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Impacts of Protected Areas on Land Degradation, Vegetation Cover and Biodiversity: A Case Study of Minglot Wildlife Park Khyber Pakhtunkhwa Pakistan

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Abstract: In the current study impact of protected areas were studied on land degradation, vegetation cover and biodiversity by comparing area "Inside" and "Outside" of Minglot Wildlife Park. Significant differences were found in soil fertility. Generally, all the soil parameters had more variation in their values inside protected area as compared to the unprotected area. Protected area was much greener while the unprotected area appeared to have a brownish color indicating less vegetation. Expert interviews and questionnaire survey revealed that the protected area had more animal and plant species inside its boundary, which were not recorded outside. Proper compensation to local communities and effective policies with adequate resource harvesting methods can help further in controlling deforestation that is intruding into protected areas also.

Key words: Protected areas, land degradation, wildlife park, Manglot, Pakistan.

Protected areas serve as a major option for restoring habitats and maintaining species diversity. Establishing protected areas is one of the most important option upon which the global efforts for controlling deforestation rely (Andam *et al*., 2008). A large number of studies have reported positive role of protected areas in controlling the decline in vegetation cover (Geldmann *et al*., 2013). In developing countries like Pakistan, because of urban expansion near protected areas, the number of staff members needs to be regulated accordingly for maintaining the conservation efforts. The purpose of this study is to identify the impact of protected areas on land degradation, vegetation cover and biodiversity by comparing the inside area with the outside area. The study is intended to figure out the actual extent to which the protected area can reduce land degradation, improve vegetation cover and biodiversity. This is likely to provide information that can be used for habitat protection and policy making regarding protected areas.

Material and Methods

The present study was conducted in Manglot Wildlife Park, Nizampur, Nowshehra district (Pakistan), which lies between 33°45'32.84" N, 72°01'55.03" E and 33°45'33.29" N, 71°59'27.79" E and has an area of 1756 acres. The Park was established in 1990 as a sanctuary for wildlife besides promoting awareness and providing recreational facilities for tourism. The area characterizes the scrub forest as found in Mardan, Kohat, Potohar and Murree foothills. Field visits were made to study the impact of protected areas on land degradation, vegetation cover and biodiversity. Soil samples (30 from each demarcated area) were collected from a depth of 0-15 centimeter from Inside Protected Area (IPA) and Outside Protected Area (OPA) (Fig. 1) and analyzed for physico-chemical properties. GPS readings were taken for all the points where samples were collected. Expert interviews were also conducted from the park authorities to know the impacts on protected area on biodiversity and other issues related the park. Vegetation cover was compared using Google Earth images and real-time images taken through digital camera.

Soil sampling and expert interviews

Soil samples were collected from a depth of 0-15 centimeter. Weight of soil in each sample was kept approximately 0.5 kg. A total 60 samples were collected from the research area; of which 30 were from Inside Protected Area (IPA) while 30 from Outside Protected Area (OPA) and analyzed for nitrogen, phosphorus, potassium, organic matter content, soil pH, and electrical conductivity following standard procedure. Google Earth images were used for comparing vegetation cover. GPS readings were

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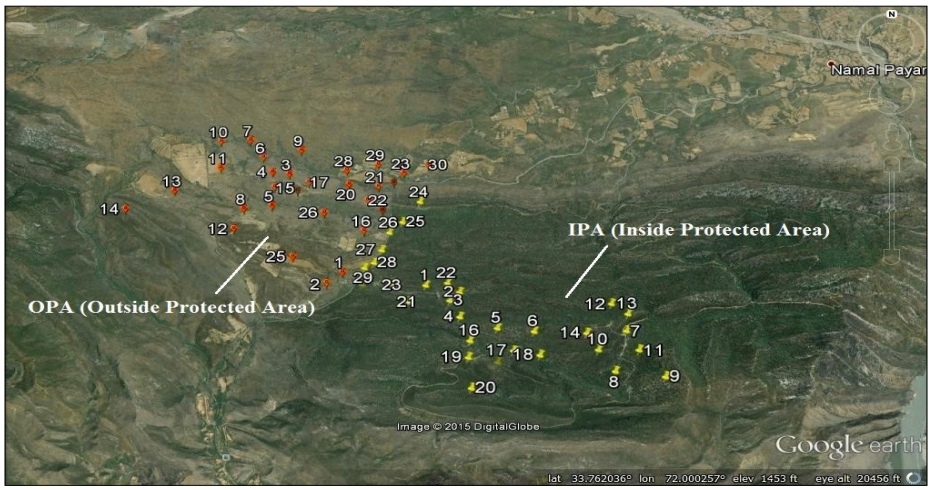

Fig. 1. Map showing sampling points with IPA samples (yellow) and OPA samples (red).

taken for all the points from where samples were collected and were located on a map taken from Google Earth (Fig. 1).

