Chapter 8

Environmental and Anthropogenic Impacts

8.1 Environmental Impacts

8.1.1 Flood hazards:

The valley of Kashmir has witnessed colossal devastations due to heavy floods in River Jhelum and its tributaries followed by a trail of numberless miseries, diseases and famines which affected the life, property and agricultural produce. These have drastically affected the economy of the state.

The flood hazards in the Jhelum river have been given due importance since historical times. As a part of the flood hazard mitigation measures, Suyya (Avantivarman’s engineer minister) in 855-83 A.D. had carried out desilting of the river bed between the Wular Lake and Baramulla, to speed-up the water discharge from the valley. But, it also gave way to reclamation of large tracts of land for cultivation. He had also changed the course of the Jhelum to allow irrigation of dry and barren portions of the valley. The floods and subsequent siltation in the Jhelum River around Wular and Dal lakes have raised the floor of the river by about 2 meters (Uppal, 1956, I & F C Department). The flood-prone zone has been shown in Fig.8.1 (Raza, 1978).
The worst and disastrous flood, as old as 879 AD, has been recorded in the vernacular history of river Jhelum resulting into its blockade and submergence of large part of the valley. Historical records of earthquakes and floods date back to 2092-2041 B.C. when a major earthquake struck the region and created a rift at the middle of the city Sandimatnagar. It allowed the flood waters of Jhelum to sweep the whole town and submerged it. It is opined that this submerged city is now the site for the Wular Lake.


The flood which has been recorded first on the gauge dates back to July 21, 1893 which reads the RL at 5197.50 feet. The full flood discharge calculated was 1750.21
cumecs and the quantity that passed through Srinagar was estimated as 1062.02 cumecs. All the bridges except Amira kadal and many houses were destroyed with an immense loss of life and property. A major flood again smashed the Srinagar city in 1903, inundating the whole city by over-topping of flood waters near the site of the present General Post office.

The history of serious destructions, caused due to these floods compelled the Maharaja of Kashmir in 1904, to initiate the construction of Flood Spill Channel (FSC) to direct the considerable part of flood waters away from city area, at Padshahibagh, through the FSC into low lying numbals of Batmaloo, Aarth and Hokesar. Recently, devastating floods have also stuck the whole valley in August 2010, where almost 48 villages of Kupwara district have been destroyed with more than 500 people dead. Its expanse was also traced till Pakistan and Ladakh regions.

8.1.2 Cloud Bursts:

The irradicity of climate in Kashmir is evidenced by heavy spells of rains during rainy season, especially during spring, when storms called ‘Chang’ blow through the valley and cause heavy destruction of life and property.

A heavy cloud burst extending over a few days occurred in Kashmir valley during the first week of September, 1950. After an interval of 12 days, a heavy rainfall occurred in the valley catchments resulting in a heavy run off and severe floods. The streams including Vishav, Rembiara, Arapal, Romushi had swelled up considerably. The bunds on both sides of river, mostly along the southern banks, were overtopped and breached at a large number of spots. These inundations into the valley had inflicted a heavy loss of life, crops, roads and buildings. Two such breaches on the southern bank of Jhelum
occurred at Gandbal and Bemina, which inundated large regions with agricultural and residential zones.

8.1.3 Earthquakes:

The seismicity in the Himalayan zone is of immense importance, not only with the point of view of past geological evolution of the region but also for its prediction for the future. Devastating earthquakes have been recorded during 855-83, 1841, 1893 and 1903 A.D. The creation of extensive sutures and reactivation of pre-existing Jhelum fault have been reported after the disastrous earthquake of 8th October, 2005 in the western Himalayan zone. It, in turn, gave rise to newer episodes of landslides within the Kashmir valley (Kumar, 2007).

