagious diseases from domestic to wild-living ungulates has been widely reported during the last 25 years[1,2,3] with sometimes detrimental effects at the population level in rare and valuable wildlife resources.[4,5]

Because of these health issues, there is a critical need to have countries sharing this transboundary Pamir landscape develop coordinated efforts to ensure that their unique wildlife continue to be an essential part of the ecosystem and that communities that share these mountains can enjoy improved livelihoods through better management of these natural resources.

Herd of sheep and goats in Afghan Pamirs, summer 2011, Wakhan District, Badakhshan Province, Afghanistan.

Developing countries such as Pakistan, Afghanistan and Tajikistan are dependent upon healthy domestic and wild animals at the local as well as national level in terms of food security and self-sufficiency, micronutrients, cultural norms, sustainable livelihoods, economic growth, and trade. However, in the Pamirs where these countries share common international borders, little is known about animal health and there is a near-complete lack of functional strategies and infrastructures to protect domestic agricultural and wildlife interests from endemic (native to an area) or introduced (akin to alien invasive species) diseases. Without training and a sound vigilance system put in place at the local level, evaluating and preparing for disease risk and the potential impact on biodiversity and human livelihoods is impossible to achieve.

The goals of this project were to encourage the acceptance in these three countries of an integrated and multidisciplinary approach (i.e., One Health – see Appendix III) to the study of diseases at the livestock/wildlife/human interface in the Pamirs, and to demonstrate through an example of coordinated and shared data collection and analysis that a global approach to animal health management is feasible despite physical borders and political sensitivities.

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2 Frölich, K. et al. (2002). A review of mutual transmission of important infectious diseases between livestock and wildlife in Europe. *Annals of the New York Academy of Sciences* 969: 4–13.

3 Hudson, P. J. et al. (2002). *The Ecology of Wildlife Diseases*, Oxford University Press, 187 pp.

4 Callan, R. J. et al. (1991). Development of pneumonia in desert bighorn sheep after exposure to a flock of exotic wild and domestic sheep. *Journal of the American Veterinary Medicine Association* 198(6): 1052–1056.

5 Dagleish, M. P. et al. (2007). Fatal Sarcoptes scabiei infestation of blue sheep (Pseudois nayaur) in Pakistan. *Journal of Wildlife Diseases* 43(3): 512–517.

Phase 1: Administrative Agreements and Methodological Discussions

The first stage of the project consisted of preliminary discussions between The Wildlife Conservation Society (WCS, the facilitating partner of the project and co-grantee); Prof. Dr. Tahir Yacub at the University of Veterinary and Animal Sciences (UVAS) in Lahore, Pakistan; and the American Association for the Advancement of Science (AAAS). Following this preliminary agreement, a second agreement had to be signed between WCS and UVAS, followed by discussions on the methodology of the scheduled field work in the north of Pakistan. A round of visits to project partners in Afghanistan (The Animal Husbandry Department, Ministry of Agriculture Irrigation and Livestock, Kabul, Afghanistan) and Tajikistan (the State Veterinary Inspection Services, Ministry of Agriculture, Dushanbe, Tajikistan) was undertaken by Dr. Stephane Ostrowski (WCS) prior to field missions. UVAS was also visited by Dr. Ostrowski in November 2011, after field missions. During the visits to collaborating partners in Afghanistan and Tajikistan Dr. Ostrowski explained the details of the project, presented and discussed the ecosystem health paradigm, concluded administrative agreements, and facilitated the organization of summer field work in the remote Pamirs. An important aspect of these visits was to put into contact and open lines of communication among project partners from the three range states. The visit to Pakistan was the occasion to meet colleagues from UVAS and interact with University officials, academics and students, visit facilities, and share the principles of ecosystem health through two presentations to academics and students. It was also the occasion for discussions with a variety of very interesting and dedicated interlocutors including Dr. Muhammad Nawaz, Vice-Chancellor of UVAS, Dr. Zafar Jamil Gill, Director General of Livestock and Dairy Development Department at Veterinary Research Institute in Lahore, Punjab Province, and Dr. Ghulam Abbas, Director General of Livestock and Dairy Development Department in Gilgit, Gilgit-Baltistan Province (in the Pamirs). Schedules and achievements of multilateral collaborations and visits are summarized in Table 1.

Table 1. A summary of achievements during preliminary visits and contacts with project collaborators in 2011.

Visits	Achievements	Cost-Coverage
	Afghanistan	
March 16 - April 7	Discussions on project concept, agreement of principles, MoU, visit to CDRL Kabul.	USAID
June 7 - June 16	Purchase of equipments and disposables, organization and launching of field missions.	USAID
August 24 - September 8	Debriefing of the field mission, delivery of serological kits to the CVDRL Kabul.	USAID
	Pakistan	
March - July	Discussions on project concept, administrative agreement WCS/UVAS, extensive discussions on protocols and methods, fund transfer, remote debriefing of the mission.	AAAS
November 21 - November 26	Visit to UVAS, delivery of serological kits and discussion on analytical methods, presentation on ecosystem health in Pamir and outreach. Meeting with animal health stakeholders, preliminary discussions about final meeting.	AAAS
	Tajikistan	
April 7 - April 17	Discussions on project concept, agreement of principle, MoU, visit to National Center of Veterinary Diagnostics, Dushanbe.	WCS
June 16 - July 6	Purchase of equipments and disposables, organization and launching of the field mission. Debriefing of the mission.	WCS
September 8 - September 23	Delivery of serological kits, collaboration in laboratory testing, preparation of final meeting with veterinary authorities.	WCS

Source: WCS

Phase 2: Sample Collection Across the Landscape and Laboratory Analysis

Wild ungulates such as this urial in Tajikstan often interact closely with the growing livestock population, creating a significant risk of disease crossover. ©WCS

General Methods

All sampling sites were selected according to the recognized presence of free-ranging populations of wild ungulates in the vicinity (i.e., within 30 km), as one of the main objectives of this ecosystem health collaboration was to evaluate the occurrence in livestock of diseases of potential risk to wild ungulates. Markhor (*Capra falconeri*) are present in Shur-obad and Diamer districts in Tajikistan and Pakistan, respectively. The Marco Polo sheep (*Ovis ammon polii*) is present in upper Ishkoshim District in Tajikistan and upper Wakhan in Afghanistan, the Asiatic ibex (*Capra sibirica*) occurs in all surveyed sites, and the urial (*Ovis vignei*) is reported in lower and mid Wakhan valleys in Afghanistan and in Diamer District in Pakistan (Fig. 1).

In each country we selected two (Pakistan) or three (Afghanistan, Tajikistan) sampling areas at least 50 km from one another and across an altitudinal gradient to gain a wider geographical coverage and evaluate the possible effect of altitude. In each of these areas teams were supposed to sample a total of c. 250-400 animals from 3 to 5 different localities. This number of samples was determined so as to detect a statistically significant difference of 5% prevalence between areas, assuming the lowest prevalence in these areas would be 10%. Overall we requested the teams to collect 800 samples including at least 400 samples from domestic goats. This target sample size was selected in order to be able to detect at least one positive individual with a probability of 98% assuming a minimal prevalence of 0.5% of the disease in sheep and goats (brucellosis) or 1% in goats (CCPP).

Upon arrival to the laboratories all samples were stored frozen until analyzed one to five months after sampling. The test kits were maintained at +4°C - +8°C during transportation and stored at +4°C; only the conjugate for the *Brucella* competition ELISA test was stored at -20°C. The following tests were performed at the three collaborating laboratories using positive and negative controls and following standards of the World Animal Health Organization (OIE):

- Qualitative Rose Bengal Test (RBT, Synbiotics, France, expiry date 10th January 2014) for rapid detection of antibodies against *Brucella* sp. in all samples collected.
- Quantitative competition ELISA (COMPELISA, Veterinary Laboratories Agency, UK, expiry date 1st June 2012) for the detection of antibodies against *Brucella* sp. in sera reacting with RBT and a random selection of samples negative with RPT.
- Latex agglutination test (CapriLAT, Veterinary Laboratories Agency, UK, expiry dates 16th June 2012 and 25th August 2012) for the rapid detection of antibodies against *Mycoplasma capricolum* subspecies *capripneumoniae* (Mccp), the causative agent of contagious caprine pleuropneumonia (CCPP) on all goat samples.

In addition 359, 410, and 197 goat serum samples originating from Afghanistan, Pakistan and Tajikistan, respectively, were tested by *Centre de Coopération Internationale en Recherche Agronomique pour le Développement* (CIRAD), Montpellier, France, for the presence of antibodies against *Mycoplasma capricolum* subspecies *capripneumoniae* (Mccp) using the competition ELISA test kit developed by this OIE reference laboratory for the disease. The cut-off value for this test at CIRAD was 55%. Because of measurement uncertainty, CIRAD considered the test results doubtful for inhibition percentages ranging between 47% and 63%. It was considered positive for percentage inhibition values higher than 63% and negative for percentage inhibition values lower than 47%.

