Chapter 4: Individuals to neighbourhood communities: network arrangements for managing neighbourhood parks

Introduction

There is an increasing evidence that social well-being is enhanced not only by the presence of nature in the immediate surroundings where people live, but also through community participation in greening activities (Westphal 2003). Large heritage green spaces which are often symbols of every city around the world have managed to persist amidst the pressures exacerbated by developments as they enjoy the patronage of civil society organizations (Chapter 1; Ernstson et al. 2010a; Hur et al. 2009). In contrast, newly set up urban commons such as the neighbourhood parks (henceforth NPs), especially in developing countries, have always been in a state of flux, often succumbing to various developments (Chapters 1 & 2). Efforts to increase the stewardship of NPs are essential and have been attempted by developing green spaces within walking distances and also by up-scaling them to provide services that the society requires (Giles-Corti et al. 2005; Millennium Ecosystem Assessment 2005; Pyle 1993; Chapter 2). Failure by city municipalities in adequately meeting the community’s requirements has been the rationale behind community participation in management arrangements (Devy et al. 2009; Chapter 2). Studies have highlighted that involvement of diverse actors in the governing process improves how complexities of the system are addressed (Berkes and Folke 1998; Ostrom and Nagendra 2010). This process of governance is captured through the concept of co-management, which is emerging as an important paradigm to manage uncertainties and build resilience (Carlsson and Berkes 2005). Current studies have suggested that governance processes leading to satisfying the community’s needs are often difficult, but not impossible to achieve (Ostrom 1990; McClanahan et al. 2008). Hence, there is a need to identify the governance structures that exist around these systems, followed by evaluating the functioning of the structure, the partnerships that form the network and ways to strengthen it (Ernstson et al. 2010a; Ernstson et al. 2010b).
In the recent years, studies have suggested that governance structures can be effectively studied, using social network analysis (henceforth SNA), a useful tool with regard to environmental issues (Scholz and Wang 2006; Bodin et al. 2006; Crona and Bodin 2009; Ernstson et al. 2010a). Since networks comprise individual actors who are linked together through various relationships, SNA helps in understanding and analysing their strengths and weaknesses along with the ties (Granovetter 1973), which can influence the outcome of the management. Ego-network (also termed as personal network) analysis a form of SNA which deals with such networks provides an opportunity to merge the different case studies of actors (egos) to illustrate the structure of the entire management (Borgatti et al. 2009). SNA has lately gained attention, especially in studies on social-ecological systems (henceforth SES, Bodin and Crona 2009) such as urban ecosystems, and hence this tool along with the SES framework would help towards grounded speculation about the ways of strengthening the governance and management of existing NPs.

Bangalore, often quoted as the “Garden city”, is known for its numerous green spaces such as heritage parks (HPs), large institutional campuses, home gardens and avenue trees (Nagendra and Gopal 2010). In recent times, NPs are yet another important addition to the existing green spaces in most residential areas (Anonymous*). Rapid development in recent years has caused a decrease in green cover such as felling of avenue trees to widen roads, and the cosmopolitan influence has affected traditional practices such as home gardens to disappear (Chapter 2; Biodiversity in patches1#). The city has lost its historical image as the “Garden city” and transformed into the “IT city” of India (Chapter 1). The city once known for its green environs with a salubrious climate and rich biodiversity has dramatically changed to a highly developed city (Chapter 1). Citizenry have realized this and have begun to value NPs, which were earlier neglected as only large green spaces were appreciated (Nagendra and Gopal 2009; Nair 2005; Sudhira et al. 2007). NPs are pocket green spaces within residential areas, which are utilized

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* refers to documents with incomplete reference # refers to newspaper articles

1# Biodiversity in patches (2012)
largely by the neighbourhood community (Chapter 2). They are dominantly managed by
the Bruhut Bengaluru Mahanagara Palike (municipality, henceforth BBMP), horticulture
department, but in a few areas, residents have formed a registered body, residential
welfare association (henceforth RWA) and collaborated with the municipality to manage
NPs (Anonymous**).

Landscape architects who are often involved in designing urban landscapes focus mainly
on aesthetic values, but pay less attention to other ecosystem services (henceforth ESs)
such as biodiversity support service (Colding 2007; Kendle and Forbes 1997).

Biodiversity conservation requires more than just landscaping green spaces. Lack of
knowledge, funds and involvement of the local community makes the entire process of
biodiversity conservation extremely difficult in an urban environment (Colding 2007;
Chapter 3). Although, in several countries, newer greening concepts such as vertical and
roof-top gardening are being implemented to act as corridors, specifically for the mobile
taxa to move from one patch to another (Getter and Rowe 2006; NewYork Times##); in
India, such practices have not yet been adopted. Greenscapes can vary across the city,

hence a universal management structure addressing biodiversity conservation is
insufficient and various management regimes for varying landscape configurations are
required. Thus, through this study, I evaluate the current governing structures, identify
some good practices within NPs and examine the plausibility of scaling up the ecosystem
services from NPs by proposing a hypothetical model, which incorporates findings on
NPs in Bangalore.