The choking of the drainage of Jhelum during the seismicity of the Quaternary period led to activation of a fault along the river Madhumati, diverting the earlier drainage of the river Jhelum (Kulkarni and Khan, 2008). Such fluctuations, as well as, reversals of drainage systems have also been observed all along the Himalayan zone (Agrawal, 2006). It is now realized that seismic shocks may bring about local or regional tilting of the terrain and may lead to formation of depressions (basins). The remote sensing studies have indicated spatial association of co-seismic landslides with the pre-existing Jhelum fault and Main Boundary Thrust (MBT). It has also given rise to new trends in the alignment of landslides, which indicates reactivation of a new faults or fractures in this region. As these earthquakes mostly trigger minor or major uplifts within the basin, subsequently give rise to flooding of the affected streams. This unavoidable hazard must be tackled by bringing about suitable mitigation measures and adopting disaster management and emergency preparedness programs.
8.1.4 Glaciations:

The physical erosion due to glaciers is a usual phenomenon in the Kashmir valley. The glaciers have been etching the mountain slopes since their formation during the Himalayan orogeny. The presence of ‘U’ shaped valleys, hanging valleys, moraine deposits and varves are all indicative of glaciation. In the geological past, the evidence for the palaeo-glaciation in the valley has been suggested by dE Terra and Paterson, 1978 and Agrawal et al., 1989 (Fig. 8.2).

There are at least 4 major episodes recorded in the region, which alternated with interglacial periods with warmer conditions and intense fluvial activity. However, the data is insufficient to suggest their presence in the proximity of the Wular Lake. Although, the glacial evidences are lacking in the vicinity of Wular Lake, it is beyond doubts that the floods resulted due to the water draining from high lands / glacial regions had deposited sediments in the geological past and are also active presently.

Fig. 8.2 Four major glaciations in Kashmir valley
8.1.5 Discussion

The seismicity and flood hazards in the Himalayan zone are a continuous series of events since time immemorial. Hence, recurrence of volcanicity/seismicity and related flood hazards in the Himalayan zone reveal the dynamicity of the Himalayan zone in the present time (Halder et al., 1992 and Rajendran et al., 2003). The evidences for palaeo-earthquakes have been evidenced all along the Himalayan zone (Sukhija et al., 1999 a and b; Bagati, 2001). The presence of micro-seismicity along nappes, associated with various deformational phases, has also been detected along the Main Boundary Thrust. Some of the geomorphic misfits are indicative of palaeo-geomorphology. The steep slopes of the north Kashmir range towards the Kashmir valley near Zoji-la have been considered as relics of the ancient river by Burrad (1907).

The Himalayan uplift had resulted into severe and multiple deformations and metamorphism in space and time. During these polycyclic orogenic phases, the rivers carved out huge basins and led to the formation of flood plains, with meandering morphology. Due to the rigorous erosion, rivers were also heavily loaded with sediments. As the Himalayan uplift continued with varying rates, the rivers migrated laterally and often encroached each other’s flood plains (Kumar et al., 1989; Kumar and Singh, 1980; Tandon, 1991; Tandon et al., 1984). With continuation of the uplift, intermontane basins were developed during Neogene-Quaternary times all along the Himalayan and Tibetan regions. The Kashmir valley is considered as one such intermontane basin, often termed as ‘thrust top’ or ‘piggy back’ basin (Burchfiel et al., 1992 and Burbank et al., 1996).
The drainage lineaments of river Jhelum (Fig. 5.5) suggest compressional stresses in the directions of north and south, which must have been operative during its evolution. It is during such neo-tectonic episodes that the palaeo-drainage of the mega river (Indus) got disrupted and gave rise to drainage anomalies. Such periodic deformations kept the region seismically active from time to time. The uplifts of post Pleistocene have also been recorded in the gravel deposits that were displaced and uplifted (Kiyoshi et al., 1992, Valdiya, 1992 and 1993). The presence of faulting in the lower Karewa sediments has been reported, with offsetting of about 1400 to 1700 mts (Bhatt, 1978).

The author is, therefore, of the opinion that the present day river Jhelum could have been a tributary of the Indus river, which drains the region towards north of the Jhelum catchment. It probably got disrupted due to neo-tectonic uplift and was diverted towards its present day channels. The remnants of its palaeo-channels may be seen in the form of escarpment-walled streams with very little amount of flow today (Burrad, 1970). The presence of isolated patches of Karewa sediments and gravel deposits confirm shift in the stream directions in the recent geological past. The lineament controlled faults along N-S, NW-SE and NE-SW direction must have resulted in the ‘U pin’ bends in the River Jhelum (Fig.5.5) and other tributaries.

