

## MAINTAINING THE BIODIVERSITY OF INFORMAL PROTECTED AREAS: A COLLABORATIVE CONSERVATIONAL APPROACH

Mugdha SINGH<sup>1\*</sup>, Ashok Kumar SINHA<sup>1</sup>, Preetvanti SINGH<sup>2</sup>

<sup>1</sup> Department of Zoology, Faculty of Science, Dayalbagh Educational Institute, Agra, 282 100, India

<sup>2</sup> Department of Physics and Computer Science, Faculty of Science, Dayalbagh Educational Institute, Agra, 282 100, India

---

### **Abstract**

*Collaborative conservation strategies for protecting and managing natural resources help in creating a healthy eco-system. A collaborative approach gives a chance in which conservation issues are targeted collectively by using an adaptive management of whole ecosystems, including human communities. The idea is to conserve the local landscape, wildlife and resources by the community and for the community. Collaborative conservation strategies also apply widely for ecosystem management in informal protected areas. In this paper the role of a collaborative conservation of an informal site is discussed, to demonstrate how it may help in maintaining and managing the biodiversity. Additionally, the conservation of formal protected areas and the adjoining cultivated landscape is compared with the biodiversity of the informal landscape. It was found that there is no significant difference in biodiversity richness between the formal and informal protected sites. The paper also focuses on the use of collaboration in conservation as a way for bringing together diverse views, to make decisions on how to protect the environment for the future.*

**Keywords:** Collaborative conservation strategy; Informal protected area; Dayalbagh eco-village; Biodiversity maintenance

---

### **Introduction**

Protecting the natural resources and landscapes is essential for sustaining our quality of life and economy. Protected areas are internationally recognized as regions set aside primarily for nature and biodiversity conservation and are a major tool in managing species and ecosystems which provide a range of goods and services essential to sustainable use of natural resources [1-3]. These formal sites are rich with fauna and flora and often play a host for local migratory species. However, there is growing recognition that the landscape matrix surrounding protected areas also plays an important role in protecting many species [4]. Need of conservation of species and habitat is widely accepted, but there are some gaps which possibly occur because of lack of planning and design. These gaps can be filled by better conservation practices and collaboration effort. This paper presents the importance of collaborative conservational approach in maintaining biodiversity in an informal site, Dayalbagh, Agra. The paper is divided into four sections. Second part presents the collaborative conservational approach with example of Dayalbagh Ecovillage that helps in maintaining the biodiversity. A

---

\* Corresponding author: [mugdhasingh31jan@gmail.com](mailto:mugdhasingh31jan@gmail.com)

comparative analysis of the three formal sites of Agra with the informal site Dayalbagh is also presented. Last section is devoted to discussion and conclusions.

The purpose of this study is to prove that informal protected areas are as important as formal ones for biodiversity conservation at informal sites.

### Collaborative conservation

Collaboration is a way to address the complexity of the conservation issues [5]. It is a process through which parties who see different aspects of a problem constructively explore the differences and search for solutions that go beyond their own limited vision [6]. Collaborative conservation is the process of creating a sustainable future for people and places by inviting diverse and inclusive groups of stakeholders to jointly solve problems through collective learning and action. It is also named as ecosystem management, community forestry, community-based conservation, and coordinated resources management [7, 8]. The emphasis of collaborative conservation is on the process to bring stakeholders together and to negotiate access and use of natural resources. The collaborative conservation is different from other approaches because of its focus on a particular process, but not on particular issues [9]. The reason for this new and wider focus is that many of our natural resource problems cross both human-made and eco-system boundaries, but collaboration has the potential to span far more than just natural resource boundaries.

The process of collaboration can span the social and psychological boundaries of people from different walks of life and different economic levels [10]. It brings together academics from different disciplines like economists, anthropologist, ecologists and engineers. Collaborative efforts can also bring together people who are local and non-local, indigenous and non-indigenous, powerful and powerless, rich and poor, young and old, male and female. It can also span boundaries horizontally among people or organizations and vertically, among people or organizations in a hierarchy [11].

