

Rapid Assessment
of
Flood Impact on the Environment in Selected Affected Areas of Pakistan



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Cover page: Designed by Ahmad Khan

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Abstract

In Pakistan, the flood of July and August, 2010, caused unprecedented damage and threatened human lives on a national scale including the provinces of Gilgit-Baltistan, Khyber Pakhtunkhwa, Punjab and Sindh, and the Azad Jammu and Kashmir. In Khyber Pakhtunkhwa, specifically, damage was inflicted in the districts of Chitral, Dir, Swat, Kohistan, Mansehra, Charsadda, Nowshera, Peshawar, Bannu and Dera Ismail Khan. The flood took a heavy toll of human lives and severely impacted a wide-range of infrastructure including tourist hotels and centres, livestock, agriculture, forests, and wildlife. By August, 2010, the value of damage caused could not yet be assessed because, in much of the area floodwater had not yet receded and a significant proportion of the area remains inaccessible.

The damages caused to natural forests, wildlife and their habitats, rangelands, and aquatic flora and fauna has not been considered by any organisation at this stage due to inaccessibility, lack of expertise, lack of baseline information, and lack of awareness of natural resources-livelihood nexus. It is obvious that ultimately the natural resources have to bear the brunt of the damages caused by the flood in one way or the other ranging from extraction of timber, firewood, and fodder to earning cash from sale of forests and wildlife. The flood has also caused direct damages to natural environment and natural resources including washing out of forest land, killing of wildlife, washing out of indigenous aquatic fauna, spreading of exotic flora and fauna, spreading of epidemic diseases, increase in pollution, and destruction of habitats.

Findings of this study suggest that the flood has severely damaged the natural forests, plantations, community forests and trees raised for fuelwood, habitat of wildlife and ex-situ conservation areas, fish resources and fisheries development infrastructure, and has altered habitat for some of the species such as Indus dolphin and hog deer. The findings suggest that there will be a reversion to use of natural resources for livelihood, as the existing resources with the communities are either washed or are thinned out. It is therefore imperative to take early measures, so as to avoid secondary damages.

This report, prepared for the UNDP gives a list of recommendations to address the current situation and the situation that is expected to emerge once rehabilitation starts.

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1. Introduction

The severe floods, resulting from heavy monsoon rains and freak weather systems commenced in July, 2010, in the high altitude, northern parts of the country. The rains, which broke a long standing, 100 years record flood in early 1900s, rapidly became devastating for the provinces of Khyber Pukhtunkhwa, Punjab, Gilgit-Baltistan and Azad Jammu and Kashmir. They also inflicted heavy damage in some districts of Sindh and Balochistan. By August 22nd, 2010, the BBC estimated that more than 2,000 people had lost their lives, not counting the missing persons whose bodies may still be buried in silted-up areas. The flood waters indirectly affected about 20 million people according to UN sources and figures presented by President Asif Ali Zardari in a press conference with UN Secretary General, Ban Ki Mon. By August 22nd, 2010, the floods had affected about 160,000 km², and were increasing as they flowed towards the Indus Delta (see figure 1). It is worth noting that the number of people affected by this disaster exceeded the combined total of affectees from the 2004 Indian Ocean Tsunami, the 2005 Kashmir earthquake, and the 2010 Haiti earthquake.



Figure 1: Devasted infrastructure and agriculture after the flood/Ayaz Khan, PWP

Floods, being a natural phenomenon are a part of the earth's bio-physical processes but these turn devastating when the effects are exacerbated by human activity such as clearing of vegetation, deforestation, intervention in natural drainage lines and permanent occupancy of wetlands in the buffer zones of riverbank ecosystem are not checked.

In response to the flood damages assessment, emergency rescue and rehabilitation, many organizations focused on human losses, damages to livelihoods, properties, and infrastructures. There are no, or very few, who showed concerns for assessment of the environmental impacts of the floods. The Pakistan Wetlands Programme, in response to the call and financial support from United Nations Development Programme, conducted a rapid assessment of environmental impacts of the floods in selected sites. Although the study was limited by a number of factors, yet this an initial assessment will provide baseline for detailed studies and environmental rehabilitation strategies in the future.

The Pakistan Wetlands Programme sent its field teams for a rapid assessment to the areas that were accessible (see annexure I for teams composition). The teams, after conducting the field work compiled field reports, which were analysed to produce this report for the use of UNDP Pakistan and its partner organizations.

2. Methods and Materials

The Pakistan Wetlands Programme organized four field missions to cover accessible areas of the following districts:

1. Swat district and lower parts of Shangla District, Khyber Pukhtunkhwa
2. Lower and upper Dir districts, Khyber Pukhtunkhwa
3. Charsadda and Nowshera districts, Khyber Pukhtunkhwa
4. Muzzafar Garh, and Layyah Districts, Punjab
5. Gilgit Baltistan, accessible districts in Gilgit

The field teams visited the selected districts and collected secondary and primary data from various sources. The secondary data is mostly compiled reports by relevant government line departments, while primary data is through interviews, and discussions with officials of governmental and non-governmental organizations. The primary data was also collected through interview, while using a check list as a guiding document, from the local communities affected by the floods.

The field teams submitted their findings for compilation of this report. The sampling in sites was limited by two key factors, 1. Access and communication to various areas, and 2. Willingness of respondents, as most of the people interviewed or met were concerned about food, shelter and emergency relief.

The data collection was focused on damages to the sectors of forest, wildlife, fisheries, livestock, and agriculture, while the ex-situ conservation facilities and in-situ conservation sites in the affected areas were also considered a priority for assessment of damages.

In spite of the challenges and constraints, the affected areas were visited and information was generated from the people in different villages of the selected districts. In addition to the interviews, coordinates of sites of interests were recorded with help of Global Position System (GPS).

The Global Information System laboratory of the Pakistan Wetlands Programme was used to generate maps that are given as cross reference in this report and in support of the findings presented here.

3. Constraints

- As a whole, it remained a challenging task to assess the damages caused to natural environment at this early stage when still the affected areas are under the flood water and the affected are in need of food, water, shelter and medicine. Moreover, the affected are prone to talk of food, water, medicine, and shelter and cannot visualize the direct damages caused to natural environment.
- Accessibility to most of the areas, particularly in Lower Dir, Upper Dir and Swat districts remained a constraint. The flood has washed all major and minor bridges and road links, thus cutting off most of the valleys from the main channels. The floods in Southern Punjab and Khyber Pukhtunkhwa also left many of the areas without road access.
- The time allocated to the rapid environmental impact assessment was not enough to cover the whole affected areas and thus selected samples were the only way to make

an assessment of the nature of damages. This is a constraint, but can be covered in detailed assessment. This constraint to the study also did not allow a quantitative estimation, and thus we have to rely on quantitative estimates.

- The team of Pakistan Wetlands Programme couldn't move to many parts of the affected districts in southern Punjab, as roads were flooded and communication means were not functioning. The team had to rely on collecting information from government line departments and local non-governmental organizations either through telephone calls or meeting them in person.

4. Findings of the Rapid Environmental Impact Assessment

4.1 Swat and Dir

4.1.1 Forest Resources

- Road links to most of the forested and remote valleys is not restored and therefore a comprehensive data is not available about damages to forests in Swat and Dir. According to the Khyber Pukhtunkhwa Forest Department, the surveys on the subject are in progress and a detailed damages assessment will be in place soon.
- The observations made during the field work suggest heavy damages to the forests resources in the valley bottom and in valleys. The visual scan of the area shows land slides on steep terrains in the forested valleys and washing out of forest patches along the river courses on valley bottoms. There was severe clouds bursts with heavy frequency in most of the areas that has severely damaged vegetation cover, soil cover and forests.
- The Chief Conservator of Forest, Malakand Circle, Mingora Office has reported the following forest damages so far;

Table 1: Damage Extent of Forest Resources

S.#.	Location	Activity	Area / Extent of damage
1	Kalam and Lower Swat	Drifted Timber	Forest department surveys for all the regions are underway and no exact figures have yet presented. Abdul Ghafoor, Divisional Forest Officer Wildlife Swat, however informed that estimated 800,000 cft of measured and marked stocked logs have been drifted by the river Swat. He further added that about 2,000,000 cft wood including standing conifer trees and stocked timber have been washed by the flood.
2	Kalam, Lower Swat	Nurseries	The flood has damaged about 25% of tubes and about 30% of flat beds in nurseries of the forest department.
3	Kalam, Swat, Alpuri, Malakand and Lower Dir	Afforestation	The flood has washed away about 20% of the plantations that were carried out during the 2009-10.

Source: Chief Conservator of Forests, Khyber Pakhtunkhwa, Peshawar and Divisional Wildlife Office, Mingora, Swat

- In addition to the protected forests managed by the Khyber Pukhtunkhwa Forest Department, the flood has inflicted heavy damages on communal forests and community plantations that were established by the projects such as Environmental

Rehabilitation Project (ERP), and Social Forests Project in Swat. There is no accurate and precise data available at the moment, but an educated guess made indicates that about 20% to 25% of the areas of communal forests and about 25% to 35% of the plantations are damaged (see figures 2, washed away logs in Swat).