8.2 Anthropogenic Impacts

The natural erosive processes have been accelerated due to the physical deterioration of the hill slopes around the Wular catchment. The Wular Lake, today, is overexploited due to the land acquisition and is subjected to large siltation rates. It is mainly because of deforestation and creation of residential zones wherever hilly tracts have been affected by man’s interference. The very existence of the Wular Lake is,
therefore, threatened due to overexploitation of resources and encroachment by burgeoning population (Photo 8.1).

![Photo 8.1 Steep gradient and almost flattened morphology of the Wular lake](image)

The factors affecting the siltation rates are as described below:

1. **Conversion for agriculture and horticulture development:** A rapid increase in the population has accelerated the need to bring more area under agricultural and horticultural development at the cost of forests.

2. **Increasing dependence for energy:** Kashmir valley has one of the highest dependence on forest resources and the highest annual average per capita consumption of fuel-wood. However, the regenerative capacity of the forests has come down sharply owing to degradation. As a result, the forests are capable of meeting only 20% of the fuel wood demand. The forest line, therefore, has shrunk along the margins of the lake. In the vicinity of Kuhnis village, situated along the banks of Wular, the forest line has receded.
by 0.8 km during last 30 years, whereas the women of nearby Panzgam village have to struggle more than 2 km more everyday to collect fire wood.

3. **Adoption of erosion intensifying agro practices in catchments:** The past surveys have indicated that nearly 30% of the area belonging to the Wular catchment, under dryland agriculture, is under severe erosion as these are ploughed across the contours. This has resulted in creation of channels, streams and gullies contributing high sediment load into the lake. High fertilizer intensity in horticultural lands also contributes to the river water pollution, which ultimately drains into the lake Wular.

4. **Degradation of high altitude pastures:** The pastures under the Wular direct catchment are under constant pressure of the nomadic grazers (Photo 8.2) According to the official government reports, 2000 ha of the pasture land, today, is identified as severely eroded, 2,500 ha as moderately eroded and 4,100 ha as slightly eroded (Report, CMAP)

Photo 8.2 Grazing activities in the encroached land within Wular catchment
5. **Quarrying:** Quarrying is an intensive activity in the direct catchment, particularly along the Bandipora-Srinagar road in the Sadarkote sector. During the course of survey, a number of stone quarries in the Wular direct catchment, especially concentrated in Sadarkote Bala were observed (Photos 8.3 and 8.4). These quarries run throughout the year and dislodge tremendous quantity of loose detritus into the lake bed during the monsoon seasons. Besides these, sand and bajri mining is also practiced intensively within the Madhumati river catchment. These activities severely alter the natural siltation profile of the catchment. Degradation of the catchments has contributed to high levels of erosion. Similarly, remote sensing surveys on slopes and landuse patterns reveal that 43% and 19% of the catchment area falls under moderate to high erosion categories, respectively.

**Photo 8.3  Mining activities in Pir Panjals.**
6. **Poverty**: High dependence on natural resources, declining resource base and limited opportunities for occupational diversification have led to high levels of poverty within the communities.

7. **Changes in resource harvesting methods**: Declining resources have forced the communities to adopt more exploitative forms of harvesting, particularly, in case of fisheries. For better yield, fishermen have resorted to use of nylon nets with lower mesh sizes and long gill nets which drastically affect the regeneration of resources. This has also created conflicts amongst various fisher groups within the lake.

8. **Encroachment of Wetland area by various enterprises**: Many government, as well as, private enterprises have encroached upon the wetland catchment, thereby shrinking the original area and making the slopes more vulnerable to erosion, wherever such landforms are occupied (**Photo 8.5 and 8.6**). Such practices should be thoroughly checked by the concerned departments and strict actions should be taken against the parties involved.
Other environmental factors which deteriorate the water environment of the lake Wular include the following:

1. **Lack of sanitation facilities:** Absence of adequate sanitation and safe drinking water facilities have led to severe health hazards, particularly for the lakeshore communities. There is a sharp rise in the water borne diseases such as gastroenteritis, jaundice and diarrhoea. Presently, less than 2% of the households living in the lakeshore
villages have access to safe sanitation facilities and 42% use untreated water from Wular for domestic purposes rendering them highly vulnerable to water borne diseases and infections (Photo 8.7).