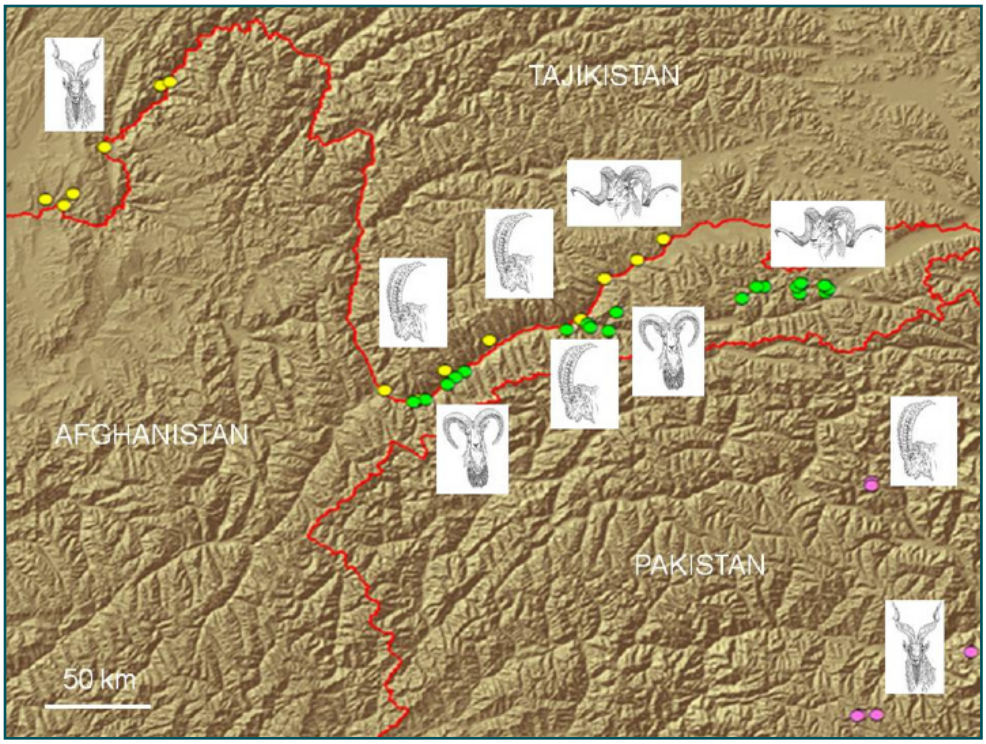

Figure 1. Location of livestock sampling sites in Afghanistan (green dots), Pakistan (pink dots), and Tajikistan (yellow dots) in relation to the presence of wild ungulate species in the vicinity. Markhor are present in the extreme south-east and north-west of the survey area (c. 650 km from each other in direct line), Marco Polo sheep occurs in the north and north east of this area, Asiatic ibex is present throughout the area, and urial occurs in the vicinity of two sampling sites in Afghanistan and one site in Pakistan.

Sampling Results

In **Afghanistan** the field mission started behind the scheduled time because of delays in receiving sampling equipment and disposables, followed by transportation complications between Kabul and the remote north-east Badakhshan Province linked to weak security conditions in the valley of Warduj. Instead of the typical four days, the team took seven days to reach the first outshoot of the Little Pamir region in Wakhan District. However, by July 17 the team started the sampling mission, which it completed on August 5. A total of 283 samples were collected in three localities in upper Wakhan, 234 samples in three localities in mid Wakhan and 276 samples in three localities in lower Wakhan (Table 2, Fig. 2). On August 9, the 793 sera samples stored in liquid nitrogen dry shippers were air-shipped to Kabul. Samples were stored (at -20°C) at the WCS Program office in Kabul and then forwarded to the Central Veterinary Diagnostic and Research Laboratory (CVDRL) on September 12, after Eid el-Fitr holidays.

In **Pakistan** the field mission started on July 5 and ended July 18. Sampling took place in two districts of Gilgit-Baltistan Province, at altitudes ranging from high to very high (3,164 to 3,856 m asl or 10,380 to 12,650 feet). The team collected 371samples from four localities in Diamer District and 412 samples from two localities in the Gilgit District. Overall 783 samples were collected (Table 2, Fig. 2). All sera were transported in liquid nitrogen dry shippers and stored at -80°C, pending analyses, at the veterinary laboratory facilities of UVAS, Lahore.

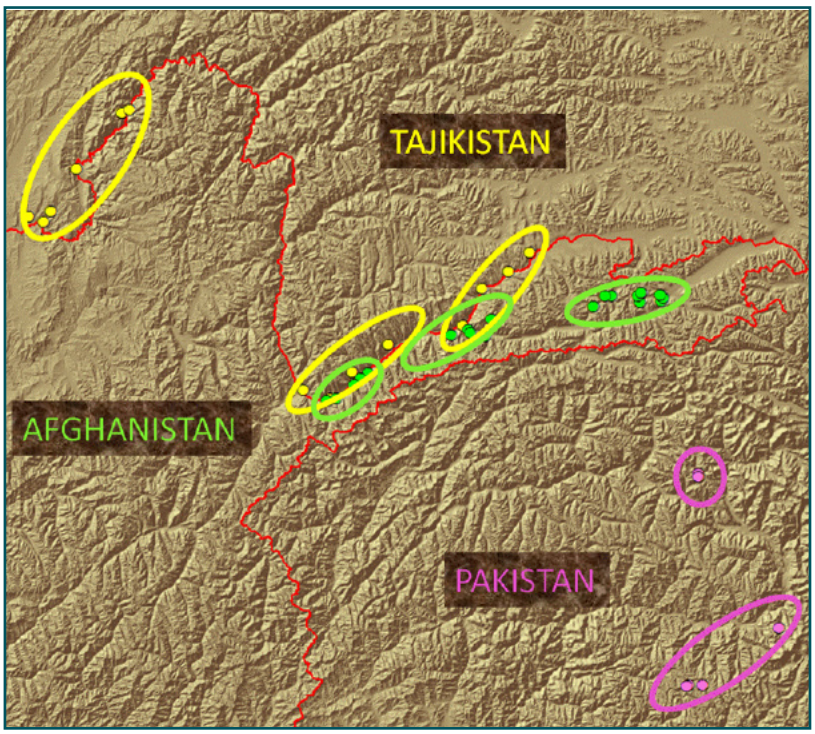

Figure 2. Localities (filled dots) and areas (unfilled circles) of livestock sampling in Afghanistan (green), Pakistan (pink), and Tajikistan (yellow), summer 2011.

In **Tajikistan** the field mission started on June 20 and ended on July 3. Samples were taken in three districts at altitudes ranging from low to very high (738 to 4,022 m asl or 2,421 to 13,195 feet). In Murghob/upper Ishkoshim districts of Gorno-Badakhshan Autonomous Oblast (GBAO) the team sampled 200 animals in two localities, in mid/lower Ishkoshim District 287 animals in five localities and in Darvoz/Shu-obod districts 276 animals in five localities. Overall 763 animals were sampled (Table 2, Fig. 2). All sera were stored at -20°C, pending analyses, at the National Center for Veterinary Diagnostic in Dushanbe.

Table 2. Result of transboundary blood-sampling of livestock living in contact with valuable wild ungulate populations, June-July 2011, Pamirs and outskirts.

Sampling Location	Goats	Sheep	Total	Wild Ungulate Species[1]
Afghanistan				
Abgarch, mid Wakhan, Badakhshan	0	45	45	Urial
Chapdara, upper Wakhan, Badakhshan	48	48	96	Ibex / Argali
Digargund, lower Wakhan, Badakhshan	46	49	95	Ibex / Urial
Gharin-Garamdeh, upper Wakhan, Badakhshan	47	46	93	Ibex/ Argali
Qarchindeh, upper Wakhan, Badakhshan	48	46	94	Ibex / Argali
Qazideh-Shitkhawr, lower Wakhan, Badakhshan	46	46	92	Ibex / Urial
Qila-e-Panja, mid Wakhan, Badakhshan	50	47	97	Ibex / Urial
Sast-Wuzed, mid Wakhan, Badakhshan	45	47	92	Ibex/ Urial
Wergund, lower Wakhan, Badakhshan	45	44	89	Ibex / Urial
Sub-total	375	418	793	
Pakistan				
Lalusar, Diamer, Gilgit-Baltistan	82	0	82	Ibex
Tatoovat, Diamer, Gilgit-Baltistan	91	48	139	Ibex
Ashad, Diamer, Gilgit-Baltistan,	16	43	59	Ibex
Fairy Meadows, Diamer, Gilgit-Baltistan	73	18	91	Markhor / Ibex / (Urial)
Naltar Lake, Gilgit, Gilgit-Baltistan	117	0	117	Markhor / Ibex
Naltar Valley, Gilgit, Gilgit-Baltistan	40	255	295	Markhor / Ibex / (Urial)
Sub-total	419	364	783	
Tajikistan				
Darshay, Ishkoshim, GBAO	0	25	25	Urial*
Ishkilik, Murghob, GBAO	100	25	125	Ibex / (Argali)
Khostav, Darvoz, GBAO	48	0	48	Markhor / (Ibex)
Khargushi, Ishkoshim, GBAO	50	25	75	Ibex / (Argali)
Mats, Ishkoshim, GBAO	50	25	75	Ibex / (Urial)
Namadgul, Ishkoshim, GBAO	0	51	51	Urial*
Ryn, Ishkoshim, GBAO	0	59	59	Urial*
Shitkharv, Ishkoshim, GBAO	0	67	67	Urial*
Guliston, Shurobod, Khatlon	7	0	7	Markhor
Kaboq, Shuruobod, Khatlon	59	22	71	Markhor / (Urial)
Khermanjo, Shurobod, Khatlon	51	24	75	Markhor / (Urial)
Sia Rish, Shurobod, Khatlon	50	25	75	Markhor / (Urial)
Sub-total	415	348	763	

Source: University of Veterinary and Animal Sciences, Lahore, Pakistan; State Veterinary Inspection Services, Dushanbe, Tajikistan; and the Wildlife Conservation Society-Pakistan, Gilgit, Pakistan

[1] Urial (*Ovis Vignei*), ibex (*Capra sibirica*), argali (*Ovis ammon*), markhor (*Capra falconeri*)
* Reintroduction project in this area

The three teams collected 2,339 blood samples across the surveyed area (Table 3), with slightly more samples collected from goats (51.7% of the total) than sheep (48.3%). They sampled significantly more females (83.8%) than males (16.2%), which reflect in part the biased sex ratio in the adult population of livestock in the Pamirs. Based on a targeted number of 2,400 samples we conclude that the field part of the simultaneous sampling operation was achieved at 97.4%.

Table 3. Result of transboundary blood-sampling of livestock living in contact with valuable wild ungulate populations, June-July 2011, Pamirs and outskirts.