Figure 2: Washed away logs collected and converted by people in Swat/phot: Ahmad Said, PWP

- According to the Forest Department and local communities, no visible damages to the natural forests are recorded in Lower Dir District.
- The estimated damages to tube plants of chir pine (*Pinus roxberghii*), eucalyptus, and phuali (*Acacia modesta*) is about 110,000 in Bandagai nursery, while some 80,000 tube plants of deodar (*Cedrus deodara*) are damaged in the same nursery of lower Dir district.
- The flood has damaged about 30% to 40% of the 800 acre plantation in Timargarah, about 25% to 35% of the 600 acres plantations in Chakdarra, and about 25% to 35% of the 400 acres plantation in Samar Bagh.
- Farm forestry and raising on-farms energy plantations is an old practice in Swat and Dir districts. The flood has heavily damaged the plantations of willow (*Salix babylonica* and *salix alba*) and poplar (*Populus euphratica*, *Populus ciliate*, *Populus nigra*) raised along the boundaries of agricultural fields and along the streams, and water channels. The damages to such plantations on lands near to the River Swat and its tributaries range from 50% to 80%. There are, however no exact estimates available yet.
- Farm Forestry is very common practice in District Lower Dir. It is mainly carried out along the river banks. Mostly Poplar being the cash crop is cultivated. The recent floods have caused damage to the farm forestry resources. According to the estimates presented by the Forest Department at Timargarah, about 1000 acres commercial poplar block plantations, 800 acres of domestic farm forests, and about 300 acres of linear plantations in lower Dir district are damaged (see figure 3, damage to linear plantation in Chakdarra).



Figure 3: Linear plantation and rice paddies near Chakdarra, Khyber Pukhtunkhwa/Ahmad Khan, PWP

- According to initial estimates, 30% of the natural forests of upper Dir District sustained damages either from river over flows, floods, cloud bursts and landslides.
- The flood has damaged the forest nursery in upper Dir and approximately 150,000 tube plants have lost to it.

4.1.2 Wildlife and biodiversity hotspots

River Swat is biologically an active wetland that has enormous biodiversity value. Its riparian zones are significant habitat for migratory water fowls and resident water birds. The findings of the study suggest the following damages from the flood to wildlife in district Swat, Lower Dir and Upper Dir:

- The flood has washed away the riparian substrates, spawning grounds, nesting areas of birds, swamps and ponds. These are significant habitats for migratory waterfowl, waders, and resident water birds and song birds. The flood forced fish to the banks, and there are reports of large catches by the locals of the Swat. The flood also forced the fish to flow to pond areas, where a good number is still found dead (see figure 4, picture of dead fish). The damages recorded during the field mission of the rapid assessment of the flood's impact suggested that *shizothorax spp.* (Swati fish) is affected the most, while fresh water eels are also found dead. The flood also washed the trout from upstream Madyan to as lower as Barikot. The local community reported to have caught trout fish in Mingora, Udigram, Panjigram, and Barikot. This must be a change in composition of the fish fauna and distribution of the fish species in the River and may pose threat to the resident species of the area.
- The flood has either washed away or silted up rice paddies along both sides of the river from Aman Darra to Khwaza Khela on the valley bottom (see figure 3 of dead fish on river side in Swat). The damages to rice paddies vary from partial to complete wash out at various places. In Chakdarra and Thana, the estimated losses to paddies on both sides of the river are significant, as this is the best rice growing area. Similarly, the rice

paddies in Shamoza and Barikot are heavily affected, as are the rice paddies along the river Swat in Udigram, Balogram, Derai, Charbagh, Ali Grama, Alamganj, Matta, and Khwaza Khela. These rice paddies are important feeding grounds for species such as Russian doves, migratory sparrows, European starlings (*Sturnus vulgaris*) and migratory black-throated thrushes. Their food base is reduced significantly. These rice paddies also provide significant habitat cover to some of the waterfowl species such as mallard (*Anas platyrhynchos*), common teal (*Anas crecca*) and pintails (*Anas acuta*). This has been reduced, and thus these species will face a high risk of exposure to hunting. The rice paddies are favourite feeding and resting sites for some of the wader species like common snipe (*Gallinago gallinago*), and red shank (*Tringa totanus*), green shank (*Tringa nebularia*). The habitat of these species is shrunk and therefore might have a significant impact on their distribution, migration patterns, and might expose them to threats such as poaching and depredation.



Figure 4: Fish died and found on sides of River Swat/Ahmad Said, PWP

- The floods in Swat and Panjkora Rivers, and their tributaries and streams have affected the wildlife species including reptiles, amphibians, and small mammals. According to an estimate about 80% habitats of these groups of wildlife along the Rivers and their tributaries have been affected.
- As reported by Mr. Afzal Khan, president of Mankial Community Organization, Mankial to the Swat Wildlife Division, two dead bodies of Markhors have been recovered from the flood water in Mankial River, a tributary of the River Swat. This indicates to damages to wild ungulates populations in the high altitudes of the Swat Valley. The higher reaches of Kalam and Utror have received damaged of higher degree than the Mankial and there must have been damages to wildlife populations such as Himalayan ibex (*Capra ibex himalyensis*), markhor (*Capra falconeri*), must deer (*Moschus chrysogaster*), and black bear (*Ursus thibetanus*). There is however no detailed information received from those valleys so far.
- The Lower Dir and Upper Dir are gifted with plenty of wildlife resources. The recent flood heavily damaged the wildlife resources of the area as well as its habitat. According to data of the Wildlife Department of Dir (lower and upper), population of chukar partridges (*Alectoris chukar*) is damaged by 30%, black partridges (*Francolines francolinus*) by 45%, and grey partridges (*Francolinus pondecerianus*) by about 20%, while damages to their habitats are estimated at about 40%, and food resources by 10%.
- According to the Upper Dir Wildlife Division of the Khyber Pukhtunkhwa Wildlife Department, the damages to markhor population is about 5%, while about 15% of its habitat is disturbed and damaged. The flood has affected about 15% of the koklass pheasant (*Pucrasia macrolopha*) and about 30% of its habitat with about 30% of its food resources. The damages assess for Monal pheasant (*Lophophorus impejanus*) are about 10% to its population, 30% to its habitat and about 30% to its food resources in the Upper Dir district.
- The Khyber Pukhtunkhwa Wildlife Department has established the Tangi and Adenzai Community Game Reserves in Upper Dir District. According to the reports from the local community to the Wildlife Department, mortality of birds in both of the game reserves is about 50%, while the cover and food resources there are also damaged to the extent of 50%.

4.1.3 Ex-situ conservation facilities

- The Khyber Pukhtunkhwa Wildlife Department has been maintaining a pheasantry at Fiza Ghat Park near Mingora City. This was a nice facility, where several pheasant species were displayed. Although, the number of birds was low there, as most of the pheasants were relocated from here due to the recent conflict in Swat (See figure 5, silt loaded in the Fiza Ghat Pheasantry).
- The flood however has damaged the infrastructure of the pheasantry, and has silted up the area. The damage received by the pheasantry includes collapse of about 80% of cages, brood rooms and partition walls; and severe damages to 22 bird cages (each cage size is 15'x15'x10').
- The flood washed away all the bird feeding, and heating utensils.
- The staff of the Wildlife Department rescued the six to seven pairs of pheasants that were kept over here. One pair of ringed necked pheasant was trapped in a cage and was lost to the floods.



Figure 5: Silt dumped in Fiza Ghat Pheasantry, Swat/Ahmad Said, PWP

4.1.4 Fisheries Resources

- River Swat provides spawning grounds to fish species including species of high economic value such as the endangered mahaseer (*Tor putitora*), vulnerable species of *Shizothorax plagiostomus* and *Shizothorax labiata*. The river habitat varies with changes in water temperature and elevation that is why fish are prone to such high floods as it forced them to downstream channels, which are not suitable for their survival and eventually they are dying. The high turbidity, turbulence of flash floods, low temperatures, and high silt load destroy the habitats and affects fish populations directly.
- District Office of Fisheries and Forestry, Swat has reported the following damages to available fisheries resources.
 - i. The flood and muddy water has caused large scale mortalities of fish fauna in Swat River and its tributaries. The damages are high in particularly in the tributaries where endangered species such as Mahaseer breeds these days.
 - ii. The over fishing during the flood period has also put tremendous pressure on the Fish population of river Swat. It is estimated that in some fish hotspots about 50% of the existing fish stock has either died or caught by the local people.
 - iii. The market rates, an indication of large scale hunting, dropped to Rs.50 per kilogram from Rs. 300/- per kilogram for Swati fish and to Rs.150/- per kilogram from Rs.400/- to 450/- per kilogram for trout fish. At the same time the undersize fishing happened at an alarming rate all along river Swat.
 - iv. Total 26 numbers of trout and 17 numbers of carp fish farms and hatcheries in public and private sectors have been flooded and washed away only in district Swat. The flood completely damaged the trout hatchery of Madyan, while partially damaged the Mahaseer fish hatchery near Chakdarra.