There are multiple conceptual roots of collaborative conservation (Fig. 1), which create an interesting image of key concepts like management, development and so on.



Fig. 1. The roots of collaborative conservation come from different approaches and discipline

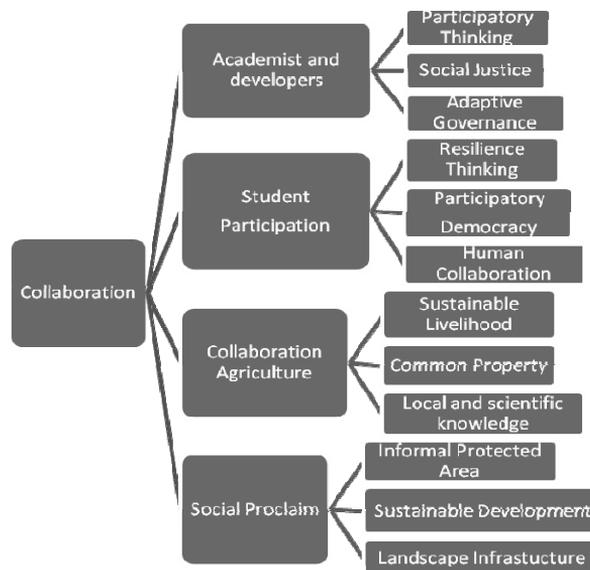
Most collaborative conservation efforts attempt to go well beyond traditional conservation goals to include a wide range of social, economic and cultural goals. The goals of Diablo Trust include landscape conservation and quality of life, good relations among stakeholders and continued production of beef and firewood from the land [12]. In east Africa, the community-based Kitengela Land Leasing Program promotes a win-win by encouraging landowners to keep land open for both livestock and wildlife grazing [13]. This program pays pastoral households to keep fences down and collect poachers’ snares. In India collaborative conservational approach is not much in practice. This paper demonstrates how collaborative conservation can be helpful in maintaining biodiversity in an informal site by taking a case study of Dayalbagh eco-village [14].

Dayalbagh, situated at a satellite projection of the northern periphery of Agra, is a self-sustained colony with serene environment and secular establishments like the industries, educational institutions and agriculture farms. The activities of its inmates lead an active, disciplined and co-operative community life, conforming to the high spiritual ideals of their faith. In Dayalbagh full benefit is taken of the characteristics of rural areas and living infrastructures with advance amenities [14].

***Collaborative features of the informal site: Dayalbagh Ecovillage***

The unique collaborative features of Dayalbagh which help in conserving biodiversity are as follows:

1. Collaboration between academist and developers
2. Teaching environment related courses from primary level students
3. Organizing National Social Service (NSS) Camps, Workshops by SPHEEHA(Society for Preservation of Healthy Environment and Ecology), etc.to lower the conservational problems
4. Collaborative agriculture
5. Social proclaim and urban forestry



**Fig. 2.** Collaborative approach of Dayalbagh

The collaborative conservational approach of Dayalbagh helps in conserving the biodiversity of this informal site by:

- Developing open protected areas and other high quality habitats which conserve the existing biodiversity.
- Maximising conservation range and ecological variability of habitats so that the probability of all local species being lost is minimized.
- Developing ecologically resilient and varied landscapes to provide niche for local and migrant species.
- Enhancing the landscape in terms of primary features such as vegetation structure, slope and elevations, water resource etc.
- Establishing ecological networks through habitat protection, restoration and creation to provide a place for local migrant. Providing species natural corridors can increase the chances of creating new habitat naturally and restoring degraded habitat.
- Releasing herbicides and pesticides is minimized in environmentally sensitive areas, such as streams and rivers because most of these chemicals take many years to degrade naturally.
- Recycling and reducing energy lessen the adverse impact on the environment.
- Increasing greenery, better trash management, less use of private vehicle are the practices done by people in order to save the wildlife and environment.
- Creating new wetlands by taking following measures:
  - Making space for the natural development of rivers and ponds
  - Changing rainfall patterns
  - Allowing natural processes of erosion and deposition to take place for increasing the potential for wildlife to naturally adapt to these changes.