Sampling Location	Goats	Sheep	Total
	Females		
Afghanistan	358	335	693
Pakistan	327	389	716
Tajikistan	237	315	552
	Males		
Afghanistan	60	40	100
Pakistan	37	30	67
Tajikistan	111	100	211
Total	**1,130**	**1,209**	**2,339**

Source: Compilation of WCS

Laboratory Analysis Results

Results of serological analysis for brucellosis and CCPP are provided in the following two tables (Table 4 and 5). Because extensive discussions about these results were developed during the final meeting in Dushanbe, these will be presented in a later section.

Table 4. Results (% [95%CI]) of *Brucella* sp. antibody detection with two different tests in domestic sheep and goats sampled across the study area in summer 2011.

Sampling Locations	Serological Tests		
	RBT	*cELISA*	*RBT + cELISA*
Afghanistan			
Upper Wakhan, Badakhshan	0/283 (0.0% [0.0-1.3])	1/114 (0.9% [0.0-4.8])	0/114 (0.0% [0.0-3.2])
Mid Wakhan Valley, Badakhshan	0/246 (0.0% [0.0-1.5])	0/104 (0.0% [0.0-3.5])	0/104 (0.0% [0.0-3.5])
Lower Wakhan Valley, Badakhshan	0/264 (0.0% [0.0-1.4])	0/177 (0.0% [0.0-2.1])	0/177 (0.0% [0.0-2.1])
Subtotal	0/793 (0.0% [0.0-0.5])	1/395 (0.2% [0.0-1.4])	0/395 (0.0% [0.0-0.9])
Pakistan			
Diamer District, Gilgit-Baltistan	0/371 (0.0% [0.0-1.5])	0/168 (0.0% [0.0-2.2])	0/168 (0.0% [0.0-2.2])
Gilgit District, Gilgit-Baltistan	2/412 (0.2% [0.0– 1.3])	0/155 (0.0% [0.0-2.3])	0/155 (0.0% [0.0-2.3])
Subtotal	2/783 (0.3% [0.0-0.9])	0/323 (0.0% [0.0-1.1])	0/323 (0.0% [0.0-1.1])
Tajikistan			
Murghob/upper Ishkoshim districts	0/200 (0.0% [0.0-1.8])	0/50 (0.0% [0.0-7.1])	0/50 (0.0% [0.0-7.1])
Mid Ishkoshim District	0/277 (0.0% [0.0-1.3])	0/70 (0.0% [0.0-5.1])	0/70 (0.0% [0.0-5.1])
Shur-obod /Darvoz districts	8/286 (2.8% [1.2-5.4])	10/203 (4.9% [2.4-8.9])	8/203 (3.9% [1.7-7.6])
Subtotal	8/763 (1.01% [0.4-2.1])	10/384 (2.6%[1.3-4.7])	8/384 (2.1% [0.9-4.1])
Total	**10/2,339 (0.4% [0.2-0.8])**	**11/1,102 (1.0% [0.5-1.8])**	**8/1,102 (0.7% [0.3-1.4])**

Table 5. Results (% [95%CI]) of detection with two different tests of antibodies against *Mycoplasma capricolum* subspecies *capripneumoniae* (Mccp), the causative agent of contagious caprine pleuropneumonia (CCPP) in domestic goats sampled across the study area in summer 2011.

Sampling Locations	Serological Tests	
	Latex agglutination	*cELISA*
Afghanistan		
Upper Wakhan, Badakhshan	1/143 (0.7% [0.02-3.8])	0/132 (0.0% [0.0-2.7])
Mid Wakhan, Badakhshan	1/107 (0.9% [0.02-5.1])	0/104 (0.0% [0.0-3.5])
Lower Wakhan, Badakhshan	1/125 (0.8% [0.02-4.3])	0/123 (0.0% [0.0-2.9])
Subtotal	3/375 (0.8% [0.2-2.3])	0/359 (0.0% [0.0-1.0])
Pakistan		
Diamer District, Gilgit-Baltistan	97/262 (37.0% [31.2-43.2])	60/260 (23.1% [18.1-28.7])
Gilgit District, Gilgit-Baltistan	46/157 (29.3% [22.3-37.1])	2/150 (1.3% [0.2-4.7])
Subtotal	143/419 (34.1% [29.6-38.9])	62/410 (15.1% [11.8-19.0])
Tajikistan		
Murghob/upper Ishkoshim districts, GBAO	0/150 (0.0% [0.0-2.4])	Pending
Mid Ishkoshim District, GBAO	0/50 (0.0% [0.0-7.1])	Pending
Shur-obod /Darvoz districts, GBAO/Khatlon	23/215 (10.7% [6.9-15.6])	20/197 (10.1% [6.3-15.2])
Subtotal	23/415 (5.5% [3.5-8.2])	20/197 (10.1% [6.3-15.2])
Total	**169/1,209 (14.0% [12.1-16.0])**	**82/966 (8.5% [6.8-10.4])**

Phase 3: Final Workshops and Recommendations

Workshop in Dushanbe

The field missions and laboratory work were followed by a three-day workshop in Dushanbe, Tajikistan on March 5-7, 2012 to bring all collaborators to meet, discuss results, summarize and disseminate the work, deliver to partners additional theoretical and technical trainings, and discuss opportunities related to both a transboundary Pamir health initiative and improved national efforts at health management within each of the countries. Approximately 45 people attended this workshop (Appendix I is the Agenda, Appendix II presents the list of main participants) from a variety of stakeholder groups, including project collaborators from the three countries, Tajik health experts, representatives from the government of Tajikistan, FAO, the World Bank, EU, the Aga Khan Foundation, foreign experts and WCS staff.

After hearing introductory talks and a series of presentations on the animal health situation and veterinary systems in the Pamir region of each country, one day was dedicated to presentations and discussion on brucellosis, and another day to discussions and work on CCPP, including training on a new diagnostic kit (Appendix I). Each day ended with technical discussions and less formal open interactions during which project collaborators were actively sharing ideas and experiences. Pre-meeting events organized by Tajik hosts and lunches, dinners and tea breaks were facilitated by WCS staff as 'ice-breakers.'

Workshop Session on Brucellosis

Brucellosis Discussions

Brucellosis is caused by *Brucella* sp., a Gram negative coccobacillus which is a facultative intracellular pathogen. In sheep and goats brucellosis is mainly caused by *Brucella melitensis*, while *Brucella abortus* is more frequent in cattle;

yet both species can also affect other hosts. Infection in livestock can also spill over into wild ruminants and vice versa; *B. melitensis* infections have been reported in Alpine ibex (*Capra ibex*) in Italy and in chamois (*Rupricapra rupricapra*) in the French Alps as result of contacts with infected livestock. However, there is no evidence that these wild species serve as reservoir hosts for domesticated sheep and goats. The predominant symptoms in naturally infected sheep and goats are hygromas of carpal joints, abortions, stillbirths and the birth of weak offspring. In wild chamois, this organism was linked to orchitis, polyarthritis, blindness and neurological signs, but not abortion. *B. melitensis* is very contagious to humans and is transmitted from animals to humans by contact with the placenta, fetus, fetal fluids and vaginal discharges from infected animals and via consumption of unpasteurized dairy products. In humans the disease is extremely debilitating, responsible for relapsing fevers, arthritis and reproduction defects such as abortions and orchitis.

Because of the widespread consumption of unpasteurized dairy products in Central Asian pastoral societies and associated health risks, the pivotal importance of livestock production in these local economies and the risk posed to valuable wildlife resources, brucellosis is a priority disease for surveillance in the Pamirs.

Although Rose Bengal Test has been shown to be of relatively low sensitivity and specificity it remains an excellent screening test and it is easy to implement in the field. The cELISA test combines a high sensitivity (>97%) and a very high specificity (>99%) (Godfroid, pers. comm. 2012). Based on this information we considered that animals positive to both tests have been exposed to *Brucella* sp.

The serological prevalence of brucellosis in the surveyed populations was very low, with the notable exception of 8-10 animals found positive in one locality in Tajikistan (10 out of 75 animals sampled in this area were positive with cELISA test). Even when including these localized positive results, the overall prevalence was <1% based on the combined results of two tests. There is actually 95% probability that seroprevalence to brucellosis in the surveyed area was <1.5% in livestock populations. Should we exclude the results from Sia Rish in Tajikistan, the highest possible prevalence level drops below 1%.

Right: Livestock sampling by Mr Orom, Ziyoev, member of the team from Tajikistan, summer 2011, GBAO, Tajikistan.

Below: Livestock sampling by Dr. Ali Madad Rajabi, member of the team from Afghanistan, summer 2011, Badakhshan Province, Afghanistan.

The four sheep and four goats in Sia Rish confirmed positive with the cELISA test did not show clinical symptoms of brucellosis. Although recent investigations confirmed that sheep and goats in Sia Rish were not vaccinated against brucellosis, several animals purchased from other herds during the past year could have received vaccination shots (Rev-1 vaccine has been used in Tajikistan for the last years). Local livestock owners said that this hypothesis was unlikely yet not impossible.

Serological exposure to *Brucella* sp. is only an indirect test of the prevalence of brucellosis and should ideally be combined with isolation attempts of the bacteria. Serological diagnosis of brucellosis is known to underestimate the real prevalence. However, despite

this caveat our results support the position that prevalence to brucellosis infection in livestock was low in the surveyed area.

The results from the Pamirs and mountainous outskirts contrast with those of serological investigations carried out during the last decade in Central Asia. Cross-sectional serological surveys carried out in 2003 in Khatlon Province and in the Region of Republican Subordination, Tajikistan on 13,625 domestic ruminants and three years later in Kyrgyzstan on 4,936 livestock revealed higher exposure levels to brucellosis than in the present survey (Table 6). There are several hypotheses to explain the apparent low prevalence of this debilitating disease in the surveyed area. It is possible that the harsh environmental conditions prevailing in this high altitude ecosystem reduce the prevalence of infectious agents, including brucellosis, in livestock populations. It has been documented that in Wakhan, Afghanistan, climate and harsh weather conditions play a key role in livestock survival. Extreme cold temperatures and poor nutrition, as exist during the long winters, are responsible of more than 50% of livestock mortality every year, exceeding diseases (15%) and other causes[6]. It is likely that animals affected by a debilitating disease, such as brucellosis, are less likely to survive winter conditions compared to healthy ones. Also, the infectious agent may expose its sick host to a higher level of predation, such as from the gray wolf (*Canis lupus*) still fairly common in this part of Afghanistan.