- In Upper and Lower Dir Districts 75% to 85% of the spawning and breeding grounds along the Panjkora River have been completely damaged or washed away by the recent floods.
- The flood has washed out the four private trout fish hatcheries in Upper Dir causing a loss of approximately Rs.10 million to the owners of the fish hatcheries.

4.1.5 Soil Erosion

The bed of river Swat is geared by the surround valley bottom. In narrow valley, upstream Madyan, the river flows in one main channel, while downstream Madyan it adapts to the wide valley and transforms to a braided river. In both cases, people have encroached upon the river land, either for erecting hotels and market structures or for agricultural fields. The information collected from the Soil Conservation Office of District Swat, indicates that:

- Nearly 55 thousands (55,000) acres land has been washed away in both district of Swat and Shangla (see figure 6, on washed away land areas);
- Approximately 40-50 G.I and cemented embankments schemes have been completely damaged in Tehsil Matta, Kabal, Barikot, and Shamoza of District Swat and Tehsil Alpuri of District Shangla.
- In Upper and Lower Dir districts, about 25% of the land under terracing, and steep slopes is affected by the heavy rainfall, run off, cloud bursts and flash floods.
- Sedimentation of agricultural lands and lands along the river sides is observed and about 80% - 90% of the land along the river courses has been subject to it.



Figure 6: Washed away lands and villages along the river in Swat/Ahmad Said, PWP

4.1.6 Eco-tourism

- The Swat valley is famous for its eco-tourism potential and this sector remained as backbone of the local economy. The floods have severely affected the tourism hotspots including Kalam, Behrain, Madyan, Fiza Ghat in the valley. At end of the conflict in

Swat, the Pakistan Army had recently established parks along the River Swat in Shamoza, Charbagh, and Matta. These were becoming popular for picnic and camping. The flood has damaged these parks severely and has washed away almost 80% of these new developments.

- According to sources, the hotels along the River in Kalam, Behrain, and Madyan are severely affected. The damages were particularly heavy to those hotels that were built on the river course by erecting pillars out of the river channel. This, though an encroachment and violation of the law, is a loss to tourism in the River Swat. According to reports, about 60 hotels of different sizes have been washed away. Many others are reported partially damaged in tourism hotspots such as Madyan, Behrain, Pishmal, Kalam, and Ushu. The information has yet to be confirmed though.

4.1.7 Livestock

- Livestock plays a significant role in subsidizing livelihoods of the local communities in mountainous environment, where livelihood options are limited. Livestock is a source of energy for the local community, and the dung provided is converted to dung cakes and burnt for cooking and heating. The heavy damage to livestock from floods is not only loss of subsistence livelihood but also a source of energy of the local community.
- Although, the exact data on losses of livestock and cow dung stocks is not yet available, an estimate from the Khyber Pukhtunkhwa Livestock Department shows the following damages to the livestock in Swat:

Table 2: List of affected and dead livestock

S.#.	Area	Type	Livestock	Affected	Dead
1	District Swat	Cows	Bullocks (3 years and above)	1279	192
2			Cows (3 years and above)	4077	612
3			Cows (in Milk)	2478	372
4			Male Young Stock	1439	216
5			Female Young Stock	1199	180
6	District Swat	Buffalo	Male Buffalo (3 Years and Above)	123	18
7			Buffalo (3 Years and Above)	1402	210
8			Buffalo (in Milk)	1033	155
9			Male Young Stock	467	70
10			Female Young Stock	467	70
11	District Swat	Sheep	Male (1 year and above)	2522	378
12			Female (1 year and above)	479	72
13			Male Young stock	1236	185
14			Female Young stock	807	121
15	District Swat	Goat	Male (1 year and above)	7441	1116
16			Female (1 year and above)	744	112
17			Male Young stock	4316	647
18			Female Young stock	2381	357
Total				33890	5083

Source: Livestock Department, Khyber Pakhtunkhwa, Peshawar

Table 3: List of indirect Livestock losses/damages

Type of Animal	No. of milking animals survived	Production and Growth Losses		Total
		Production	Growth	
Cattle	16043	733.97	12.33	746.30
Buffalo	25133	723.83	15.78	739.61
Sheep	8843	13.26	6.82	20.08
Goat	32156	48.23	28.36	76.59
Poultry (Domestic)	369261	0.00	138.47	138.47
Poultry (Commercial)	220890	41.42	0.00	41.42
Total	672326	1560.71	201.76	1762.47

Source: Livestock Department, Khyber Pakhtunkhwa, Peshawar

Note: Cattle production losses = (Animal survived*6*305*25*/1,000,000)
Buffalo production losses = (Animal survived*4*180*40/1,000,000)
Sheep production losses = (Animal survived*0.5*120*25/1,000,000)
Goat production losses = (Animal survived*0.5*120*25/1,000,000)
Poultry (domestic) losses = (Birds*75/100*250/1,000,000)
Poultry (commercial) losses = (Birds*75/100*250/1,000,000)
Growth losses cattle/buffalo = (Young male*30%*5000/1,000,000)
Growth losses sheep/goat = (Young male*30*3000/1,000,000)

- According to the estimates of the Livestock Departments of Lower Dir district, about 37 buffaloes (0.0023% of about 16300 heads), 841 cattle (about 0.0034% of 250000 heads), and 1734 goats and sheep (0.005% of 340,000 heads) were drowned in the flood. The estimate for poultry indicates that about 35,000 poultry (0.033% of 1,050,000) were lost in the floods.
- The Livestock Department of Upper Dir District reported loss of 115 buffaloes, 1320 cattle, 2500 goat and sheep and 2000 poultry to the flood.

4.1.8 Agriculture

The agriculture in a mountain environment such as that of Swat and Dir, is a blend of land use pattern dependent on water availability. The lands under permanent source of water and near to main water course and river beds, are usually sown with rice, while the ones with seasonally available water and distant from the main channels are sown with maize or wheat. The flood has badly affected the agriculture communities in the valley and has altered the cropping pattern and ultimately will affect the market economy of agricultural based economy in the near future (see figure 7, silted rice paddies in Swat).

According to estimates of the Agriculture Department of Swat, the following damages were sustained by the agriculture sector in Swat.

Table 4: Extent of Agriculture Damages in the valley of Swat

S.#.	Crop type		Extent of damage in % age	Extent of damage in Hectare	Remarks
1	Maize		60	50,000	Maize crops have been fallen on ground, which is a main source of food and fodders.
2	Rice		65	8,000	Rice crops have been fallen on ground, which is a main source of food and fodders, and habitat for water fowls
3	Vegetables	Tomato	60	5000	
		Others	60	2000	
4	Fruit Orchards		30 %	11000	

Source: District Agriculture Office Mingora, Swat



Figure7: Washed away and silted rice paddies in Swat/Ahmad Said, PWP

- According to the data collected from the Agriculture Department of Lower Dir district, the flood has affected about 25% of the 8500 ha of rice paddies, 15% of the 6800 ha of irrigated maize crops and about 15% of the 2500 ha of rain fed maize crops, 50% of the vegetables on about 800 ha and about 10% of the 500 ha of fruit orchards.
- According to the data from the Agriculture Department of Upper Dir District, the flood has damaged about 5300 fruit plants (about 75% of fruit orchards), 450 acres of maize crop (about 50% area), about 100 acres of vegetables (about 70% area), about 60 acres of rice paddies (about 50% area). The flood has also completely damaged 75% of model fruit orchards in 28 union councils (see figure 8, silted rice paddies in Chakdarra).
- The flood has washed away road links that has put the 2000 mounds (cwt) of cabbage and 7000 mounds (cwt) stocked onion at risk of spoiling, while it has damaged about 15000 mounds (cwt) of potato stock.
- The cumulative losses to agriculture sector in Upper Dir district are estimated at about Rs. 700 million.



Figure8: Rice paddied near Chakdarra dumped with silt/photo: Ahmad Khan, PWP

4.2 Charsadda and Nowshera

4.2.1 Forests

- The flood has caused damages to forests by washing out block plantations, linear plantations, natural forests, and loose soil along Indus River and Kabul River. The major damage has been caused to nurseries at Nowshera and block and linear plantations in all villages on both sides of Kabul River in District Nowhsera and in villages along the rivers Jindi, Khayali, and Sadaryab.
- In areas along the Jindi, Khayali, and Sardaryab Rivers, the flood has washed away eight out of 10 trees in linear plantation (80%), while in areas away from the rivers the damage range between 10% - 20% (see figure 9 of the farm forestry near Sardaryab, Charsadda).

- In Kund Park, Nowshera and in the nearby villages 5 out of 10 trees (about 50%) of trees have been uprooted by the flood.
- In areas, where flood spread on large surface, the Bela forests, Riverine forests, and Poplar plantations received minor damages, but still water standing there is a potential threat and could cause mortality of standing trees.



