

Summary

PWS is the largest wildlife sanctuary of Sikkim. It falls under the Himalayan biogeographical region under the IBA Site Code no IN-SK-09 and is located in the eastern flank of East district of Sikkim. The total area of the sanctuary is 128 sq km (29.424.53 Hectares) and it belongs to the bio-geographical zone 2C (Central Himalayas) as recognized by Rodgers and Panwar (1988) and is situated in between 27° 08' 03" N and 27° 21' 59" N latitudes from and 88° 55' 23" E to 88° 41' 28" E longitudes. The PWS has vast extensive forests; shares its boundary with Tibetan Autonomous Region (TAR), Bhutan and part of Darjeeling district of West Bengal.

The PWS is one of the locally recognized biodiversity hotspots Lepcha *et al.* (2006,2007,2009). The forests of Pangolakha range being situated in the most difficult Himalayan terrain are virgin and botanically unexplored. Being remain isolated and undisturbed for many centuries, the sanctuary holds tremendous richness in floristic diversity in comparison to the other areas of Sikkim. Significantly, it also holds greater values, in respect to scientific, environmental, and cultural aspects. Most importantly, the sanctuary holds it wide range of habitats representing all forms of habit pertaining to plant resources. The PWS is also a unique natural conservatory for the state and also for the country.

The rich bioresource of the sanctuary are of great values to the researchers, scientists, botanists and environmentalists across the globe. The sanctuary is unique from its counterparts because of its distinct geographical orientation, sharp altitudinal variations with diverse climatic conditions resulting in the tremendously rich diversity of flora and fauna. The present study has clearly indicated that the sanctuary represents a comparatively higher percentage of unique floras. Not only this, the flora of the sanctuary also reveals of its representation of major groups of plants from lower temperate region to the highest alpine region.

Significantly, the flora of the PWS also hold a vital meaning in respect of rich, traditional knowledge especially ethnobotany and traditional medicine. The people residing in the vicinity sustained themselves living upto the close and symbiotic association with these forests. Their close association with forests determines the greater aspects of the man and environmental

relationship. The sanctuary is a huge store-house of non-timber forest produces (NTFPs) that can be brought into sustainable use for scientific utilities as well for the economic upliftment of local forest-dependent people.

In comparison of the floras of PWS (128 sq km.) with the other prominent floras of Eastern Himalayan region including *Flora of Eastern Himalaya* (Hara 1966, 1971; Ohashi 1975), *Enumeration of Flowering Plants of Nepal* (Hara et al 1978, 1979, 1982) and *Flora of Sikkim – Monocot* (Hajra & Verma 1996). The flora of the PWS represents 140 Families, 421 Genera and 892 species of the total families, genera and species, respectively of that of the entire Flora of Eastern Himalaya. While comparing the flora of PWS with the *Enumeration of Flowering Plants of Nepal*, the flora of PWS comprises of 60 % of families, 27.24 % of genera and 18.04 % of species of the entire angiospermic flora of Nepal.

The PWS being remained less disturbed and of constant presence of the pioneer habitats consequently exhibits appreciable number of endemic taxa. The flora of the sanctuary also reveals that the single family in the flora Asteraceae holds 21 endemic species. Apart from that out of 818 species of angiosperms, over 26.53 % are endemic.

Many threatened or endangered species have been recorded from the PWS and many other species are now becoming rarer in their own natural habitat.

The PWS also holds a wide range of vegetation types and several phytogeographically significant areas with varying of vegetation types at different altitudes. Conspicuously, besides its rich flora, the PWS equally supports a rich fauna, specifically a diverse population of avifauna. Wide distribution of significant wetlands including lakes and rivers are the noted regulators of both climate and the hydrological cycle, which are the major sources drinking water for the adjoining villages like *Rongli*, *Rigu*, *Kupup*, *Padamchen*, *Subany Dara* etc, and act as ultimate reservoir of water sources and its conservation in future. Significantly, the PWS also contributes a diverse form of species that has been source of wild food plants, medicinal plants, and sources of wide range of species of traditional and social values, which is of tremendous economic potential for future sustenance. Therefore, considering all these facts, the bioresources of Pangolakha range has immense potential in regard to the services of the increasing human needs. This resource has potential to restrain from numerous dreadful diseases from the world, and which can be added with values as per the need basis in days to come. The PWS has been a part of *in situ* conservation of both the flora and fauna for many centuries. Many of the faunal elements of the sanctuary are already known to be with rare and endangered status. The PWS is also reported to have highest density of tiger (*Panthera tigris*) population in any national parks and sanctuaries of Sikkim (Forest Department Report). It is also an ideal home to many species of

mammals which are reported to be in *Schedule I of Indian Wildlife (Protection) Act, 1972*. The forest of the sanctuary is also the home of the state's animal "Red Panda (*Ailurus fulgens*). (Anonymous 2009).

Interestingly, the rich floristic resource of the PWS also supports a considerable number of species of foreign origin. They must have been established themselves in the area through a long drawn different processes of migration and naturalization. The species of foreign origin those were recorded from the sanctuary are from America, Australia, Africa, Afghanistan, China, Iran, Pakistan, Russia, E Asia, Malaysia, etc.

The intact belt of Pangolakha range and Neora valley under Darjeeling district of West Bengal has been remained unexplored and undisturbed for hundreds of years, which ultimately could be an excellent model of *cradle for evolution* of species for floristic diversity in the Eastern Himalayan region (Rai & Das 2002). Hence, due to long biological isolation and continues evolutionary process in the local biota, the flora of the PWS uphold an invaluable resource for the scientific researchers in days to come.

The task of assembling available information about the plants of PWS is both vital and formidable. It is because except Khangchendonga National Park (KNP) a comprehensive floristic inventory works for other Protected Areas are yet to be undertaken. Although sporadic collection have been made by different scientists after the visits of Sir J.D. Hooker and W.W. Smith in last two hundred years. Therefore, the task of recording the information of native plants and their cataloging turns out to be immensely important. As a result, the flora holds tremendous potential for those wishing to study the medicinal value of a given species or for searching the relatives of commercially valuable plants that are more resistant to diseases or drought.

Considering these facts, bioresources of the PWS shall be of immense potential for growing needs of human population if exploited in sustainable and scientific manner.

Therefore, the intensive scientific documentation of this gene-pool and framing the future policy for the conservation of these resources is the need of the hour. The biotic disturbing elements including grazing, illegal orchid collectors, and transboundary medicinal plant trafficker etc. are the major causes for the eventual loss of vegetation. Eventually the abiotic factors that ultimately disturbed the ecology of sanctuary are landslide, soil erosion and other ecological degradation.

The entire area can be declared as a Transboundary International Park for further conservation of the bioresources. Considering these facts, a high level committee for conservation of gene-pool of the buffer zone of boarder area, a joint approach can be taken up among three nations – India, TAR region of China and Bhutanese. This step will ensure long-term

sustainability of natural resources in not only parts of Indian Territory but also develop a contiguous chain of protected areas for biological resources in the adjoining countries too.

Hence, the entire area of study, located completely within the Himalaya Biodiversity Hotspot, may be identified as an important hotspot corner for the biodiversity richness jointly with the Neora Valley National Park under government of West Bengal and the governments of Bhutan

The PWS deserves to be taken up in the top priority for conservation aspect. As such, an effective and substantial conservation program considering the total genetic assets needs to be laid down to facilitate the process of natural regeneration. Being one of the immensely rich in biological diversity, the PWS also needs to be recognized as an area of prime biodiversity importance for holistic approach to allocate substantial and adequate funds for its conservation.