Husbandry conditions could also contribute to the low prevalence of brucellosis in the livestock population. In the Pamirs, such as in many areas of this corner of the Asian highlands, livestock foreign to the area, and their associated pathogens, are rarely imported; instead animals raised and fattened in the area are massively exported from the area in autumn as the main economic resource for locals. The pattern of circulation of potential infectious agents is therefore largely centrifugal to the area.

Table 6. Comparative seroprevalence of brucellosis in livestock from Tajikistan (Pamirs not surveyed), Kyrgyzstan, and Pamirs (present study).

	Tajikistan (2003)[7]		**Kyrgistan (2006)[8]**		**Pamirs (Present Study 2011)**	
Species	**Prevalence (N)**	**95%CI**	**Prevalence (N)**	**95%CI**	**Prevalence (N)**	**95%CI**
Sheep	5.8% (6,238)	[5.2-6.4]	3.3% (2,076)	[1.5-6.9]	0.4% (1,130)	[0.1-1.0]
Goats	5.5% (6,767)	[5.0-6.0]	2.5% (1,286)	[1.4-4.5]	0.2% (1,209)	[0.0-0.7]

6 Noori, H. et al. (2012). Activities of the ecosystem health component in 2011 in Wakhan District, Afghanistan. Unpublished Report, WCS, New York, 48 pp.

7 Jackson, R. et al. (2007). Survey of seroprevalence of brucellosis in ruminants in Tajikistan. *Veterinary Record* 161:476-482.

8 Bonfoh, B. et al. (2011). Representative seroprevalences of brucellosis in humans and livestock in Kyrgyzstan. *Ecohealth*, Dec 6.

Brucellosis Recommendations

Based on discussions it was decided that there was no immediate need to put in place vaccination programs in areas investigated in the Pamirs, but because of the occurrence of the disease in neighboring mountainous ranges such as in Southern Tajikistan, veterinary workers should be taught to identify the symptoms of the disease and trained at reporting it quickly to local veterinary authorities. Word should also be spread that animals from these neighboring areas should not be purchased and imported into the Pamirs. Fortunately this is rarely happening since the livestock market in the area is essentially exportation of animals native to the Pamirs.

In the absence of serological screening capabilities, animal health professionals across the region should be taught to consider the occurrence of carpal joint hygromas as an evocative symptom of endemic brucellosis. This symptom has been consistently observed in cases of brucellosis in different taxa of susceptible ruminants.

Dr Godfroid from the Norwegian School of Veterinary Science urged the Tajik veterinary authorities to investigate the brucellosis status in the Sia Rish locality, Shur-obod District where seroprevalence of brucellosis among tested animals seemed high. He also underlined that wild boar (Sus scrofa) populations would be worth investigating for the presence of Brucella suis wherever they occur in Afghanistan, Pakistan and Tajikistan.

The study did not survey brucellosis in cattle and domestic yak. Although results of recent surveys done in Wakhan tend to support that the disease is also uncommon in these species, more investigations were recommended.

Workshop Session on Contagious Caprine Pleuropneumonia

Discussions on Contagious Caprine Pleuropneumonia

Contagious caprine pleuropneumonia (CCPP) is a disease caused by the bacterium *Mycoplasma capricolum* subsp. capripneumoniae (Mccp), which can lead to severe losses in domestic goat populations in the developing world. The morbidity and mortality are very high when the disease affects naïve herds, occasionally reaching 100% and 90%, respectively. For the last 10 years the disease has been confirmed in an increasing number of countries. In 2002, Mccp was detected only in five countries (Nepal, Oman, Turkey, United Arab Emirates, Yemen) in Asia.[9] Yet in the past eight years the disease has spread to new territories, including to the European side of Turkey[10] and Tajikistan.[11] The causative agent has also been detected in other countries such as Pakistan as a result of improved diagnostic tests, although the disease was suspected in this country for long time.[12]

Prior to our study nothing was known about the status of the disease in the Pamirs. In Pakistan and Tajikistan the present study confirmed the presence of the disease in domestic goats in a number of lowland and mid-mountain areas where valuable populations of wild caprines also survive. Despite the claim that in southern Tajikistan the disease was spread by sick goats smuggled from Afghanistan, CCPP still remains to be identified in Afghanistan.

Results of the present study show a heterogeneous epidemiological situation across the landscape. In the northern part of the surveyed area in the Pamirs of Tajikistan and Afghanistan, and along the upper course of the Amu Darya River in the Wakhan Corridor there was no serological indication of CCPP in surveyed livestock. This was contrasting with the situation in Diamer District of Gilgit-Baltistan, Pakistan, where serological prevalence was found to be high, on average >20%. However, this high serological prevalence was not always associated with evocative clinical

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9 Nicholas RAJ et al. (2008) Contagious caprine pleuropneumonia In: *Mycoplasma Diseases of Ruminants.* CABI Publishing. Pp 116-129.

10 Ozdemir U et al. (2005) Contagious caprine pleuropneumonia in the Thrace region of Turkey. *Vet Rec* 156, 286-287.

11 Office international des Epizooties (OIE). Contagious caprine pleuropneumonia, Tajikistan. 2009 May 15 [cited 2009 Nov 3]. http://www.oie.int/wahis/public.php?page=single_report&pop=1&reportid=8610

12 Awan MA et al. (2010) First report on the molecular prevalence of Mycoplasma capricolum subspecies capripneumoniae (Mccp) in goats the cause of contagious caprine pleuropneumonia (CCPP) in Balochistan province of Pakistan. *Mol Biol Rep* 37, 3401-3406.

The markhor is one of the most impressive wild goats and trophy males are greatly desired on the international market. Recent die-offs from disease show their vulnerability to this threat. ©T.Rosen

symptoms or a situation of developing outbreak, suggesting that the disease is probably endemic in these areas, such as it is indeed currently perceived by local animal health authorities based on clinical reports (Dr Ghulam Abbas, pers. comm.). Eventually in the west of the surveyed region, in mid-altitude mountains of Tajikistan along the course of the Amu Darya River, serological results coupled with high mortality reported by the Tajik survey team support that the disease was epidemic when the area was visited. The disease was discovered relatively recently in this area (OIE, 2009), and our investigations confirm that it is still present with high mortality. The failure to control the outbreak in the area is in part due to the use of ineffective vaccines.

Although Mccp was thought to be a pathogen highly specific to domestic goats it has recently been found to affect captive wild goats (*Capra aegagrus*), urials (*Ovis vignei*) and Nubian ibex (*Capra ibex nubiana*) in Qatar[13] and semi-captive dorcas gazelles (*Gazella dorcas*) in the United Arab Emirates[14], with mortality rates ranging between 58% and 90%, depending on the species.

The present study raises concerns over the risk of CCPP transmission to valuable wild ungulate populations in the Shur-obod District of Tajikistan and in Diamer District in Pakistan. Species of wild goats present in these areas, namely the Himalayan ibex (*Capra sibirica*) and the markhor (*Capra falconeri*), appear to be particularly at risk. This is highlighted by the fact that very recently the phylogenetically close subspecies capricolum emerged as a main cause of mass mortality in the endangered markhor in southern Tajikistan in 2011, causing the death of at least 64 animals, a significant proportion of the current population in Tajikistan.[15] This sort of die-off can have significant economic impact, as markhor have one of the highest values of any Caprid on the international trophy market (see below).

Recommendations Following CCPP Discussions

Based on discussions it was decided that there was no immediate need to put in place vaccination programs in areas investigated in the Pamirs, but because of the occurrence of the disease in neighboring mountain ranges such as in northern Pakistan or southern Tajikistan, veterinary workers should be taught to identify the symptoms of the disease and trained to report it quickly to local veterinary authorities. Word should also be spread that animals from these neighboring areas should not be purchased and imported into the Pamirs. Fortunately this is rarely happening since livestock market in the area is essentially based on exportation of animals.

In areas with relatively localized epidemic cases of CCPP, such as it seems to be the case in southern Tajikistan, local veterinary authorities should take full action to eradicate the disease while it is still relatively uncommon. Vaccination is possible but difficult to implement efficiently because there are few effective vaccines on the market. The vaccine commercialized in Pakistan has been ineffective at controlling the diseases in Gilgit-Baltistan where the disease seems to be endemic (Dr Abbas, pers. comm.).

The lack of efficient vaccine produced in Pakistan does not allow for the implementation of efficient vaccination campaigns in areas that have embarked in specific projects of sustainable use of natural resources, such as the very profitable trophy hunting of markhor and ibex, two wild species of caprine susceptible to CCPP. An outbreak of

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13 Arif A et al. (2007) Contagious caprine pleuropneumonia outbreak in captive wild ungulates at Al Wabra wildlife preservation, State of Qatar. *J Zoo Wildl Med* 38, 93-96.

14 Nicholas RAJ et al. (2008) *Contagious caprine pleuropneumonia In: Mycoplasma Diseases of Ruminants*. CABI Publishing. Pp 116-129.

15 Ostrowski S et al. (2011) Fatal outbreak of Mycoplasma capricolum pneumonia in endangered markhors. *Emerg Infect Dis* 17, 2338-2341.

The delegation from Pakistan with invited disease experts and meeting organizers, March 2012, Dushanbe, Tajikistan.

CCPP in a markhor population could have disastrous economical effects to an industry that generates significant revenues to impoverished communities ($150-200,000 per annum in Gilgit-Baltistan only, with a single trophy male worth over $80,000 on the international market).

Capacity Building

The workshop in Dushanbe was also an occasion to train technical staff from the three delegations in the use of a new competitive ELISA test for the detection of CCPP. This test was developed by CIRAD, Montpellier, France, and is under the latest phase of accreditation. On the afternoon of the last day of the meeting three laboratory experts from each delegation joined Dr. Thiaucourt, CIRAD, to receive training on using the kit. At the end of the training Dr. Thiaucourt donated 2-4 sets of this kit to representatives of each delegation.