Figure 9: Heavily damaged block and linear plantations in Charsadda and Nowshera/photo: Ayaz Khan

4.2.2 Wildlife

- Bela and riverine forests along Indus River are completely inundated which are habitats of Hog deer, hares, jackals, and foxes. It is expected that most of the population of hare and remnant population of hog deer would have been completely washed out or the flood would have forced them to migrate to areas near to settlements, where these could become exposed to poaching.
- Indus and Kabul River and their tributaries provide important staging and feeding grounds to hundreds of thousands of migratory waterfowl and other water birds. These important habitats have been badly damaged by filling all the lakes through siltation and washing away of agriculture fields along the rivers which provided food to water birds and were an important component of river ecosystem. Similarly washing out of indigenous fish fauna from Kabul River and Indus River would also inflict negative effect on the population of migratory waterfowl and water birds.

4.2.3 Ex-situ conservation facilities

- In addition to impacts on wildlife in their natural habitat, the flood has severely damaged the Kund Park (see figure 10, Kund Park of the park), a breeding centre and wildlife-based tourism spot in Nowshera district. The flood resulted in killing 219 wildlife including 37 spotted deer, six hog deer, four chinkara deer, 28 black bucks, two common leopards, two urials, and pheasants that included 21 blue Java peacocks, 19 white peacocks, eight black shouldered peacocks, five silver peasants, and 23 ring-necked pheasants. The total value of these mammal and birds species has been

estimated at 7-10 million Pak Rupees (see figure 10 on glimpses of damage in Kund Park and annexure II for details).



Figure 10: Glimpse of damage in Kund Park/photo Ayaz Khan, PWP

- The flood has damaged the Kund Bear Centre, located in the Kund Park, has been severely damaged and 20 bears out of 23 have been killed by flood. Three bears were evacuated and shifted to Balkasar in Punjab. Kund Bear Centre is the only facility in the country where confiscated bears are kept. It is jointly managed by Biological Resource Center (BRC) and Khyber Pukhtoonkwa Wildlife Department).

4.2.4 Fisheries

- Fish fauna is an important source of livelihood and recreation to local people in Charsadda and Nowshera districts. The presence of five rivers in Charsadda District and two big rivers in Nowshera District and more than 100 private fish ponds in these districts provide ample livelihood opportunity to people living along these rivers.
- The natural fish fauna in these rivers includes Schizothorix (Swati), Rahu, Gulfam, and Singaro, while people raise Silver carp, Grass carp, China carp, Rahu, and Mori in ponds for commercial purposes.
- It is expected that the natural fish fauna would have been washed out from Khayali, Sadaryab, and in parts of the Indus River. The impacts on hatchlings would be severe, as shallow waters were not left and high speed flows washed embankments. However, complete baseline information on fish fauna of these all rivers need to be maintained for long-term monitoring.
- The flood has washed away about eight fish ponds out of 47 (17%) in Charsadda and 32 fish ponds out of 59 (54%) in Nowshera. In Nowshera about 15-20 fish ponds are severely damaged in Khaishki and Azakhel villages. The area of these fish ponds vary from 1 Kanal to 8 Jareb with about 2500 fish per acre of pond. The value of fish pond including fish stock ranges from 0.02 million to 1.5 million. The total damage to fish

ponds caused by flood in Charsadda and Nowshera districts is valued at Rs. 15 million and Rs. 30 million respectively.

4.2.5 Livestock

- Livestock rearing and agriculture are the main sources of livelihood for the local community along the rivers in Charsadda and Nowshera districts. The people living in some of the villages are entirely dependent on livestock for selling their milk. They graze their livestock mostly in rangelands along the river.
- A total of about 68000 and 35000 livestock were found dead in Nowshera and Charsadda districts respectively. The livestock killed by the flood mostly include buffalos and cows followed by goats and sheep. Dead bodies of livestock in some villages are still covered with silt in rangelands and places near rivers (see figure 11, dead bodies of livestock in Charsadda).



Figure11: Dead bodies of livestock in flood affected area is an environmental and health problem/Ayaz K

- Livestock provides cow dung, which is a vital energy source for the poor rural communities in Charssada and Nowshera areas, and has been used as fertiliser in agriculture since long. The flood, not only killed a large number of livestock, but has also washed stocks of cow dung. This would put tremendous pressure on natural vegetation, as people would revert to forest stands and other natural vegetation for fuel wood and to artificial fertilisers for application on crops, when re-habilitate their agriculture lands.

4.2.6 Agriculture

- The flood has washed all the agricultural crops along the rivers in Charsadda and Nowshera and has silted up the agricultural fields.
- In Charsadda, about two kilometre wide and five kilometre long strip between Jandi River and Sadaryab has been badly affected while in Nowshera about one to two kilometres wide strip between Jandi and Kabul rivers is severely damaged.

- The flood has also damaged the agricultural crops, and fruit orchards of pears and peaches that were located away from the river courses.
- The agricultural fields near rivers are completely silted while 2 to 3 feet high flood water is still standing in orchards and fields that are located away from rivers even at about 10 km. The areas affected include Tarkha, and Akbarpura on Peshawar GT Road. The standing water is further deteriorating orchards and agricultural fields and may result in mortality of trees and plants by suffocation in standing water. It is hoped that it will take long to restore these agriculture fields and orchards which are crucial for the livelihood of local people and their livestock.

4.3 Central and Southern Punjab

- The flood severely affected the four tehsils namely Ali Pur, Muzaffar Garh, Jatoi and Kot Adu in Muzaffar Gargh district, two tehsils of Taunsa, Dera Ghazi Khan and tribal area of Dera Ghazi Khan District, three tehsils of Layyah, Chehbara and Crore in Layyah district and three tehsils of Kot Mitran, Rujhan, and Rajan Pur in Rajan Pur district.

4.3.1 Forest and plantation damages

- The flood has damaged about 30% of the 48500 acres of irrigated plantation in district Muzaffar Gargh.
- The total area of communal bela forests in Muzaffar Garh district is about 60,000 acres. The flood has damaged about 75% of these forests. The bela Forests support livelihoods of the local community and provide them with timber, fuel wood, and range lands for livestock.
- The flood has damaged approximately 315 acres (25%) of the 1250 acres of canals side linear plantations in Muzaffar Garh district.
- The flood has uprooted about 20% of the trees of the 380 acres of linear plantations along road sides in the Muzaffar Garh district.
- The Punjab Forest Department had planted about one million seedlings of various plant species in the affected districts. The flood has completely devastated this plantation (pers. comm. with Mr. Liaqat Gulzar, DFO, Forest Muzaffar Garh).
- The flood has damaged 600-700 (about 2%) acres of forest area out of about 38,000 (pers. comm. with Mr. Saleem, DFO, Forest, Mianwali)
- The flood has damaged about 3000 acres of irrigated plantation area in Dera Ghazi Khan District, while the total forest area damaged is about 25% of the total of 64,000 acres.
- The damages to the road side linear plantations on about 700 km are about 25%. (pers. comm. with Mr. Syed Imdad Rasool, Head Clerk, D.G. Khan Forest Department).
- According to the Divisional Forest Officer, Layyah, no considerable losses in forest sector are documented.

4.3.2 Wildlife

- Taunsa wildlife sanctuary is located upstream of Taunsa Barrage over 19625 acres, out of this about 7500 acres is habitat of hog deer population. According to a survey conducted in 2008, there were 900 hog deer (*Axis porcinus*) recorded in the Taunsa Wildlife Sanctuary. According to information from of the Punjab Wildlife Department the flood has affected approximately 25% of the hog deer population (pers. comm. with Mr. Riaz District Officer, wildlife Punjab, Muzaffar Garh) (see figure 12 for map of Taunsa Wildlife Sanctuary before and during floods).

- ❑ The Indus River is home to the endangered endemic Indus dolphin (*Platanista minor*). Its fragmented populations occur throughout the stretch from Jinna Barrage downstream to Kotri Barrage. The barrages are major cause of its habitat and population fragmentation, where small populations such as that between Jinna and Chashma Barrages, and Chashma and downstream might face genetic drift and interbreeding. The floods resulted in an opportunity of genetic flow among the isolated populations in general and particularly with the meta population that inhabits the part of Indus River between Guddu and Sukkar Barrages. On the other hand, the flood has potential serious threats for the Indus dolphin, as the individuals might have flowed to pond areas and to canals throughout the Indus River. The impact will be apparent, when flood water recedes and a search and rescue for stranded individuals of Indus dolphin is conducted (see figure 13 on distribution of Indus dolphin in the Indus River).
- ❑ The agricultural fields, irrigated plantations and shrubs along the canals and roads in the districts of Mianwali, Layyah, Muzzafar Garh, Dera Ghazi Khan, Rahim Yar Khan, and Sadiq Abad provided habitat to black and grey partridges. The flood has washed most of the habitat and has affected about 80% of it.
- ❑ The flood has also affected about 40% to 50% of the habitat of wild boar in the districts of Central and Southern Punjab.
- ❑ The flood has washed about 90% of the habitat in Rakdama Wildlife Sanctuary that is located in Rajan Pur over 5000 to 6000 acres.
- ❑ The flood severely hit the Cheena Wala Bela, which is located downstream of Ghazi Ghat. The Cheena Wala Bela is habitat of hog deer from where 40 – 50 individuals were reported before the flood. The flood might have washed this population or might have forced it to migrate to other areas.
- ❑ The flood washed about 65% of the Kot Sabzal Game Reserve, which stretches over a length of about 110 km. The game reserve provides habitat to houbara bustard.
- ❑ In addition to habitat and wildlife populations, the flood has also damaged the infrastructure of the Punjab Wildlife Department in the protected areas. The infrastructure included fences, guard rooms, and watcher huts.