Thus it can be seen that collaborative approach helps in maintaining the bio-diversity of an informal site.

### ***Comparative Analysis***

This section presents a comparative analysis between the three formal sites of Agra and the informal site to show that there was no significant difference in biodiversity richness between these formal and informal protected areas.

### ***Study Area***

Agra, located in State of Uttar Pradesh, India, comes under semi-arid zone. The city is situated near river Yamuna. Agra is rich in terms of biodiversity and greenery. The area consists of eight land use types; River, lake, forest, sand dunes, grass land, cultivated land, pond and orchards (Fig. 3).

The area was categorized in two major acts which then were further divided in parts (Fig. 4):

*a. Protected Areas Act* includes:

- *Special nature reserves* like Bear rescue facility;
- *National Park* includes Keoladeo NP;
- *Nature reserve* includes Soor Sarovar and Patna Bird Sanctuary and
- *Protected environment* Includes black buck breeding ground, *Sikandara*

b. *Biodiversity Act* includes

- *Biodiversity management agreement* for example Taj nature walk and
- *Informal conservation areas* like Dayalbagh Ecovillage

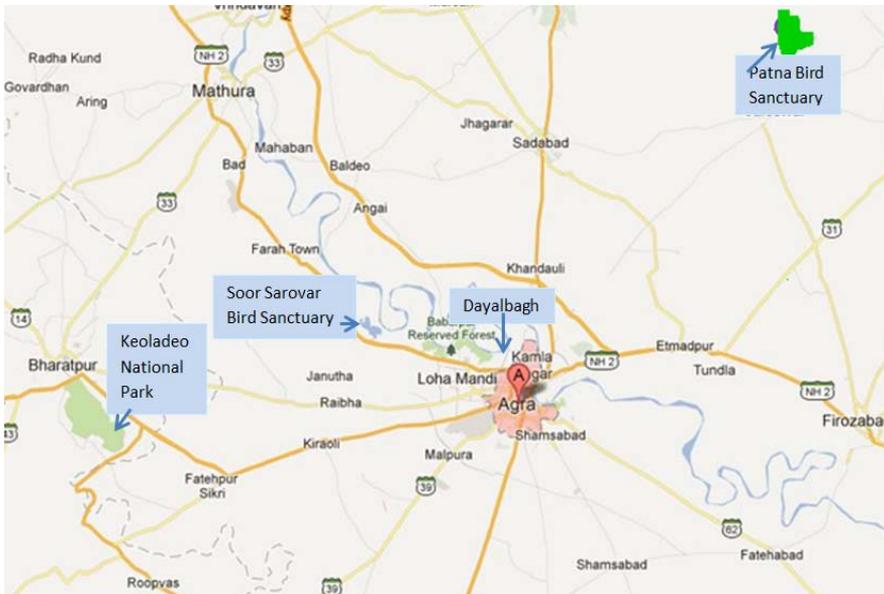


Fig. 3. The study Area

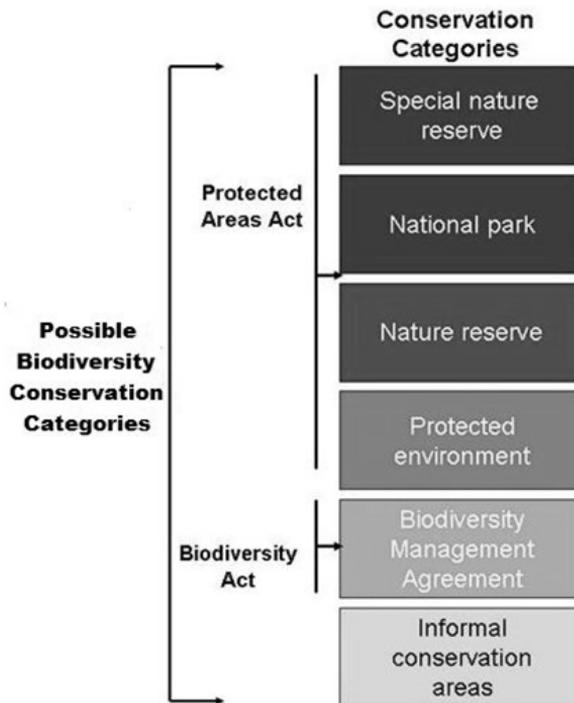


Fig. 4. Possible Biodiversity Conservation Categories (BCC)