In order to compare the efficiency of the training, 261 goat samples from the batch collected in Pakistan were tested in April 2012 both at CIRAD reference laboratory and at UVAS, Pakistan by the recently trained staff. Results showed a low level of divergence in results (<3.5%) (Table 6), confirming that the technical capacity was well transferred and properly acquired.

Table 7. Comparison of cELISA CCPP test results on a batch of 261 goat samples at the laboratory of the University of Veterinary and Animal Sciences (UVAS), Lahore, Pakistan and at the CCPP reference laboratory of Centre de Cooperation Internationale en Recherche Agronomique pour le Développement (CIRAD), Montpellier, France.

Serological Results		Quantity	Conclusions
UVAS	**CIRAD**		
Positive	Positive	26	} 75.5% of matching results
Negative	Negative	152	
Doubtful	Doubtful	19	
Positive	Doubtful	6	} 21.1% of doubtful but coherent results
Doubtful	Positive	6	
Negative	Doubtful	21	
Doubtful	Negative	22	
Positive	Negative	1	} 3.4% of divergent results
Negative	Positive	8	

Final Recommendations, Multilateral Decisions and Conclusions

A number of conclusions, recommendations, and multilateral offers were presented at the end of the workshop. All of them emphasized the importance that all stakeholders held about the need for a better understanding of the status of infectious diseases in the Pamir highlands.

- In contrast to what has been documented in several parts of Central Asia, the investigated areas in the Pamirs did not demonstrate a serological occurrence of brucellosis in domestic sheep and goats. Recent studies made in the Afghan Pamirs suggest that the disease is also of low prevalence in this area in cattle and domestic yaks, yet more investigations should be done on these species in other areas of Pamirs.
- Livestock-born brucellosis has not been diagnosed as a significant threat to wild ungulate species in investigated areas in the Pamirs.
- Goats are an important livestock resource in the Pamirs and if they have not acquired some immunity from past exposures to CCPP, as the present study seems to suggest, an outbreak of this disease could have devastating effects on their populations. As a corollary the food security and livelihoods of local communities, who already struggle with malnutrition and poverty, will be significantly impacted.
- Contagious caprine pleuropneumonia could also spread to valuable populations of wild goats with whom domestic goats increasingly share habitats as a result of shifts in livestock husbandry practices from strict pastoralism to agro-pastoralism. A CCPP outbreak in wild ungulates has the potential to damage a unique natural resource, the ecology of the mountains, an important livelihood opportunity in some areas (trophy hunting), and to some extent the burgeoning touristic economy in Pamirs.
- In general it is of global importance to have a better understanding of which infectious agents circulate in a landscape shared by four countries including two of the largest goat producers in Asia (China and Pakistan). Any disease outbreak in this multinational landscape could contain the seeds for tension among neighboring states if it is perceived as threatening the livelihood and well-being of local societies. A coordinated effort between range states to improve the epidemiological surveillance of such a devastating disease as CCPP could prevent such tensions.
- In order to better disseminate the knowledge accumulated during the present study, project collaborators agreed to publish these results collegially within the next two years in one or two peer-reviewed articles.
- Delegates from UVAS, Pakistan, offered to develop a cooperative agreement (MoU) with the State Veterinary Inspection Services in Tajikistan. They also advertized the existence of international scholarships at UVAS that are accessible to veterinary students from Afghanistan and Tajikistan.
- Dr. Thiaucourt reminded the participants of the willingness of CIRAD to isolate and genotype any suspected strains of Mccp occurring in the three countries.

Final Evaluation of the Project

Achievement of General Goals

The general goals of this project were to a) encourage the acceptance of an integrated and multidisciplinary approach to the study of diseases at the livestock/wildlife/human interface in the Pamirs, and b) produce data that will inform rangeland management and support sustainable agricultural practices and natural resource use in the Pamirs.

Both objectives were successfully achieved. Project partners were introduced to the concept of One Health. In the course of the project, WCS facilitators emphasized the importance of disease risk at the livestock/wildlife interface both as a destructive factor to wildlife and as an emerging threat, sometimes zoonotic, in livestock. The importance

of human health within the One Health paradigm was less extensively emphasized, however all participants were aware of the zoonotic risk, human health epidemiologists from Tajikistan were present and active in the final workshop, and Dr. Kasymbekov presented the result of his work in Kyrgyzstan that included assessment of the health of human beings in a nationwide study on brucellosis risk factors.

The project has generated a scientifically valid dataset with a large and homogeneous sample size, using pertinent modern methods approved by scientific authorities and with informative, usable results. In Afghanistan and Tajikistan the results of the livestock screening study were made readily available to veterinary authorities as project partners were affiliated to governmental institutions. In Pakistan the information produced at UVAS, an academic institution, will have to be conveyed through collaborating provincial authorities to the State veterinary authorities. We believe that thanks to the work, project partners have gained a much better understanding of the status of two important diseases in the Pamirs, an area that has almost never been investigated scientifically, yet where livestock and natural resources are key economical and cultural assets.

Above: The people of the Pamirs face extreme conditions, little to nothing in the way of medical or veterinary services, and are some of the most disadvantaged communities in the world. ©WCS

Left: Participants to the transboundary ecosystem health workshop, March 2012, Dushanbe, Tajikistan (Right to left: Dr. Mullojon Amirbekov, Dr. Abdol Baqi Mehraban, Dr. Francois Thiaucourt, and Dr. Jacques Godfroid).

Challenges

As a facilitating partner WCS has faced (or at least identified) three main challenges throughout the project:

Communication problems: While the collaborators in Afghanistan and Pakistan had in general a good to excellent understanding of English, this was not the case in Tajikistan where the staff is literate in Tajik and Russian but had poor literacy in English. This communication problem rendered the organization of the field phase of the project in this country and of the final workshop complicated and partly decreased the efficiency of the collaborative interactions during this final workshop. Although Afghan participants could communicate with Tajik counterparts in the shared Tajik language, this could not be achieved by most participants from Pakistan. This communication problem is likely to slow down further collaboration initiatives between Tajikistan and collaborators from the two other countries.

Weak technical capacity in field sampling: With the exception of Pakistan, the technical and logistical capacity at implementing disease screening surveys in remote areas of Afghanistan and Tajikistan require significant improvements. It is noticeable that veterinary institutions in these countries lack well-trained field staff capable of completing large-scale sampling efforts according to international standards. Competent staff exist but either avoid involvement in field activities or are already involved in other time-consuming professional activities. The logistical capacity would also need considerable improvement. The principles of sample storage and refrigeration during sample transportation is known yet often insufficiently implemented. In Afghanistan where infrastructure is nonexistent or has been

destroyed it will take considerable time to build the appropriate network that will simplify logistical constraints. Other methods exist but are often difficult or too expensive to put in place. This logistical problem is likely to depreciate the quality of future epidemiological surveys in the most remote areas. During the project we have extensively communicated with partners over how to improve the conduct of this kind of research.

Weak financial capacity: While veterinary work in Afghanistan is largely supported by foreign aid and is better institutionalized in Pakistan, the financial capacity of authorities responsible for animal health surveillance in Tajikistan is worryingly low, impairing the ability of this structure to fulfill its epidemiological surveillance mandate. In this country this duty is largely supported by FAO. In Afghanistan foreign funds are helping to rebuild the surveillance capacity; however, the mechanisms that would render the system self-sustainable are not in place.

Other challenges: A number of other, less important, challenges also contributed to reducing the organizational efficiency of the project. Among those we note the delay at concluding preliminary agreements between AAAS and WCS and later between WCS and UVAS, which delayed the inception of the project and complicated the organization of the one-year work plan, considering that field work can only be undertaken during the three months of summer in the high-elevation Pamirs. The difficulty of forwarding the refrigerated serological kits to project partners with a reliable shipping company also had to be resolved and rare flight connections between neighboring project partner countries complicated the organization of the final workshop in Dushanbe, Tajikistan.

Achievement of Particular Objectives

The particular objectives for this project were to:

1. Identify priorities for disease research (foot and mouth disease, brucellosis, plague, caprine contagious pleuropneumonia, nutritional deficiencies, etc.) of national and international concern in the transboundary Pamirs region. The study indeed provided the first set of scientific data on the serological occurrence of brucellosis and contagious caprine pleuropneumonia in the Pamirs. During the final workshop, further important initiatives related to these diseases have been proposed to participants by foreign experts. Eventually participants agreed to publish in collaboration the results of the serological screening work in peer-reviewed journals.
2. Foster an integrated approach at both the agency and ministry levels to disease research and management in the transboundary Pamir region with an emphasis on understanding the epidemiology and ecology of key disease cycles in livestock, wildlife and human populations. This was definitely achieved at the level of participating entities (UVAS in Pakistan, General Directorate of Animal Husbandry and Production in Afghanistan, and State Veterinary Inspection Agency in Tajikistan). We believe it reached the ministry level in Tajikistan thanks to the active participation of FAO in the final workshop and the presence of the Deputy Ministry of Agriculture during the first day. We have not yet assessed how this technical knowledge diffused within higher authorities in Afghanistan and Pakistan.

Laboratory work by Ms. Nadia Mukhtar at the University of Veterinary and Animal Sciences, Lahore, Pakistan.

3. Train young scientists and future leaders in the agricultural, environmental and health sectors in an integrative and trans-disciplinary (or multi-disciplinary) approach to study and manage diseases at the livestock/wildlife/human interface. This important scope was in our opinion well achieved. In Afghanistan, young veterinarians and paraveterinarians affiliated with the private sector and NGOs were directly involved in the

field work; two of them participated also in the final workshop in Dushanbe. In Tajikistan young "aspirants" of the Academy of Agriculture Sciences and a student from Veterinary School led the field work and participated actively in the final workshop. In Pakistan promising postgraduate and undergraduate students were involved in all stages of the project, and two PhD candidates participated in the final workshop in Dushanbe. All young scientists were very active at interacting with workshop participants and offered presentations in English.