4.3.3 Fisheries

- ❑ According to the data collected from the Punjab Fisheries Department, flood will positively impact the fisheries in the Indus river. It however, has severely damaged the private fish farms.
- ❑ In district Muzaffar Gargh the flood has damaged 05 private fish farms (42%) out of total 12 farms over areas of about 300 acres. The average production from these fish farms is estimated at about 1000 Kilograms per acre. The estimated loss to fish farms in Muzzafar Garh is about 500 million rupees. (per. comm.. with Mr. Bashir Hussain, Fisheries Department Muzaffar Gargh).
- ❑ According to the information collected from the affected community members of various districts of the central and southern Punjab, the estimated damage to private fish farms is about 40%.

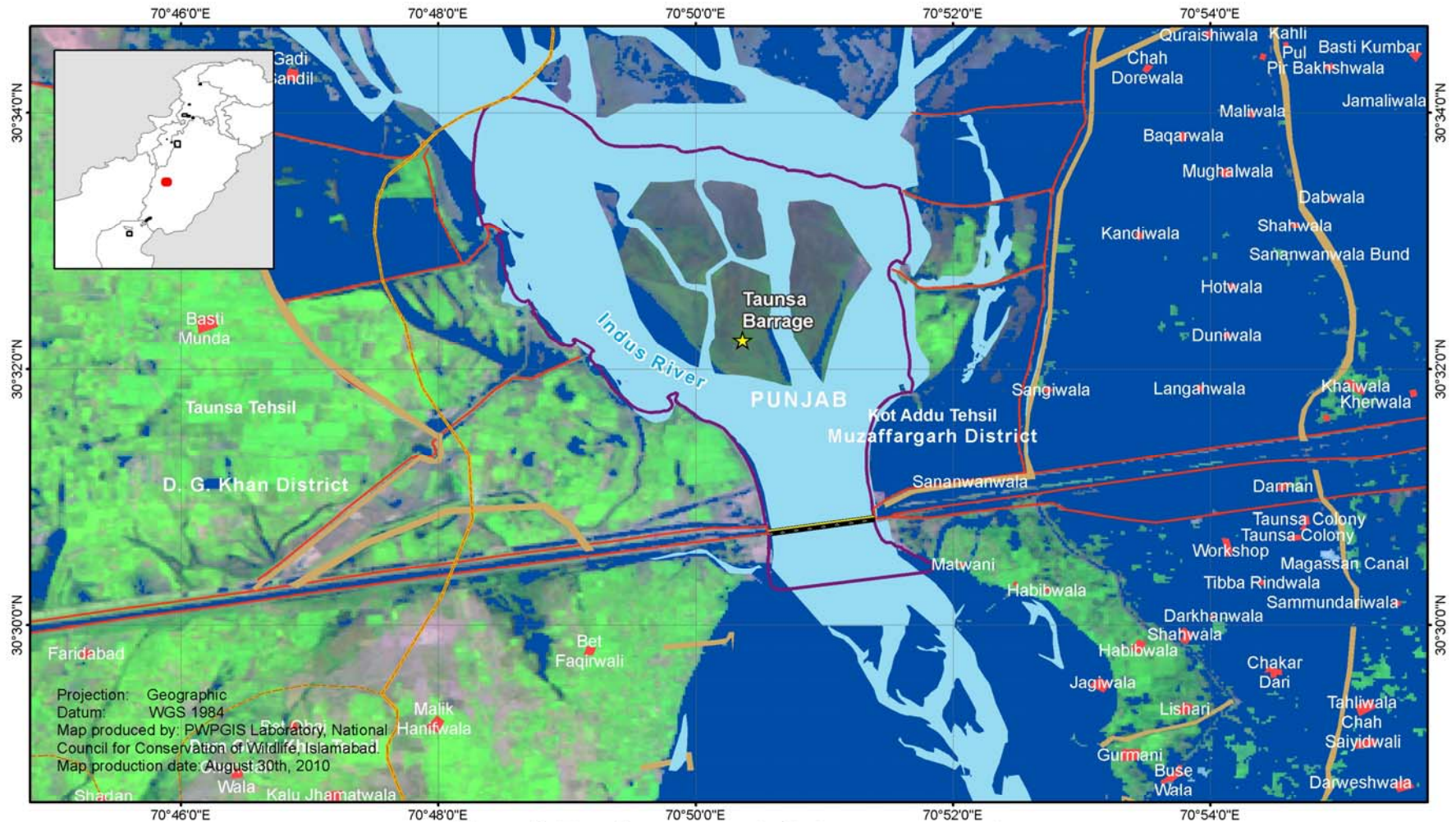
4.3.4 Livestock

- ❑ Livestock rearing is one of the main livelihood options of the people living in different districts of the central and southern Punjab. According to the data from the Punjab Livestock Department (pers. comm. with Dr. Abdul Hameed, District Officer, Livestock and Dairy Development, Muzzafar Garh, Punjab) the flood has damaged the livestock

sector in the entire district of the central and southern Punjab. The direct and indirect damages to livestock in Muzaffar Gargh district are heavier than the other district.

The information shows that the flood affected about 2.4 million livestock including cattle, buffaloes, goat and sheep including mortality and loss of about 0.4 million heads. (pers. comm. Mr. Dr. Abdul Hameed, DO, Livestock and Dairy Development Department, Punjab).

- In Rajan Pur district, the flood direct and indirect affects hit about 0.74 million livestock, while about 200 are reported dead there (HEPL, Foundation, Rajan Pur).
- In addition to mortality and losses of livestock, the other problems erupted from the flood for livestock is loss of shelters and fodder and emergence of communicable diseases in livestock. These indirect problems are common in all of the districts of the central and southern Punjab.

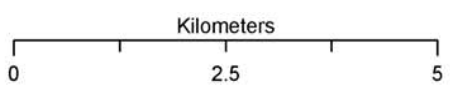


Projection: Geographic
 Datum: WGS 1984
 Map produced by: PWPGIS Laboratory, National
 Council for Conservation of Wildlife, Islamabad
 Map production date: August 30th, 2010

- Legend**
- Town/City
 - ★ Protected Area
 - Wetland
 - Barrage/Bridge
 - Road
 - Tehsil Boundary
 - District Boundary
 - Provincial Boundary
 - Village
 - Protection Bund
 - Wetland Extent
 - River Extent April 24th 2010
 - River Extent August 12th 2010

Flood Environmental Assessment

Taunsa Barrage



Disclaimer: The depiction and use of boundaries, geographic names and related data shown here do not necessarily imply official endorsement or acceptance by Pakistan Wetlands Programme/ WWF-Pakistan.