The three formal sites of Agra considered in this paper are Keoladeo National Park, Soor Sarovar Bird Sanctuary and Patna Bird Sanctuary. They all come under protected zone provide by the list of IUCN Category IV, Protected Areas. The informal site of Agra, Dayalbagh Ecovillage [14] provides a secure micro habitat for the number of species as good as other protected landscapes.

**Keoladeo National Park (27.158142 N - 77.523445 E)**

Keoladeo National Park, listed as World Heritage site in 1985 by UNESCO, is a wetland of international importance for migratory waterfowl, where birds migrating down the Central Asian flyway congregate before dispersing to other regions. Today the Park is recognized as an important breeding and feeding grounds for the birds in the world.

**Soor Sarovar Bird Sanctuary (27.258292 N - 77.839302 E)**

Soor Sarovar Bird Sanctuary is a shallow water reservoir developed for the continuous water supply in earlier time. Also known as Keetham Lake, it is the biggest lake in Uttar Pradesh, and an emergency reservoir to take care of the water needs of Agra city during summer. Due to abundance of species, especially water birds in March 1991 it was declared as Bird Sanctuary.

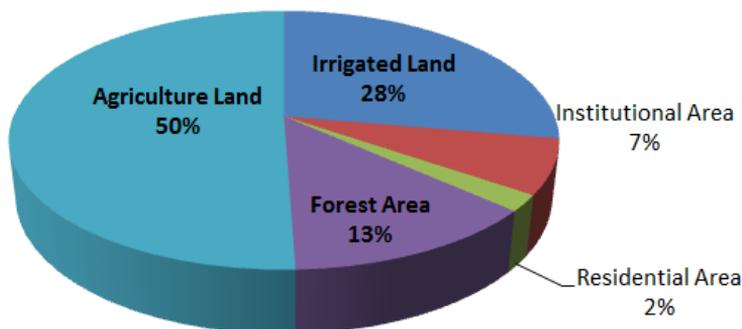
**Patna Bird Sanctuary (27.52791 N - 78.313848 E)**

It is a protected sanctuary in the Jalesar sub division of Etah district in Uttar Pradesh. It covers an area of 108 hectares, and was founded in 1991. It is the smallest Bird Sanctuary in Uttar Pradesh, with a wetland area of only 1 km<sup>2</sup>.

Table 1 presents the locations and areas of the four sites. The land structure of Dayalbagh Ecovillage is as given in figure 5. The total land area of Dayalbagh is 2235 acres of which 63% area is covered by greenery.

**Table 1.** Location and Area of the four sites

	Keoladeo NP	Soor Sarovar	Patna Bird Sanctuary	Bird	Dayalbagh Ecovillage
<b>Location</b>	59 km from Agra	23 km from Agra	57 km from Agra		13 km from Agra
<b>Area</b>	7099.34 acres	1934.84 acres	247.11 acres		1928 acres



**Fig. 5.** Land-use at Dayalbagh Eco-village

## Sampling

To measure the biodiversity of these 3 formal and 1 informal land use types, four contrasting groups of organisms: trees, mammals, birds, and herpetofauna were observed. Four primary forest reserves, four wetlands, 7 orchards, 23 cultivated landscapes were sampled from January 2011 to January 2013. The study areas were rich in species distribution however the green patch sizes were different as well as distance of the study area from the city was varying (Table 1). At each site, we selected a baseline that ran along a natural or human-made linear landscape feature (e.g., track, path, fence, boundary, streams). These transect areas represented all habitats within the site rather than give the “best” one for conservation.

The landscapes sampled for the study were heterogeneous. We started with simple *ad libitum* (at random) sampling of the area. Scan and focal sampling was done to determine number of individuals (observations in the case of mammals, birds and herpetofauna) at each site. Table 2 displays the species distribution of all the four study sites. To create the equal importance areas one zero sampling method was applied.