4. Foster the creation of an information network based on veterinary auxiliaries, communities and rangeland managers that will help mitigate disease transmission and improve health at the livestock/ wildlife/ human interface. This activity is already largely developed in the Afghan Pamirs by WCS thanks to the financial support of USAID. Presentations of this work were offered by WCS during visits to the three countries and at the final workshop. Provincial animal health managers were involved in the organization of field activities, and those from Tajikistan and Pakistan joined the final workshop. An influential member of a local community from Gilgit-Baltistan, Pakistan was invited to the final workshop. While cooperation within this network of health workers has been actively built (such as in Afghanistan) or partially implemented (such as in Pakistan), considerable work will have to be invested in Tajikistan to increase the cooperation within this network. In this country FAO is actively involved in facilitating this process.
5. Build international collaboration that links students, scientists, and policy makers within the animal disease and natural resource management fields to their counterparts in United States. This objective was only partially attained. There are two main reasons for that. The first reason is that contagious caprine pleuropneumonia, one of the two diseases targeted by the project, has never been reported from the United States or anywhere in North America. Currently there are no institutions or agencies as active and productive as European, Asian or South African counterparts in scientific research related to CCPP. There are two reference laboratories for CCPP recognized by OIE, both in Europe. In the field of CCPP, international collaboration was therefore built and actively promoted during the project with the two reference laboratories in the UK and France. On the other hand, brucellosis occurs in the United States and the ecology of the disease in domestic and nondomestic hosts is most actively studied in North America. Unfortunately the two US experts approached for the project could not attend or had to cancel their attendance in the final workshop and we had to invite, on short notification, a recognized expert affiliated with the Norwegian Veterinary School and the University of Pretoria.
6. Advance the incorporation of disease management in the field of sustainable agriculture and natural resource management through collaborative research and the global dissemination of tested approaches through new and established networks. Participants have agreed to render public the results of their work, and to disseminate these results in peer-reviewed publications.

Lesson Learned and Further Steps

Overall the project was of great benefit in bridging the current gaps in knowledge and communication among and between participants and connecting them with world experts in the field of CCPP and brucellosis. A number of small collaborative initiatives have been discussed or initiated (see previous section on final recommendations).

Tajikistan also has emphasized to international donors and implementing agencies (e.g., FAO) the need for modernization and restructuring of the veterinary system and immediate improvement of some analytical capabilities, especially in the field of CCPP. During the final workshop interactions between international experts and participants provided an excellent opportunity to emphasize responsible research conduct in the field of sampling methodology, laboratory analysis, and result interpretations.

An important lesson learned about building collaboration in the field of health in this region of the world is that it very much requires the combination of true support from leadership, appropriate and smooth facilitation, and globalization of health topics. Dr. Mohibullah Halimi in Afghanistan, Dr. Muhammad Nawaz in Pakistan and Dr. Mullojon Amirbekov were those strong leaders who enabled the projects to run smoothly and successfully. We also

believe it is important to achieve progress in the framework of initiatives involving a strong field component. The field component is extremely important to develop within any such project as it provides both skill development opportunities and solid data upon which to build plans and further actions. In Central Asia, too often too much is ascertained or extrapolated because of the lack of good quality field data or the lack of its dissemination.

The relatively small scale of the project was also deemed important. The principles of ecosystem health first require their explanation and dissemination among a small and educated group of people to avoid misunderstanding and the emergence of unnecessary controversy. For example, the ecosystem health paradigm does not systematically promote disease eradication and acknowledges that infectious agents may play an important role within the ecosystem, including positive aspects in the long term. Such modern concepts are often less acceptable to large, unselected audiences who may be locked into older paradigms.

Future development of an ecosystem health initiative in the transboundary context of the Pamirs will obviously depend on the availability of funding. WCS is working at finding this resource to continue fostering transboundary ecosystem health in the three countries that have contributed to the project. Thanks to this successful project and the increasing collaborations fostered in the region, WCS hopes to continue promoting global health in the Pamirs.

Final Statement

The American Association for the Advancement of Science's goal for their program on 'International Engagement: Responsible Bioscience for a Safe and Secure Society' was to support scientific relationships and promote increased collaboration among scientists within the BMENA region and more developed nations. Projects funded under this solicitation were to:

- facilitate long-term, mutually beneficial international scientific collaboration in the biological sciences;
- explore common norms for a shared sense of safe, secure, and ethical conduct of research and methods for implementation;
- explore, recommend and suggest ways of overcoming barriers and challenges towards international scientific collaboration in the areas of biotechnology, infectious disease and biomedical strategies to combat disease;
- promote education, recruitment, and retention of talented scientists; and
- build a network of scientific and institutional leaders in the region and their U.S. counterparts.

We are pleased that the project on 'Transboundary Ecosystem Health in the Pamirs' has contributed directly to each of these goals for Tajikistan, Pakistan, and Afghanistan, and we believe that the project has been a critical step toward improving each of these aspects of international engagement in responsible bioscience for a safe and secure society.

Acknowledgements

We wish to thank AAAS for their financial support and comprehensive efforts to promote global health in the Pamirs. We also wish to thank USAID for their support for parts of this project within Afghanistan. Without this support the project would not have been possible. Objectives would have never been reached without the support and active participation, facilitation and implementation of collaborators in the three countries involved in the project. In Afghanistan we wish to thank Mohibullah Halimi, Ghulam Muhammad Ziay, Noor Agha Sliman Khil, Fahima Mahbodi and Willy Schauwers. In Pakistan, Muhammad Nawaz, Ghulam Abbas, Asamat Ali, Imtiaz Aziz Agra, Muhammad Zubair Shabbir, Nadia Mukhtar, Tasara Anjum, Arfat, Hashaam. In Tajikistan, Mullojon Amirbekov, Abdurakhmon Makhmadshoev, Orom Ziyoev, Dustmurod Vahobov, Khalil Karimov. Also we thank WCS staff for efficient help, and particularly Lisa Yook in New York for the careful financial supervision of the project, David Lawson the WCS Afghanistan Country Director, Mayoor Khan, Pakistan Program Manager, and Hafizullah Ziaodin and Ali Madad Rajabi Mosa Khan, who led the ecosystem health initiative in Afghanistan.

Disease is a significant risk to livelihoods and to human health as well as to livestock and wildlife across the Pamirs ecosystem. ©WCS



Конфронс
Бемориҳои сарҳадгузари чорво дар Помир ва атрофи он

Conference on
Transboundary Animal Diseases in Pamirs and Outskirts

5 - 7 Марти соли 2012 ш. Душанбе

5 - 7 March 2012, Dushanbe

Рӯзи 1-ум (5-уми Марти соли 2012)

14:00-14:15 Сарсухан, сухани ифтитоҳӣ, муҳокимаи барномаи рӯз (Доктор Муллоҷон Амирбеков, Сардори ХНДБ, ВК ҶТ)
14:15-14:25 Сухани ифтитоҳи Сиҷоуддин Исроилов – Муовини Вазири кишоварзии Ҷумҳурии Тоҷикистон
14:25-15:00 Баромадҳо (Доктор Абдулбоқӣ Меҳрубон, Зулфия Давлатбекова, Мизроб Амирбеков)
15:00-15:20 Танаффус ба чойнӯшӣ
15:20-15:40 Шиносоии WCS ва лоиҳаи AAAS (С. Островски)
15:40-16:00 Сохтори ветеринарӣ ва вазъи солимии чорво дар Гилгит-Балтистан (Др. Ғулам Аббас, шӯъбаи солимии чорво, Гилгит-Балтистан, Пакистан)
16:00-16:20 Сохтори ветеринарӣ ва вазъи солимии чорво дар ВМКБ (Др. Бурибеков Анвар, Раёсати назорати давлатии байтории ВМКБ, Тоҷикистон)
16:20-16:40 Ҷамъбасти барномаи рӯзи якум, муҳокимаи барномаи рӯзҳои 2-юм ва 3-юм.

Рӯзи 2-юм (6-уми Марти соли 2012)

9:00-9:30 Сухани ифтитоҳӣ, Муҳокимаи барномаи рӯз
9:30-10:30 Бемории буғумдарди чорвои хонагӣ ва ваҳшӣ, сатҳи дониш (Проф. Др. Жак Годфрауд, Тибби ветеринарии Арктика, Норвегия).
10:30-10:50 Танаффус ба чойнӯшӣ
10:50-11:10 Бемории буғумдард дар Қирғизистон (Йолдошбек Касимбеков, «Институти солимии халқ ва тропикӣ» - и Шветсария)
11:10-11:30 Бемории буғумдард дар Тоҷикистон (Др. Муминов Абдулло директори Маркази назорати маводҳои байторӣ, Тоҷикистон)
11:30-11:50 Бемории буғумдард дар Афғонистон (Др. Фаҳима Маҳбобӣ, МТТБ, Афғонистон)
11:50-12:10 Бемории буғумдард дар Покистон (Проф. Др. Таҳир Яқуб, Донишгоҳи ветеринарӣ ва чорводорӣ, Лаҳор, Покистон)
12:30-14:00 Хӯроки нисфирӯзӣ
14:00-15:00 Ташхиси бемории буғумдарди чорвои хонагӣ ва ваҳшӣ (Др. Жак Годфрауд, Тибби ветеринарии Арктика, Норвегия)
15:00-15:20 Танаффус ба чойнӯшӣ
15:20-15:30 Натиҷаи ташхиси серологии тобистони соли 2011 дар Бадахшон (Др. Ғулам Муҳаммад Зияӣ, МТТБ, Афғонистон)
15:30-15:40 Натиҷаи ташхиси серологии тобистони соли 2011 дар Гилгит-Балтистан (Хонум Надя Мухтар, ДВЧ, Покистон)
15:40-15:50 Натиҷаи ташхиси серологии тобистони соли 2011 дар ВМКБ ва вилояти Хатлон (Ҷаноби Зиёев Ором, АИКТ, Тоҷикистон)
15:50-17:00 Мавриди муҳокима қарор додани натиҷаҳои ташхис ва зинаҳои ояндаи тараққиёбӣ (Аз тарафи Др. Жаком Годфрауд ва Стефан Островски)