Soil analysis

Soil pH was determined by 105-ion analyzer pH meter calibrated against the buffers of pH 7.0 and 9.0. Similarly soil electrical conductivity (EC) was measured by using EC meter. For soil organic matter analyses, Walkley-Black method was used. Phosphorus was measured following the methods used by Leon Sarkissian, Lala (1984). Similarly potassium content in soil was measured by flame photometer while soil available nitrogen was determined by Walkley-Black method.

In soil analyses, t-test was applied on the data obtained to know the significance of the difference among IPA soil samples and OPA soil samples.

Results and Discussion

Impact of protected areas on land degradation

Organic matter comparison: Soil organic matter (SOM) showed difference as IPA samples had higher values of organic matter than that of OPA. Out of 30, 16 IPA samples showed 2% or more organic matter with a highest value of 3.86%. In contrast, 17 out of 30 OPA samples showed less than 0.5% of organic matter. Further, there was higher variability between OPA samples (Table 1). However there was no significant difference between the soil pH of IPA and OPA. All the pH values of the two sample groups were found to be between 7.33 and 8.06 (Fig. 2).

In IPA samples, more than half of the points had EC values less than 0.15 mS cm^{-1} with 11 points showing 0.11 mS cm^{-1} or less electrical conductivity, while among OPA samples only 12 points had EC values less than 0.15.

Major elements: Soil analysis showed that IPA soil samples are very rich in potassium (50 to 550 ppm) as compared the OPA soil samples (16 to 312 ppm). Phosphorus content in IPA samples ranged from 0.137-4.2 ppm than OPA (0.069 to 3.2 ppm). IPA samples had comparatively more variation in nitrogen values also (Table 2). Manglot Wildlife Park reflected improvement in the available N to a significant degree.

Impact of protected areas on soil erosion

Experts interviews conducted during the study revealed that there are strict rules and regulation regarding the use of the park's resources like vegetation. The collection of fuel

Table 1. Percent organic matter and electrical conductivity of IPA samples and OPA samples (t-test)

Group	Samples	Mean	Std. deviation	Std. error mean
% organic matter IPA	30 Samples each	1.934	0.872	0.159
% organic matter OPA		0.587	0.515	0.094
Electrical conductivity IPA		0.136	0.03	0.006
Electrical conductivity OPA		0.156	0.031	0.006

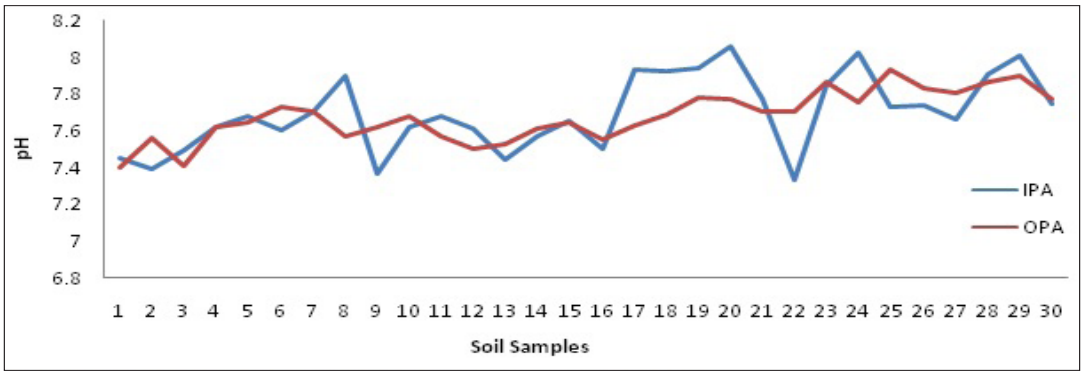

Fig. 2. Comparison of pH values at IPA and OPA.