**Table 2.** Species Distribution at the four sites

	Keoladeo NP	Soor Sarovar	Patna Bird Sanctuary	Bird	Dayalbagh Ecovillage
<b>Vegetation</b>	68	49		21	79
<b>Mammals</b>	78	48		15	27
<b>Birds</b>	205	168		106	122
<b>Herpetofauna</b>	47	38		44	17
<b>Total</b>	398	303		186	245

The biodiversity affecting characteristics of each of these sites were observed and rated on a 5-point scale (0-none and 5-extreme).

**Table 3.** Biodiversity affecting characteristics of the four sites

	Keoladeo NP	Soor Sarovar	Patna Bird Sanctuary	Bird	Dayalbagh Ecovillage
<b>Water Continuity</b>	2	5		1	5
<b>Forest Fire</b>	2	3		0	0
<b>Soil Fertility</b>	3	3		2	5
<b>Grazing</b>	2	4		3	1
<b>Wood Cutting</b>	1	3		1	0
<b>Hunting</b>	2	3		3	0
<b>Fishing</b>	1	2		0	1
<b>Urbanization</b>	3	3		3	2
<b>Food chain</b>	4	4		2	3
<b>Total</b>	20	30		15	17

According to the Table 3, features like forest fire, wood cutting etc. are high in Soor Sarovar as compared to other sites which affect the biodiversity richness of the area. Similarly there is also a need of development in Keoladeo National Park and Patna Bird Sanctuary. But

because of collaborative approach, Dayalbagh (the non-formal conserving site) is in the position of not only protecting the existing biodiversity but will also be a perfect model for biodiversity maintenance.

During the study, landscape feature was compare from < 1 or >1 where 1 is ideal for conservation e.g. wide and canopy covered, clear and regular water, less pollution, minimally disturbed by human activity etc.

### Analysis and Results

To test that there was no significance difference amongst the four sites, ANOVA test was applied. The null hypothesis formulated was:

- i.  $H_0 = \mu_1 = \mu_2 = \mu_3 = \mu_4$ .
- ii.  $H_0 = \mu_{.1} = \mu_{.2} = \mu_{.3} = \mu_{.4}$

This means that there is no significant difference between the species richness and neither is there any significant difference between the habitats. The formulated alternative hypotheses are

- iii.  $H_1 = \mu_1 \neq \mu_2 \neq \mu_3 \neq \mu_4$ .
- iv.  $H_1 = \mu_{.1} \neq \mu_{.2} \neq \mu_{.3} \neq \mu_{.4}$

i.e. there is significant difference between the species richness and also between the habitat.

As can be seen from the figure 6 the entire ecosystem is good at Dayalbagh (ANOVA test, F-value = 4.54, p-value = 0.086), although it is an informal site with not very huge area. There was no significant difference in the distribution of endemic and threatened species across the four land-use types, although native trees are more abundant in Dayalbagh than in any other protected area. The number of resident birds is as high as in any other protected area. Thus Dayalbagh being informal site as well as residential area has balanced habitat.

Figure 6 also demonstrates that Dayalbagh Ecovillage is an equally important area for the entire organisms as compared to the three formal sites. This informal site is able to maintain the biodiversity because of its collaborative conservational approach.