Рӯзи 3-юм (7-уми Марти соли 2012)

8:30-9:00 Сухани ифтитоҳӣ, Муҳокимаи барномаи рӯз
9:00-10:00 Бемории сироятии плевропневмонияи бузҳо (БСПБ), сатҳи дониш (Франсуа Тиокар)
10:00-10:15 Танаффус ба чойнӯшӣ
10:15-10:30 БСПБ дар Покистон ва натиҷаи ташхиси серологии тобистони соли 2011 дар Гилгит-Балтистан (Др. Муҳаммад Зубаер Шаббир ва Таҳир Яқуб, ДВЧ, Покистон)
10:30-10:45 БСПБ дар Тоҷикистон ва натиҷаҳои ташхиси серологии тобистони соли 2011 дар ВМКБ ва вилояти Хатлон (Др. Музафар Аноятбеков, Тоҷикистон)
10:45-11:00 БСПБ дар Афғонистон ва натиҷаи ташхиси серологии тобистони соли 2011 дар Бадахшон (Др. Ғулам Муҳаммад Зияӣ МТТБ, Афғонистон)
11:00-12:00 Мавриди муҳокима қарор додани натиҷаҳои ташхиси тобистони соли 2011 ва зинаҳои ояндаи тараққиёбӣ (Аз тарафи Франсуа Тиокар ва Стефан Островски)
12:00-14:00 Хӯроки нисфирӯзӣ
14:00-14:30 Шиносоӣ бо комплекти рақобатпазири ЭЛИЗА барои ташхиси дарёфти Бемории сироятии плевропневмонияи бузҳо (Франсуа Тиокар)
14:30-15:30 Ҷамъбасти барнома, зинаи оянда, сухани ҷамъбастӣ.
16:00-18:00 Омӯзиши комплекти ЭЛИЗА дар Маркази миллии ташхиси байторӣ истифода карда мешавад (Франсуа Тиокар).

19:30 Банкети ҷамъбасти ҳамоиш

Day 1 (5 March 2012)

14:00-14:15	Introductions, welcoming speeches, description of agenda (Dr. Mullojon Amirbekov – State Veterinary Inspection Service, Tajikistan)
14:15-14:25	Welcoming speech (Dr. Sijouddin Isroilov, Deputy Minister of Agriculture, Tajikistan)
14:25-15:00	Introductions (Dr. Abdulbaki Mehrabon, Mrs Zulfiya Davlatbekova, Mr Mizrob Amirbekov)
15:00-15:20	Tea Break
15:20-15:40	Presentation of WCS and AAAS project (Dr. Stephane Ostrowski, Wildlife Conservation Society, USA)
15:40-16:00	Veterinary system and animal health care in Gilgit-Baltistan (Dr. Ghulam Abbas, Livestock and Dairy Development Department, Gilgit-Baltistan, Pakistan)
16 :00-16:20	Veterinary system and animal health care in Gorno Badakhshan (Dr. Buribekov Anvar, State Veterinary Inspection in GBAO, Tajikistan)
16:20-16:40	Summary of Day One, Review of Day Two and Day Three Agenda

Day 2 (6 March 2012)

9:00-9:30	Welcome Remarks, Review of Agenda
9:30-10:30	Brucellosis in domestic and non-domestic animal hosts, state of knowledge (Prof. Dr. Jacques Godfroid, Norwegian School of Veterinary Science, Norway)
10:30-10:50	Tea Break
10:50-11:10	Brucellosis in Kyrgyzstan (Dr. Joldoshbek Kasymbekov, Swiss Tropical and Public Health Institute, Switzerland)
11:10-11:30	Brucellosis in Tajikistan (Dr. Abdullo Muminov, Center of Control of Veterinary Preparations, Tajikistan)
11:30-11:50	Brucellosis in Afghanistan (Dr. Fahima Mahbodi, CVDRL, Afghanistan)
11:50-12:10	Brucellosis in Pakistan (Prof. Dr. Tahir Yaqub, University of Veterinary and Animal Sciences, Lahore, Pakistan)
12:30-14:00	Lunch
14:00-15:00	Diagnosis of Brucellosis in Livestock and Wildlife (Dr. Jacques Godfroid, Norwegian School of Veterinary Science, Norway)
15:00-15:20	Tea Break
15:20-15:30	Results of recent serological investigations in Badakhshan (Dr. Ghulam Mohamad Ziay, CVDRL, Afghanistan)
15:30-15:40	Results of recent serological investigations in Gilgit-Baltistan (Ms. Nadia Mukhtar, University of Veterinary and Animal Sciences, Pakistan)
15:40-15:50	Results of recent serological investigations in GBAO and Khatlon (Mr. Orom Ziyoev, Academy of Agricultural Sciences, Tajikistan)
15:50-17:00	Discussion on recent results and further developing steps (facilitated by Drs. Jacques Godfroid and Stéphane Ostrowski

Day 3 (7 March 2012)

8:30-9:00	Welcome Remarks, Review of Agenda
9:00-10:00	Contagious Caprine Pleuropneumonia (CCPP), state of knowledge (Dr. François Thiaucourt, CIRAD, OIE CCPP/CBPP Reference Laboratory, France)
10:00-10:15	Tea Break
10:15-10:30	CCPP in Pakistan and recent serological results from Gilgit-Baltistan (Drs. Muhammad Zubair Shabbir and Tahir Yaqub, UVAS, Pakistan)
10:30-10:45	CCPP in Tajikistan and recent serological results from GBAO and Khatlon (Dr. Muzaffar Anoyatbekov, State Veterinary Inspection, Khatlon, Tajikistan)
10:45-11:00	CCPP in Afghanistan and recent serological results from Badakhshan (Dr. Ghulam Mohamad Ziay, CVDRL, Afghanistan)
11:00-12:00	Discussion on recent results and further developing steps (facilitated by Drs. François Thiaucourt and Stephane Ostrowski)
12:00-14:00	Lunch
14:00-14:30	Presentation of the new competitive ELISA kit for CCPP exposure diagnosis (Dr. François Thiaucourt, CIRAD, France)
14:30-15:30	Summary, Next Steps, Closins Statements
16:00-18:00	Training on the ELISA kit use at the Republican Veterinary Laboratory (Dr. François Thiaucourt, CIRAD, France)
19:30	Closing Banquet

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE
1200 New York Ave NW, Washington, DC 20005
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WILDLIFE CONSERVATION SOCIETY
2300 Southern Blvd, Bronx
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Appendix II. List of Participants

TRANSBOUNDARY ECOSYSTEM HEALTH IN THE PAMIRS

DUSHANBE MEETING, MARCH 5-7, 2012
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Marco Polo sheep, a subspecies of argali, are a key component of the high-elevation Pamirs ecosystem. ©Beth Wald

Appendix III. The "One Health" Paradigm

People and the natural resources from which they derive their livelihoods are integral parts of their given ecosystem – a dynamic complex of plant, animal and micro-organism communities and the nonliving environment interacting as a functional unit. The World Health Organization (WHO) defines health as a state of complete physical, mental and social wellbeing and not just the absence of disease and infirmity (Deem et al., 2001; Last, 1983), and this definition implies a link between human health and ecosystem integrity. Ecosystems provide vital services to human and animal communities, for example, by providing natural filtering systems, sources of food and fibre, and clean water (Rapport, 1998). Disruption of some of these natural services, these ecosystem "products," will have impacts on air, water, and other renewable resources and thus health.

The concept of "One Health" – the interface between human health and that of the environment –is not new. During the 1960s and 1970s visionary attempts were made to construct a bridge between, for example, medicine and agriculture. Discussions on medical ecology and zoology, animal monitors of the environment, and comparative biology and medicine were the precursors to a more holistic approach to animal and human health (Schwabe, 1974). This concept has been further developed through programmes such as Envirovet (Beasley, 1993) and the development of ecosystem health as an integrative science (Rapport et al., 1998).

The "One Health" concept takes conservation medicine a step further by broadening an ecological definition of health (Kock, 1996), while acknowledging that conservation medicine's primary goal is the pursuit of ecological health – the health of ecosystems and the species that live within these systems (Else and Pokras, 2002; Tabor, 2002). Conservation medicine attempts to bring together many disciplines, including human and public health, epidemiology, veterinary medicine, toxicology, ecology, and conservation biology (Meffe, 1999).

Adopting an ecosystem approach to health issues related to protected areas and the communities that live close to or in these areas represents an attempt to bridge the gaps that exist between the different disciplines and create an enabling environment for expanding benefits to both protected areas and local people. Conservation medicine indeed encourages practitioners to look both upstream and downstream for potential environmental impacts of land uses and activities (Tabor, 2002). A "One Health" approach can be attractive to a broader constituency, as it can be viewed with equal clarity through a conservation, development, or public health lens. Powerful biomedical tools are fortunately available to address these complex issues and develop preventive approaches.

The state of health of an ecosystem can be judged by criteria very similar to those used for evaluating the health of a person or animal, namely, homeostasis (having balance between system components), absence of disease, diversity and complexity, stability and resiliency, and vigour and scope for growth. An ecosystem can be viewed as a patient (Rapport, 1998) and can be evaluated in terms of objective standards that relate to the system's capacity for organization, vigour, and resilience. Identification and diagnosis of problems and the application of solutions along with biodiversity assessment and monitoring represent a basic approach to ecosystem health care. In biomedical terms this would be achieved through detection, diagnostics, prognostics, treatment, and prevention. In the case of ecosystem health, the precautionary principle supports an approach based on the tenets of preventive medicine – anticipatory action to protect the environment from possible or irreversible harm (Calver, 2000). The "ecosystem as patient" metaphor can also help shape our overall approach to conservation: "Critical clinical problems mandate a rigorous diagnostic plan, a multifaceted therapeutic plan, clear communication, and short- as well as long-term monitoring. Critical conservation problems deserve no less" (Osofsky, 1997). In addition, a preventive medicine approach allows for action to be taken with a causal relationship being reasonably suspected if not proven, thus lessening the risks of uncertainty.