wood or cutting trees and shrubs are strictly prohibited and there are penalties for violators. These regulations and penalties have reduced the disturbance of vegetation to a maximum level. Moreover, with increase in vegetation cover a significant decrease in the soil erosion inside the Park, led to further stability of the land. Vegetation cover is mostly comprised of plant species like *Dodonaea viscosa* (L.) Jacq., *Olea ferruginea* Royle (syn. *O. cuspidate* Wall. ex G. Don), *Acacia modesta* Wall. and *A. nilotica* (L.) Willd. ex Del. Shrubby vegetation showed highest capacity of soil conservation among all vegetation types. Zhou *et al*. (2016) also reported that erosion rate in shrubby areas and other vegetation types in Loess Plateau, China is less than in grasslands.

Impact of protected areas on vegetation cover

Vegetation comparison was studied using images taken from Google Earth, an internet application having sattelite imagery of the whole earth surface. Figure 3 shows a sattelite view of the Manglot Wildlife Park. The yellow line in the image represents the boundary of the protected area. A clear difference can be seen between the vegetation cover of the IPA and OPA. The IPA appears much greenerwhich indicates a high density of vegetation inside it. Contrastingly, OPA appears brownish, showing that it has comparatively low vegetation density. However in the OPA, there are some greener spots in the southwest of the protected area . This observation was mostly on the hilly area where there was comparatively less human disturbances.

Similarly another images (both satellite and real) taken in south to north direction from the boundary of protected area revealed that protected area is mostly covered with vegetation while unprotected area has poor vegetation (Fig. 3). Main reason for the latter situation was cutting of shrubs and trees which were transported to nearby areas as a fuel wood. Some coal kilns were also found outside protected area where woody shrubs were used for conversion into coal.

Open grazing also contributed in reducing the vegetation outside the protected area. The animal feeding on the vegetation of the protected park were limited due to restricted grazing. In the current study area, deforestation was totally controlled as there were bans and penalties on wood cutting and even on wood collection. Therefore, with respect to deforestation, Manglot Wildlife Park acted like a buffer where forest clearing was not permitted because of which large number of species existed here that were not found in neighboring open area otherwise.

Table 2. Per cent N P K inside and outside of protected area (t-test)

Group	Samples	Mean	Std. deviation	Std. error mean
% available nitrogen IPA	30 Samples each	0.097	0.044	0.008
% available nitrogen OPA		0.035	0.0277	0.005
Phosphorus IPA		1.0	0.88	0.161
Phosphorus OPA		1.159	0.673	0.123
Potash IPA		301.73	165.858	30.281
Potash OPA		135.33	108.392	19.79

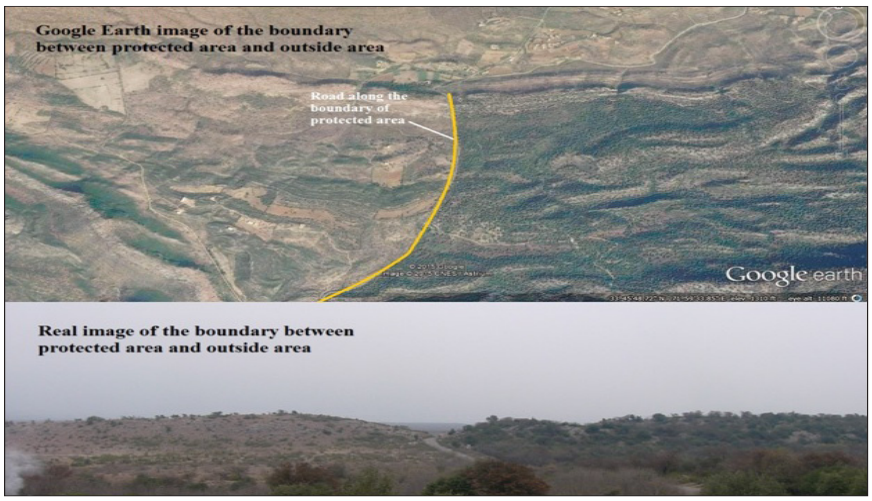

Fig. 3. Image showing satellite photograph and real photograph of the Park's boundary.