Data Sources: DCW, Google Earth, PFRC, LandSat TM, ESRI Imagery, WWF-P & PWP

Figure 12: Map of Taunsa Wildlife Sanctuary before and during the flood

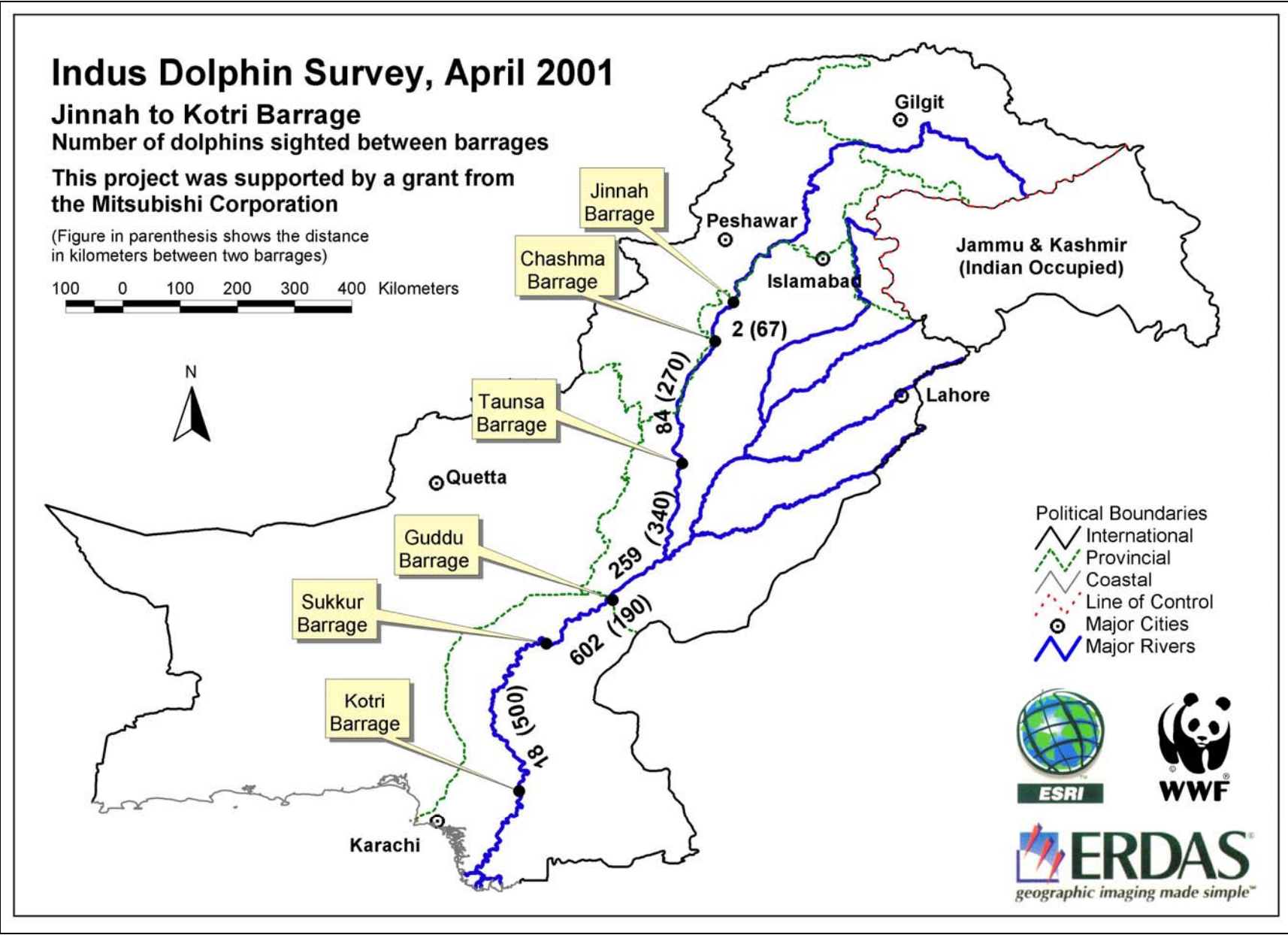


Figure 13 : Distribution map of Indus dolphin in the Indus River (2001).

4.3.5 Agriculture

- The flood has affected the agricultural lands and crops severely in the central and southern districts of Punjab.
- In Muzaffar Gargh, the flood has completely washed about 21000 acres (47%) of cotton crop out of the cultivated 455000 acres, 96000 acres (65%) of sugarcane out of the cultivated 147000 acres, about 37000 acres (62%) of rice paddies out of 60,000 acres, and 2531 acres (34%) of vegetables out of 7000 acres (pers. comm. With Mr. Ghulam Abbas Razi, EDO, Agriculture Department, Muzaffar Gargh).
- In Dera Ghazi Khan, the flood has damaged about 150,000 (23%) of the cultivated area, which is about 1100000 acres. The damages to agriculture include cotton crops over 17600 acres (8%), and 16476 acres (7%) of rice paddies. (pers. comm. with Mr. Malik Kaleem, Cotton Inspector, DG Khan Agriculture Department).
- In district Mianwali, the flood has damaged crops on about 93% of cultivated land (790,000 acres of the 850,000 acres) in 153 villages out of 256.

Table 5: Damages to agricultural crops in District Mianwali

Crops	Total area under cultivation	Damaged area	Percentage (%)
Cotton	6,200 acres	3415 acres	55%
Mung	1,22,700 acres	24,300 acres	20%
Rice Paddies	4,600 acres	660 acres	15%
Mash	500 acres	350 acres	70%
Fodder	30,000 acres	2,550 acres	8.5%
Vegetables	1,800 acres	670 acres	37.5%

Source: Mr. Haneef, Inspector, Mianwali Agriculture Department.

- In district Layyah, the flood has damaged about 143,000 acres (31%) of cultivated land out of 454,000 acres, the total cultivable area is 919,891 acres while under cultivation is 454,099 acres. The damaged cultivated crops include 20,000 acres (14%) of Sugarcane, 22,000 acres (15.5%) of Cotton, 30,000 acres (21%) of lentils (Mung), 8,000 acres (06%) of rice paddies, 2,000 acres (02%) of Till, 4,000 acres (04%) of vegetables, 2500 (2.5%) acres of orchards, 35,000 acres (3.5%) of fodder and 20,000 acres (14%) of other crops (pers. comm. Mr. Ashiq Hussain, Agriculture Department, Layyah).
- The flood has damaged about 330,000 acres (34%) of the 96000 acres of cultivated land in Rajan Pur district. (HELP foundation Rajan Pur).
- An estimated 35% of the late variety fruit orchards in most of the CIWC's districts are badly affected and damaged by flood.

4.3.6 Others environment related damages

The flood in most of the affected areas has drifted about 80% of the fuel wood stock of the local communities. The Lal Pir hydropower in district Muzaffar Gargh with capacity of 600 mega Watts productions is affected. More than 90% of the rangelands and pastures in affected areas of CIWC districts are badly affected. More than 60% of low transmission

electricity lines are affected. The water and sanitation problems are rising in most of the affected areas. (Personal observations and local information).

4.4 Gilgit Baltistan

- The severe flood in Gilgit Baltistan province affected about 87,000 people in 195 villages with 187 people dead and 2800 houses partially or completely damaged.
- The floods damaged crops on about 9000 acres, while about 100,000 trees are damaged.
- The flood has damaged about 500 water channels that are the irrigation source in the dry climatic conditions of the Gilgit Baltistan.
- The damages to cattle counts about 4600 animal heads.
- The flood has washed about 100,000 kilogram of fuel wood stocked by the local communities in various localities of the Gilgit Baltistan.
- The flood washed away about 52000 fish from private fish farms.
- The flood has destroyed about 9% of the social forestry areas in Gilgit Baltistan, while has damaged about 8% of the popular block plantations raised for commercial purposes.
- The flood has damaged about 16% of the of farm forests raised for domestic consumption, 3% of the linear plantations raised along the agricultural fields, about 5% of the linear plantations along the road sides, and about and about 4% of the linear plantation along water channels. The heaviest damage of about 26% is recorded in Kargah for the plantations along the water channels.

4.5 Pollution and oil spills

4.5.1 Spill of petroleum products

The flood, in several areas, affected petrol pumps. The flood not only damaged the machinery and infrastructure but also spilled the petroleum products there. According to the survey conducted, 15 petrol pumps located on G.T. Road between Khairabad and Peshawar, six petrol pumps located on G.T. Road between Peshawar and Charsadda, and two petrol pumps located near Chakdarra were flooded. According to the information from the district administration of Swat, three petrol pumps in Swat were affected. In Kot Adu, two petrol pumps were flood and oil spilled from there to the river.

Based on sampled petrol stations (about 40% of the total affected recorded), the average figure of spilled diesel from the affected filling stations is about 27,600 litres per pump (n=16, min. 5000 litres, max. 65000 litres), the average petrol spilled per pump is about 6,900 litres (n = 9, min. 1500 litres, max. 10,000 litres) and the average mobile oil spilled per pump is about 1900 litres (n = 7, min. 300 litres, max. 2100 litres).

Table 6: List of sampled petrol pumps affected by flood and oil spilled from these pumps

s. #	Location	Name of pump	Oil spilled from sampled pumps			Remarks
			Diesel	Petrol	Mobil Oil	
1.	Khairabad, Khyber Pukhtunkhwa	Gul Filling Station	10000	500	-	
2.		Lawangeen FS	65000	10000	1890	
5.	Jehangira, KP	Ascol FS	25000	3000	420	
6.	Nowshehra, KP	PSO FS	30000	5000	-	

7.		Shell FS	40000	15000	1959	
8.	Pir Piyaye, Nowshehra, KP	Pir Piyaye, FS	5000	1500	-	
10.	Aza Khel, KP	Afghan FS	35000	-	2100	
11.		Rasheed FS	40000	-	-	
12.		Shell Petrol Pump	30000	-	-	
15.	Sardaryab, Charsadda, KP	PSO Pump	28000	3000	315	
17.		Shell Pump	35000	-	-	
18.		Caltex	25000	-	-	
21.	Amandara, KP	Haji Amir Zada &Co.	5000	-	-	
22.		Caltex Pump	20000	-	-	
23.	Taunsa, Kot Adu, Punjab	Rind Filling Station	40000	20000	4000	
24.		Caltex pump	10000	4000	2500	
Total			443000	62000	13184	
Average per pump (Diesel: n=16; petrol: n=9; M/oil: n=7)			27687	6888	1883	

4.5.2 Wash away of pesticides, insecticides

In spite of the efforts made to record any flooding of stores of agricultural chemicals dumped or displayed in stores and shops, yet no information could be received till compilation of the report. It is however likely that agricultural fertiliser that might have been stored at household level must have been washed by the flood water.

4.5.3 Silting up of agricultural lands, water reservoirs, and dams

The flood, as was unprecedented, has washed huge land area, and has brought with it huge quantity of sand and silt. The flood, along the river courses, has silted about 80% of the agricultural fields especially the rice paddies located along the river Swat. It has also silted maize crops, and vegetable fields in Charsadda, Nowshehra, and Swat. In addition, the flood has silted up canals, as the water was diverted to canals and must have adverse impact on reservoirs of dams and barrages. This aspect however needs a detailed investigation.