The development of ecological indicators can yield powerful tools that can generate scientific information on the status or trends of important ecosystem health parameters (Sayre et al., 2000). In parallel, epidemiological tools such as disease surveillance and monitoring can be linked to various indicators in terms of disease and health trends. The use of indicators will help simplify data for decision makers, and provide a focal point for strategic planning, policy formulation, resource allocation, and specific management actions (Boyce, 2003).

[From: Osofsky, S. A., Kock, R. A., Kock, M. D., Kalema-Zikusoka, G., Grahn, R., Leyland, T., and W. B. Karesh. 2005. "Building Support for Protected Areas Using a 'One Health' Perspective," pp. 65-79, in McNeely, J. A. (ed.) Friends for Life: New Partners in Support of Protected Areas. IUCN, Gland, Switzerland and Cambridge, United Kingdom.]

Appendix IV. Project Partners

THE DIAGNOSTIC LABORATORY (UDL) OF THE UNIVERSITY OF VETERINARY AND ANIMAL SCIENCES (UVAS), LAHORE, PAKISTAN

UDL is a veterinary diagnostic facility with one of the the best reputations in Pakistan, and geographically it is one of the closest facilities of such quality to Gilgit-Baltistan (the province covering the Pakistan Pamirs). UDL provides an array of diagnostic tests that are based on quality and cost-effective testing to enhance the production potential of livestock and poultry in the country. The lab is equipped with modern diagnostic equipment, and it is included in the list of disease diagnostic laboratories having international equivalence status for testing laboratories (through the International Laboratory Accreditation Cooperation [ILAC] and Asia Pacific Laboratory Accreditation Cooperation [APLAC]). UDL also provides a solid platform for researchers investigating the complex factors affecting the livestock and poultry sectors, and it organizes workshops, provides training, refresher courses and diploma courses for UVAS staff, students, farmers, lab and field professionals and personnel from related institutions across the country.

THE CENTRAL VETERINARY DIAGNOSTIC & RESEARCH LABORATORY (CVDRL), KABUL, AFGHANISTAN

The Central Veterinary Diagnostic & Research Laboratory (CVDRL) and its regional/provincial affiliates are the only operational structures of their kind in Afghanistan. They are linked with the Directorate of Animal Health and Production (DAH&P), Ministry of Agriculture, Irrigation and Livestock. New and modern facilities have been inaugurated in Kabul in November 2009, the former laboratory buildings being refurbished into office accommodations. The laboratory is equipped to carry out a wide range of diagnostic investigations largely focusing on parasitology, microbiology, serology and hematology.

The CVDRL aims at providing services to the farming community of Afghanistan as well as safety and quality assurance to consumers. Its service is also an integral component of the recently-established national epidemio-surveillance network, in order to provide an early warning system for the detection of highly contagious animal diseases or diseases that can be transmitted from animals to human beings. The European Union has provided funding for expenses related to consumables including laboratory instruments and other equipment such as refrigerators and freezers, incinerator, glass and plastic-ware.

For the last seven years the staff has benefited considerable technical enhancement through training and supervision of a variety of foreign technical expertise (USA/USAID, USDA, MAMRU-3; EC/AHDP; UN/FAO). In 2004, the FAO initiated a regional transboundary animal disease control program in Afghanistan, which was part of broader regional efforts in Central and South Asia to complete the process of providing evidence for the global eradication of rinderpest and the control and containment of other trans-boundary animal diseases, including foot and mouth disease, peste des petits ruminants and avian influenza (HPAI). The program has supported and continues to support the operation of a previously established enzyme-linked immuno-sorbent assay (ELISA) test unit at the laboratory. This project is notable for having assisted the DAH&P to reach a point where it was able to submit a dossier detailing sufficient evidence for the OIE to consider the formal declaration of freedom from rinderpest in Afghanistan. In order to achieve a status of long-term sustainability, the CVDRL tries to build its own capacity and structure its development to seek independence from foreign aid.

THE STATE VETERINARY INSPECTION SERVICE/CENTRAL VETERINARY LABORATORY, DUSHANBE, TAJIKISTAN

The SVIS reports to the Ministry of Agriculture and Land Reform in Tajikistan, and is responsible for protection against infectious and other illnesses of animals. The SVIS has been working closely with FAO since 2003, espe-

cially on brucellosis monitoring and control, focused on the western and northern parts of the country (i.e., Kulyab zone including districts in Khatlon Province as well as southern districts in Sughd Province). SVIS has authority over the National Center of Veterinary Diagnostic (NCVD) in Dushanbe. This laboratory is in the process of acquiring modern expertise and has received support from foreign donors to build its analytical capacity. The staff is dedicated to the work and competent. Unfortunately this agency suffers extremely low financial resources that has the potential to jeopardize the long-term professional commitment of its dedicated staff.

THE WILDLIFE CONSERVATION SOCIETY (WCS), NEW YORK, USA

WCS is a US-based non-profit based in the Bronx Zoo in New York and with over 115 years of international experience. WCS now works on more than 500 projects in 60 countries around the world. WCS has been active in the Pamir region since 1996, and now has full programs and projects in both Afghanistan and Pakistan, and strong contacts in Tajikistan. The overall purpose of WCS work in the Pamirs is the promotion of sustainable livelihoods among local people and the protection of the ecological integrity of a fragile mountain landscape through a science-based approach to joint management and conservation. The important benefits include:

- Improved management of biodiversity;
- Increased scientific collaboration and more comprehensive research;
- Improved opportunities for training and information sharing;
- Improved management of wildlife resources within each country;
- Increased regional economic benefits.

The WCS Global Health Program (GHP) uses a multi-disciplinary approach to address the complexities of maintaining ecosystem health. Working with in-country wildlife experts, government agencies and public health officers, the GHP creates local training programs on wildlife diseases, conducts creative health investigations, advices on policies and compiles preventive guidelines to reduce disease transmission between wildlife, humans and their domestic animals. This program – the first of its kind in the world – benefits from the expertise in animal nutrition, pathology and clinical medicine of resident veterinarians and scientists based at WCS's Wildlife Health Center in New York.

The Global Health Program defines its goals as:

- Providing global leadership in wildlife health and wildlife well being;
- Engaging new and influential partners in conservation and connect people with wildlife (One World – One Health); and
- Developing and share tools for advancing conservation.

The Programs also define their strategies for these goals as:

- Building capacity to care for and protect the health of wildlife worldwide;
- Gathering and applying critically needed information to care for and protect the health of wildlife, people, and domestic animals; and
- Developing and promoting policies, guidelines, and best practices to ensure a healthy planet.

In the Pamirs, WCS has been active in northern Pakistan since 1996 on a program aimed at community governance, field research and capacity building for natural resource management. WCS has a country program office in Gilgit and now works in over 40 valleys across the region. In Afghanistan WCS has been active since 2006 with support from USAID, with a full-scale program of over 70 staff members working on a range of activities from drafting environmental legislation, building government capacity, community governance, protected area design and management, and wildlife research and management. WCS helped create Afghanistan's first official protected area, Band-e-Amir National Park, and now works with over 55 communities to improve natural resource manage-

ment.

WCS has studied local community livestock herds in the Afghan Pamirs since 2006, recording their species composition, numbers, ownership, range use, and transhumance patterns. The health status of livestock was first assessed by clinical examinations and questionnaire investigations. After analyzing the data collected during our 2006 mission, we decided that we needed to further investigate the range used by livestock and to better measure disease prevalence in the area, as both sets of information are essential to our understanding of the risk of dissemination of pathogens between livestock and wild ungulates. Therefore, from 2007, we carried out field surveys to 1) document the range used by livestock in the western Big Pamir in areas where Marco Polo sheep are still known to survive, and 2) collect blood samples from livestock (more than 1,000 blood samples from sheep, goats, cattle and yaks), to test their exposure to a number of pathogens that may pose a disease risk both to them and to the wild ungulates they may encounter. We identified the CVDRL in Kabul as the principal technical partner to carry out laboratory analyzes in country. We provided CVDRL with testing kits and collaborated in training Afghan staff at sampling animals, processing collected materials and analyzing them.

Our health results in the Afghan Pamirs are described in four ways:

1. Identification and mapping of range overlap between wild ungulates and livestock in the western Big Pamir;
2. Parasite collection and serological screening carried out on this same population of livestock;
3. Synthesis on the risk of cross-species dissemination of pathogens in the Pamirs; and
4. Recommendations to reduce the risk of disease spillover between livestock and wild sheep.

In the Afghan Pamir we have started an experimental mass vaccination of cattle and yak against foot and mouth disease which is endemic in this mountain range. About 4,000 cattle and yak will be regularly vaccinated for three consecutive years while 1,500 animals will not be vaccinated. The experiment intends to evaluate at a landscape-scale the effects of this vaccination on herd productivity, food security and the risk of disease spill-over to wildlife.

The WCS health work carried out in the Afghan Pamirs since 2006 is beginning to clarify the complex issue of livestock disease epidemiology in the Afghan Pamir ecosystem and bringing greater insights into the risk of disease spillover between domestic and wild ungulates in the Pamir Mountain range.

See www.wcsafghanistan.org for more information and reports on the work in Afghanistan.

Left: The delegation from Tajikistan with invited disease experts and meeting organizers, March 2012, Dushanbe, Tajikistan.
Right: The delegation from Afghanistan with invited disease experts and meeting organizers, March 2012, Dushanbe, Tajikistan.

WILDLIFE CONSERVATION SOCIETY

The Wildlife Conservation Society saves wildlife and wild places worldwide. We do so through science, global conservation, education and the management of the world's largest system of urban wildlife parks, led by the flagship Bronx Zoo. Together these activities change attitudes towards nature and help people imagine wildlife and humans living in harmony. WCS is committed to this mission because it is essential to the integrity of life on Earth.