Impact of protected areas on biodiversity

To know the impact of protected area on biodiversity, questionnaire survey and expert interviews were conducted. Biodiversity of the park was found to be remarkably different than outside the area. The diversity and density of vegetation made the park more suitable habitat for the wild life. Major plant species of the park are: *Acacia modesta, A. nilotica, Capparis decidua* (Forsk) Edgew. (syn. *C. aphylla* Roth), *Dodonea viscosa, Grewiatenax* (Forsk.) Fiori, *Grewia* spp., *Monotheca buxifolia* (Falc.) A. DC., *Olea ferruginea, Periploca aphylla* Decne., *Tylophora hirsute* (Wall.) Wt. & Arn., *Ziziphus mauritiana* Lam and *Z. nummularia* (Burm. f.) Wight. & Arn. Among these, species like *A. modesta, A. nilotica* and *Z. mauritiana* were found outside the park but at lower density as compared to protected area, however, species like *O. ferruginea, Grewia* spp. and *M. buxifolia* were mostly found inside the park.

Animal species of the park include: *Axis axis* (hog dear), *Canis aureus* (jacjal), *Canis lupis* (wolf), *Gazella gazella* (chinkara), *Hystrix cristata* (porcupine), *Lepus* sp. (hare). Species like *H. cristata* and *C. aureus* were also be found outside the park but in less number. *G. gazella* have almost disappeared from the outside area but some have been released by the Wildlife Department with condition of heavy fines on their hunters. Manglot wildlife Park hosts a number of migratory birds besides providing home to local avian species. Avian species of the Park include: *Alectoris graeca, Ammoperdix griseogularis, Columba livia, Coturnix coturnix, Dendrocitta vagabunda, Galerida cristata, Falco tinnunculus, Francolinus francolinus, Passer montanus and Pyononotus leucogenys.*

Bruner *et al*., 2001 studied the impact of protected areas on biodiversity by considering 93 protected areas of 22 countries. Majority of protected areas were found to be successful in stopping deforestation, hunting and other threats to biodiversity. In the current study, the protected area was much effective in controlling wood cutting, hunting and over exploitation of the park's resources leading to increase in the number and diversity of flora and fauna. Hameed *et al*., 2012, have also reported the effectiveness of protection on the conservation of wildlife habitat. Remarkable improvements were shown by different plant species after fencing.

Conclusion

All the soil properties studied in the present report except phosphorus content and EC was higher in protected area as compared to unprotected area. Consequently vegetation cover was denser in protected areas that also harbors number of plant and animal species. Thus, with an aim to effectively regulate deforestation activity it is envisaged that it is important to execute legal agreements with respect to harvesting of forest resources between local communities and conservation department.

References

Andam, K.S., Ferraro, P.J., Pfaff, A., Sanchez-Azofeifa, G.A. and Robalino, J.A. 2008. Measuring the effectiveness of protected area networks in

reducing deforestation. *Proceedings of the National Academy of Sciences* 105: 16089-16094.

Bruner, A.G., Gullison, R.E., Rice, R.E. and Da Fonseca, G.A. 2001. Effectiveness of parks in protecting tropical biodiversity. *Science* 291: 125-128.

Geldmann, J., Barnes, M., Coad, L., Craigie, I.D., Hockings, M. and Burgess, N.D. 2013. Effectiveness of terrestrial protected areas in reducing habitat loss and population declines. *Biological Conservation* 161: 230-238.

Hameed, M., Naz, N., Ashraf, M., Ahmad, M.S.A., Nawaz, T. and Chaudhry, A.A. 2012. Impact of fencing on the conservation of wildlife habitat in a sub-mountainous open scrub forest. *Acta Oecologica* 45: 16-24.

Leon Sarkissian, Lala 1984. Aspects of indirect atomic-absorption determinations based on molybdenum heteropoly acid chemistry. *Ph.D. Thesis*. URI: https://dspace.lboro.ac.uk/2134/7400.

Zhou, J., Fu, B., Gao, G., Lu, Y., Liu, Y., Lu, N. and Wang, S. 2016. Effects of precipitation and restoration vegetation on soil erosion in a semi-arid environment in the Loess Plateau, China. CATENA, 137, pp. 1-11.

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