5. Potential threats and opportunities

- The soil exposed by either washing away of trees, forests or by land slides will be prone to erosion in the future and will be a source of siltation of streams and rivers with torrential rains and high surface flows.
- The reduced vegetation cover may also contribute to surface run off and will result in reduced percolation and aquifer recharge rates.
- The loss of farm forests and linear plantations on agricultural fields will cause economic stress on the communities, as they will have to purchase energy sources such as LPG cylinders or they will revert to natural vegetation to lop and cut trees for fuel wood. This will cause additional loss of vegetation cover.
- The loss of energy sources such as cow dung and biogas plants will cause a reversion to natural vegetation and will be a threat to further loss of vegetation cover.

- The loss of fruit orchards and fruit trees will result in additional burden on natural vegetation for fuel wood.
- The drifted timber stocks of forest contractors, if not registered with the forest departments, will be a threat to the natural stands in the future. The contractors may potentially cut trees to compensate their losses remark these for the drifted timber.
- The reports suggest that about 2.0 million people are affected by the floods that include homeless community from about 800,000 houses that are destroyed by floods. The community will need timber to reconstruct shelters and houses. This will be a huge cost to natural forests.
- The loss of forests will affect livestock populations in the future, as the loss of forests, vegetation cover, land cover under range lands will result in reduced bearing capacity for livestock.
- The loss of agricultural crops, fruit orchards, forests and natural vegetation, have intricate links to wildlife populations, as these all loss will result in loss of cover, nesting sites, food resources, of wildlife. The ultimate result will be the exposure of wildlife to poachers, and hunters and will become easy food source in absence of the primary food sources.
- The loss of livestock and crops will have a combined effect on wildlife populations including large ungulates, and game birds including partridges, peasants, and water fowl. The communities, in absence of their primary food sources and subsistence livelihood may revert to wildlife hunting and poaching.
- The only group of wildlife that may benefit from flood will be the water birds. The flood has filled pond areas in many sites along the course of the Indus River. This habitat however may become a trap for these birds also, as the communities would be certainly reverting to them as a food base.

6. Recommendations

The following list of recommendations is not presented in any particular order of priority as needs may vary significantly from one part of the affected area to another.

- a. Develop an action plan for rehabilitation of the lost forest cover including actions to stop further cutting of forests for commercial purposes and, potentially, compensating for cut timber lost in the flood water.
- b. Develop a programme on promoting community-based forest restoration, including energy plantations, linear plantations on farms and agriculture fields, linear plantations on water channels and rural road sides. The promotion of community nurseries will help provide stocks of seedlings for the purpose.
- c. To cope with timber needs for rehabilitation, a request for donations from timber-rich countries such as Canada which has an excess of timber resources, may be made. The treated timber imported or donated may be distributed among the homeless communities for construction of their houses.
- d. There must be efforts made to rehabilitate the damaged and destroyed nurseries of the Forest Departments and of the private sector. This will help supply seedlings to farmers for raising or re-establishing their fuel-wood and block plantations.
- e. A programme for habitat restoration may be launched, that may include short-term supplementary feeding of wildlife in the affected areas.
- f. A comprehensive awareness drive for wildlife conservation may be initiated to save displaced and exposed wildlife species from poaching and other abuses.

- g. To save forest resources from felling for fuel-wood needs, a programme on subsidised energy provision such as subsidised LPG supplies may be launched. To further strengthen this, provision of fuel efficient technologies, introduction of fuel briquettes, and the promotion of biogas may help.
- h. Efforts could also be made to rehabilitate the damaged biogas plants installed by the communities along the Indus River.
- i. Support to respective government wildlife conservation agencies may be provided to re-habilitate *ex-situ* conservation facilities such as *Kund Park*, Captive bear sanctuary, *Fiza Ghat* pheasantry, and the infrastructure of many game reserves.
- j. A support programme may be established to provide financial and technical assistance to farmers for rehabilitating private fish ponds and private fish hatcheries.
- k. Support to government fisheries departments may be provided to reconstruct fish farms such as the *Madyan Trout Hatchery* and *Mahaseer Hatchery* in *Chakdarra*.
- l. A comprehensive land-use zonation may be developed along the River Indus and its tributaries to stop encroachment into the river area for settlements, hotels construction, tourist's facilities and agriculture.
- m. A livestock management programme may be launched, which initially may provide fodder for the surviving livestock and for their vaccination against prevalent diseases. This may later expand to other aspects of livestock management and husbandry.
- n. A system of "safe havens" for wildlife may be identified and set aside as a safety measure for future flooding.
- o. Professional wildlife, forestry and fisheries personnel may receive special training in the capture, care and translocation of wildlife resources during flood crises and other disasters.
- p. Adequate funds should be provided for conservation scientists to survey surviving populations in order to provide post-flood baseline data for recording trends in population recovery. It may be necessary to review the status in the IUCN Red Data Book of certain species.
- q. A system of ground level fixed-point photographs of key sites should be introduced to supplement Remote Sensing (RS) images.
- r. Care should be taken to monitor and, if necessary, take action to curb the spread of exotic *fauna* and *flora* such as *Tilapia spp.*, Kariba weed (*Salvinia molesta*), Water hyacinth (*Eichhornia crassipes*), silver carp (*Hypophthalmichthys molitrix*), grass carp (*Ctenopharyngodon idella*) and feral animals, like domestic dogs.
- s. Finally, the recommendation of this rapid assessment should be reviewed in the light of comprehensive information gathered in long-term surveys to be conducted once environmental conditions have stabilised and human resources and adequate equipment are available.

Annexure I: The plan for Flood Environmental Damage Assessment by PWP Team

Tentative Plan for the Field Mission on Flood's Environmental Damage Assessment August 13 th , 2010 to August 22 nd , 2010; Team Leader: Richard Garstang.				
Date	Activity	Expected completion date	Outputs	Remarks
13-08-2010	Hold meeting of selected PWP team members	13-08-2010	<ul style="list-style-type: none"> • Check list for the assessment developed • Team's need assessment made 	Available to the teams
14-08-2010	Conduct field work in Charsada and Nowshera districts	16-08-2010	Rapid field assessment made	Team leader Ayaz Khan, Site Manager CIWC
15-08-2010	Conduct field work in Swat and Dir districts	17-08-2010	Rapid field assessment made	Team leader Ahmad Said, Site Manager NAWC
15-08-2010	Conduct field work in Gilgit Baltistan affected districts	18-08-2010	Rapid field assessment made	Team leader Dr Humaira Khan, Wetlands Biologist NAWC- Gilgit Baltistan
15-08-2010	Conduct field Work in Mianwali, Taunsa, Kot Adu, Rajan Pur and Rahim Yar Khan districts	18-08-2010	Rapid field assessment made	Team Leader Zafar Ali Site Manager CIWC, assisted by Ahmad Khan,
19-08-2010	Develop individual field reports	20-08-2010	Field reports completed	Team leaders
21-08-2010	Develop report of rapid environmental damage assessment	22-08-2010	Report of the assessment mission completed and submitted	Ahmad Khan, Director Regional Programmes

Annexure II: The flood damages to Wildlife in Khyber Pukhtunkhwa Province; Report of the
Khyber Pukhtunkhwa Wildlife Department

**HEAVY MONSOON RAINS/ FLOOD DAMAGES REPORT IN KHYBER
PAKHTUNKHWA PROVINCE PERTAINING TO
WILDLIFE DEPARTMENT**

The unprecedented heavy monsoon rains (27-31 July 2010) and the subsequent uprising of the water flow in the streams and rivers of Khyber Pakhtunkhwa Province has caused severe damages to roads, bridges, communication system, government and private buildings. Similarly, infrastructure of Wildlife Department and wildlife in captivity in various districts have also been severely affected. Details of damages are as follows:

S#	Name of site/District	Details of flood damage	Cost/value of damage
1. DISTRICT SWAT			
1	Fizagat Pheantry Swat	a) 80% of the pheantry cages and brood rooms, partition walls have been collapsed. b) 22 bird cages (15' x 15' x 10') have been severely damaged c) The pheantry is full of silt/mud 6' - 8' high. d) All the record of pheantry including registers, files, bird's feeding utensils etc. have been washed away by the flood.	1,000,000
2	Tanazgah Hut at Mankyal Swat	The hut with a covered area of 1800 sft has partially been damaged (approximately 70%).	2,000,000
3	Eco-Tourism Sites at Mankyal and Palogah Swat	The ecotourism sites developed in 2006-07 have been completely washed away by the flood along with iron railings, sleeping bags, tents etc.	100,000
4	Publicity Boards in Swat Wildlife Division	The three newly installed publicity boards, one each at Landakay, Mankyal and Kalam Range have been washed away by the floods.	50,000
GRAND TOTAL OF DISTRICT SWAT			3,150,000
2. DISTRICT KOHISTAN			
1	Under construction Hut at Keyal	Under construction hut at Keyal (still under supervision of ERRRA) has completely been washed away by Keyal Nalla.	1,500,000
2	Hydropower Scheme of Karang VCC	Hydropower Scheme of Karang VCC is completely wrecked due to flooding in water channel.	50,000
3	Palas Valley Bridle path, Kohistan	10 km bridle path at Palas Valley has been partially damaged.	500,000
GRAND TOTAL OF DISTRICT KOHISTAN			2,050,000