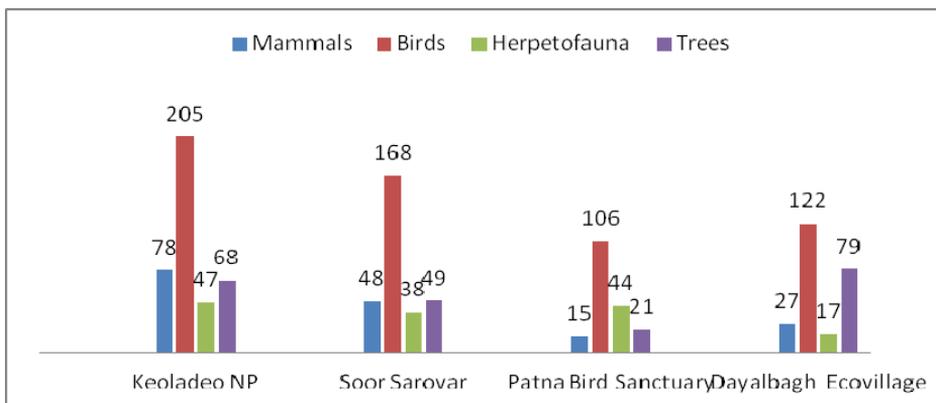


Fig. 6. Species richness at all the four sites

## Conclusion

The absurd deforestation, chemical agricultural practices, over exploitation of land, increases the habitat fragmentation and loss. Make the need for conservation become more urgent, as they constitute the leading cause for biodiversity loss in India, as well as in the world. Weakened carrying capacity and under-range situations have eroded biodiversity in its natural ecosystem.

## Reference

- [1] \* \* \*, *About Protected Areas*, **United Nations Environment Programme Report**, World Conservation Monitoring Centre, 2014. Available at [http://www.unep-wcmc.org/about-protected-areas\\_163.html](http://www.unep-wcmc.org/about-protected-areas_163.html), [Accessed on 1<sup>st</sup> March 2014]
- [2] N. Dudley (editor), **Guidelines for Applying Protected Area Management Categories**, International Union for Conservation of Nature and Natural Resources (IUCN), Gland, Switzerland, 2008.
- [3] B. Child, G. Batnes., *The conceptual evolution and practice of community based natural resource management in southern Africa: Past, present and future*, **Environmental Conservation**, **37**, 2010, pp. 283-295.
- [4] L. Hannah, G.F. Midgley, D. Millar, *Climate change-integrated conservation strategies*, **Global Ecology and Biogeography** **11**, 2002, pp. 485–495.
- [5] C. Huxham, *Theorizing collaborative practice*. **Public Management Review**, **5**, 2003, pp. 401-423.
- [6] C.W. Lee, *The politics of localness: Scale-bridging ties and legitimacy in regional resource management partnerships*, **Society and Natural Resources**, **24**, 2011. pp. 439-454.
- [7] A. Agarwal, C.G. Clark, *Enchantment and Disenchantment: The Role of Community in Natural Resource Conservation*, **World Development**, **27**, 1999, pp. 629-649.
- [8] R. Taylor, *Community based natural resource management in Zimbabwe: the experience of CAMPFIRE*, **Biodiversity and Conservation**, **18**, 2009, pp. 2563-2583.
- [9] D. Snow, *Coming home: An introduction to collaborative conservation*, **Across the Great Divide: Explorations in Collaborative Conservation and the American West** (Editors: Brick, P., Snow, D. and Wetering, S.V.), Island Press, Washington, DC, 2009, pp. 1-12.
- [10] A. Conley, M.A. Moote, *Evaluating collaborative natural resource management*, **Society and Natural Resources**, **16**, 2003, pp. 371-386.
- [11] F. Berkers, *Rethinking Community-Based Conservation*, **Conservation Biology**, **18**(3), 2004, pp. 621–630.
- [12] \* \* \*, **Diablo-Trust**, A Northern Arizona Collaborative Grassroots Land Management Team, 1999. Available at <http://www.diablotrust.org/index.htm>, [Accessed on 23<sup>rd</sup> Feb 2013]
- [13] D. Nkedianye, M. Radeny, P. Kristjanson, M. Herrero, *Assessing Returns to Land and Changing Livelihood Strategies in Kitengela, Staying Maasai? Liveil hoods*,

**Conservation and Development in East African Rangelands** (Editors: Homewood, K., Kristjanson, P. and Trench, P.C.), Springer Press, New York, 2009.

- [14] M. Singh, S.P. Singh, A.K. Sinha, P. Singh, *Dayalbagh: An eco-village model for environment conservation*, **Environment Conservation Journal**, **13**(3), 2012, pp. 73-85.
- 

*Received: July, 15, 2013*

*Accepted: January, 29, 2014*