![Photo 8.7 Lavatories with open drains entering the lake area](image)

2. **Problems in lake transportation**: The lake Wular provides an important mode of communication within its shoreline villages. However, silting up of large areas and reduction in water spread has reduced access and increased travel time for several lakeshore settlements, particularly those living in the eastern periphery of the lake. Following key issues have been identified during the assessment of community profile and resource linkages:

1. **Absence of community participation in resource management**: Although, most of the communities, living around the lake Wular, are dependent on its natural resources, they have little participation in the resource management. The government departments, on the other hand, are largely focused on revenue generation through enhancement of resource extraction. The current resource management system, therefore,
is untenable and there is dire need for institutional reorganization, with active participation of the user groups.

2. **Declining resource base:** There has been a drastic decline in the natural resources, both, within and outside the Wular catchment leading to decline in income and thereby poverty within the communities. There is also a very limited emphasis given on the value addition and post harvest management. Absence of access to economic infrastructure such as banking and credit facilities has rendered the communities vulnerable to money lenders, which lead to lower price recovery, pushing the communities into the debt traps.

3. **Developmental Activities and their Impacts:** Wular and its associated wetlands provide ecological and economic growth to the entire valley as they assure food (fish and aquatic vegetation) and also serve as centers of tourist attraction.

   However, agricultural growth has been constrained due to limited availability of land and irrigation facilities. Nature-based tourism today dominates the economy, contributing more than 50% of the state income. However, these developmental activities have failed to recognize the immense role of the wetlands and have led to their large scale conversion and degradation. The first major plan for reclamation of marshes for agriculture development was formulated in 1949 identifying 13,540 ha of area for reclamation through construction of embankments.

   In order to provide energy security to the Kashmir valley, a special drive for willow plantation along the peripheral areas of the lake Wular was introduced. Unfortunately, it led to fragmentation of overall wetland regimes, rapid siltation, water quality deterioration and social conflicts.
8.3 Landuse modifications:

A comparison of the SOI toposheets of 1911 and the imageries of 2007 indicate an overall reduction in wetland area by 45% (157.74 sq km to 86.71 sq km. \{Fig. 8.3 (a,b) and Table 8.1\}

![Fig. 8.3 (a): Landuse (1911)](image)
Fig. 8.4 (b) Landuse modifications in the lake Wular (2007)
(Source: Comprehensive Management Action Plan, Wetlands International, South Asia)
These changes between various landuse categories within the Wular wetland and associated marshes are presented in Table 8.1.

<table>
<thead>
<tr>
<th>Landuse categories</th>
<th>Area (sq. km)</th>
<th>1911</th>
<th>2007</th>
<th>NET CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td></td>
<td>91.29</td>
<td>75.23</td>
<td>-16.06</td>
</tr>
<tr>
<td>Marsh</td>
<td></td>
<td>66.45</td>
<td>11.48</td>
<td>-54.97</td>
</tr>
<tr>
<td>Plantation</td>
<td></td>
<td>0.66</td>
<td>27.30</td>
<td>26.64</td>
</tr>
<tr>
<td>Agriculture</td>
<td></td>
<td>0.38</td>
<td>44.25</td>
<td>43.87</td>
</tr>
<tr>
<td>Settlements</td>
<td></td>
<td>0.43</td>
<td>0.95</td>
<td>0.52</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>159.21</td>
<td>159.21</td>
<td>0.52</td>
</tr>
<tr>
<td>Associated Marshes</td>
<td></td>
<td>58.67</td>
<td>17.67</td>
<td>-41.00</td>
</tr>
<tr>
<td>Net Total</td>
<td></td>
<td>217.88</td>
<td>176.88</td>
<td>-41.00</td>
</tr>
</tbody>
</table>

This shows that the water body and marshy areas of the wetland has reduced from about 91 to 75 and 66 to 11 percent respectively with a subsequent increase in plantation, agriculture and settlements, resulting in an overall change of more than 40 percent.