DISTRICT NOWSHERA

A lot of damages took place within Nowshera District. The infrastructure was damaged badly, whereas a number of valuable wild animals and birds were exterminated in the severe floods. The details of preliminary damages specifically within Kund Wildlife Park, Kund Bear Centre, Manglot Wildlife Park and Cherat Wildlife Park is as under:

S#	Name of site/District	Details of flood damage	Cost/value of damage																																																																											
3. DISTRICT NOWSHERA																																																																														
1	<i>Wildlife Mortality</i>	<table border="1"> <thead> <tr> <th>#</th> <th>Species</th> <th>Number</th> <th>Approximate cost (each)</th> <th>Total Value</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Spotted Deer</td> <td>37</td> <td>100000</td> <td>3700000</td> </tr> <tr> <td>2</td> <td>Black Buck</td> <td>28</td> <td>50000</td> <td>1400000</td> </tr> <tr> <td>3</td> <td>Hog Deer</td> <td>6</td> <td>70000</td> <td>420000</td> </tr> <tr> <td>4</td> <td>Chinkara Deer</td> <td>4</td> <td>40000</td> <td>160000</td> </tr> <tr> <td>5</td> <td>Common Leopard</td> <td>2</td> <td>200000</td> <td>400000</td> </tr> <tr> <td>6</td> <td>Urial</td> <td>2</td> <td>50000</td> <td>100000</td> </tr> <tr> <td>7</td> <td>Blue Java Peacock</td> <td>21</td> <td>20000</td> <td>420000</td> </tr> <tr> <td>8</td> <td>White Peacock</td> <td>19</td> <td>10000</td> <td>190000</td> </tr> <tr> <td>9</td> <td>Black Shoulder Peacock</td> <td>8</td> <td>20000</td> <td>160000</td> </tr> <tr> <td>10</td> <td>Silver Pheasant</td> <td>5</td> <td>4000</td> <td>20000</td> </tr> <tr> <td>11</td> <td>Ring Necked Pheasant</td> <td>23</td> <td>1000</td> <td>23000</td> </tr> <tr> <td>12</td> <td>Broody Hen</td> <td>14</td> <td>500</td> <td>7000</td> </tr> <tr> <td>13</td> <td>Eggs of wild birds</td> <td>50</td> <td>100</td> <td>5000</td> </tr> <tr> <td></td> <td>Total</td> <td>219</td> <td>---</td> <td>7005000</td> </tr> </tbody> </table>	#	Species	Number	Approximate cost (each)	Total Value	1	Spotted Deer	37	100000	3700000	2	Black Buck	28	50000	1400000	3	Hog Deer	6	70000	420000	4	Chinkara Deer	4	40000	160000	5	Common Leopard	2	200000	400000	6	Urial	2	50000	100000	7	Blue Java Peacock	21	20000	420000	8	White Peacock	19	10000	190000	9	Black Shoulder Peacock	8	20000	160000	10	Silver Pheasant	5	4000	20000	11	Ring Necked Pheasant	23	1000	23000	12	Broody Hen	14	500	7000	13	Eggs of wild birds	50	100	5000		Total	219	---	7005000	7,005,000
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		In addition to the above mentioned wildlife mortality, 20 Nos. of confiscated bears kept in Kund Bear Centre has also been found dead. The facility is jointly being managed by Biological Resource Centre (BRC) and Khyber Pakhtunkhwa Wildlife Department. Moreover, bear enclosures in the facility were also badly damaged due to splash floods.	25,00,000																																																																											
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S#	Name of site/District	Details of flood damage				Cost/value of damage
4	Furniture	#	Particulars	Quantity	Approximate cost	35,000
		1	Chairs	4	4000	
		2	Table	2	10000	
		3	Beds	6	12000	
		4	Beddings	6	6000	
		5	Stove	1	3000	
			Total		35000	
5	Miscellaneous	#	Particulars	Quantity	Approximate cost	105,000
		1	Crockery	LS	5000	
		2	Feed of animals and birds	LS	100000	
			Total		105000	
GRAND TOTAL OF DISTRICT NOWSHERA					10,868,000	
4. DISTRICT CHITRAL						
1	Chitral Gol National Park	02 Cantilever wooden pedestrian bridges in Chitral Gol National Park have been completely washed away by the flood.				500,000
2	Chitral Gol National Park	18 Female and fawn Markhors in Chitral Gol National Park have been found dead due to the flood.				1,800,000
3	Goleen Chitral	01 Boundary wall of wildlife hut at Goleen has been damaged by the flood.				50,000
GRAND TOTAL OF DISTRICT CHITRAL					2,350,000	
5. DISTRICT KOHAT						
1	View point at Toi Banda	Damage parameters	Qnty	Remarks	Estimated cost	50,000
		▪ Walls of the lawn East-west	47 ft	Cracked	20000	
		▪ Walls of the lawn North-south (East side)	41ft	Cracked		
		▪ Walls of the (awn North-south (West side)	17 ft	Cracked		
		▪ Stairs of view point and stairs downing to the river	01	Partially uprooted	20000	
▪ Canopy constructed with hay.	01	Completely Washed Away	10000			
2	Drainage#1 at Togh Mangara Safari Park (TMSP) Kohat	Damage parameters	Qnty	Remarks	Estimated cost	37,500
		Fence of 10 ft height	500 Rft	Damaged/Broken	25000	
		Steel girders	04 No.	Uprooted	7500	
		RCC pipes,	08 No.	Bent & Broken	5000	
		Total			37500	

S#	Name of site/District	Details of flood damage				Cost/value of damage																											
	Mangara Beat at Togh Mangara Safari Park (TMSP) Kohat	<table border="1"> <thead> <tr> <th>Damage parameters</th> <th>Qty</th> <th>Remarks</th> <th>Estimated cost</th> </tr> </thead> <tbody> <tr> <td>▪ PCC work</td> <td>30 Rft</td> <td>Completely damaged</td> <td>3000</td> </tr> <tr> <td colspan="3">Total</td> <td>3000</td> </tr> </tbody> </table>	Damage parameters	Qty	Remarks	Estimated cost	▪ PCC work	30 Rft	Completely damaged	3000	Total			3000		3,000																	
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GRAND TOTAL OF DISTRICT KOHAT					308,000																												
S#	Name of site/District	Details of flood damage				Cost/value of damage																											

6. DISTRICT D.I.KHAN			
D.I.Khan	16 Nos. of Publicity Boards have been carried away by the flood	80,000	
Information Center near Dera-Darya Khan Bridge	The Information Center has been damaged by the flood and requires earth filling, as the flood has washed away the surrounding earth. Following repair work is estimated; <i>Stone works 2000 cft (50) = Rs.100,000/-</i> <i>Earth filling 200 sacra @ Rs.800/- per sacra= Rs. 160,000</i>	260,000	
Watcher Hut at Waterfowl Jheel	Boundaries walls of the watcher hut have got creaks due to inflow of flood water.	50,000	
Chashma Hut	Require complete earth filling Repairing cost of Chashma Hut boundary wall = Rs.50,000/- Sides and Center Earth filling 100 eft @ Rs.800/- = Rs.80,000/-	130,000	
Maskota Breeding Center	badly damaged requiring shifting from Maskota to another safer place or complete repair and its maintenance. <i>Complete dismantling and shifting of old Maskota Breeding Center material and erection = Rs.600,000/-</i>	600,000	
Watcher Hut at Lonni, Kot Lahu, Daraban Kalan, Talgi & Paintara, SaraGarah	Totally damaged and destroyed by the flood water <i>Reconstruction of totally damaged huts (02 rooms each) @ Rs.200000/- each Watcher hut (04 Watcher hut)= Rs.800,000</i>	800,000	
Kacha Water Ponds, feed lots etc during May and June, 2010	Totally damaged and destroyed by the flood water constructed by the Wildlife Department in various projects in the flood affected areas	200,000	
Damages to Wildlife Species	Hundreds of wildlife birds were found dead in the field areas because of heavy rainfall and flood from the last 10 days in D.I.Khan Division. <i>Require 100 pairs of Black & Grey Partridges @ Rs.1500/- per pair for releasing in various Game Reserves= Rs.150000/-</i>	150,000	
GRAND TOTAL OF DISTRICT D.I.KHAN		2,270,000	

ABSTRACT

S#	NAME OF DISTRICT	COST OF DAMAGE
1	District Swat	3,150,000
2	District Kohistan	2,050,000
3	District Nowshera	10,868,000
4	District Chitral	2,350,000
5	District Kohat	308,000
6	District D.I.Khan	2,270,000
	GRAND TOTAL	20,996,000

Information of damages due to flood (updated upto 18.08.2010) pertaining to Wildlife Department is submitted for information and necessary action please.

**Chief Conservator Wildlife
Khyber Pakhtunkhwa
Peshawar**