Knowing that biodiversity relies on the larger surroundings in which NPs are embedded,
little is known on how the synergistic effects that different green spaces such as home
gardens, avenue trees, private gardens, may influence in terms of supporting processes
essential for biodiversity (Colding 2007). The study in Chapter 3, shows that presence of
high-density NPs and low-density NPs with a large green space in the vicinity augments
biodiversity in the neighbourhood. Choosing these two real-time scenarios as dominant
neighbourhood landscapes (DNLs), hypothetical models were developed which explore

the managements to not merely focus on provisioning aesthetics and recreational services, but also to incorporate biodiversity support service, thereby increasing the neighbourhood’s multifunctionality. Developing such green links within neighbourhoods, could conserve the biodiversity that exists within Bangalore city.

Working towards developing an improved ecosystem management requires analysing the functioning and characteristics of the current structures of governance that exist around NPs. SNA, which analyses social relationships, consisting of actors (individual actors within the network) and ties (which represent relationships between individuals such as friendship) was used in this study (Wasserman and Faust 1994). Using SNA, this study delineated the management structures around NPs, identified gaps and means to strengthen the networks from the current state to the near-ideal state, so as to provide enhanced services through better green space governance (Figure 4.1). Knowledge that actors possess about biodiversity within the network of NPs were identified and evaluated. As biodiversity also relies on the larger surroundings, hypothetical models across two existing scenarios in the presence of NPs were developed, which could enhance the local biodiversity services within residential neighbourhoods.

![Figure 4.1: Hypothetical model of a neighbourhood park](image-url)
current to ideal state

Hypothetical models

a. Neighbourhood Parks: Urban systems are complex, and to adequately address them, there is a need for institutions that specialize and understand ecological dimensions and social dynamics to work synergistically (Ostrom and Nagendra 2010; Ernston et al. 2010a). Mere existence of fragmented groups that specialize in either of these fields is insufficient for managing the system holistically (Ernstson et al. 2008; Ernstson et al. 2010a). Most often, the reason behind fragmentation of groups is their strict individual structure and framework. This restricts collaborations and does not provide opportunity for organizations to come on to a common platform and work efficiently. The SES framework stresses on multiple stakeholders to collaborate, which can be achieved with some level of overlap in the individual institutional objectives (Ostrom and Cox 2010). Here, a model for NPs was developed, which could elevate these pocket green spaces, through better management practices, to a near-ideal state.

NPs in Bangalore city are largely located within residential localities and are managed and maintained by the BBMP horticulture department. A study by Swamy et al. (Chapter 2) shows that the community which utilizes and lives in the immediate vicinity of NPs, values a wide range of ESs such as recreation and aesthetics that the park provides. Although the BBMP manages and maintains the NPs, these small green spaces often succumb to threats of being replaced by other developments. The involvement of a representative group of the community living around the NP, through a RWA, requires collaborating with the municipality. This collaboration could help protect NPs from threats of conversions, and provide an opportunity to incorporate facilities that the community requires within the NP, which otherwise is ignored by the municipality (Chapter 2; Anonymous 2001*). Also, since the RWA members live in the vicinity of the park, they could monitor the park more efficiently than the municipality. Often, such collaborations do not extend beyond achieving social benefits that the NP can provide to the community, thus completely disregarding ecological functions (Hobbs 1997; Kendle and Forbes 1997).
Bangalore has many ecological research institutions and individuals involved in urban landscaping, biodiversity monitoring, and other outreach/education activities (Krishna 2011; Biodiversity in patches). Identifying and involving ecological institutions could help share knowledge with the BBMP horticulture department, on planting appropriate plants and creating landscape structures, which will support biodiversity. Reconciling interests with experts amidst multiple stakeholders is essential to reduce conflict and strike a balance. For example, ecologists may prefer NPs of the compact landscape type – trees along the boundary and high-density trees in the central area of the park, but the local community may prefer a mixed landscape – trees along the boundary and a few scattered in the central area, with sufficient open area. Thus, the challenge to the ecologist would be to introduce biodiversity within the community’s preferred landscape structure: by introducing plants which will harbour biodiversity, e.g., butterfly-host plants, adult nectar plants and other bird-friendly plants; and retaining leaf litter in a few nooks, which is currently being swept off, so as to ensure good litter fauna (Savitha et al. 2008; Millennium Ecosystem Assessment 2005).

The whole system should be viewed in an adaptive framework perspective, and cannot be achieved as a one-time measure. Also, there is need for a feedback mechanism, which involves both the community and the ecologists. There is ample opportunity for citizen science, where the community can be involved such as regular monitoring programmes, which are critical to assess ecosystem functioning and processes (Herzele and Wiedemann 2003). Involving local academic institutions and volunteers for biodiversity monitoring programmes under the guidance of the ecological institutions would help gather long-term monitoring data, which is critical for conserving local biodiversity within residential neighbourhoods. Conducting regular capacity-building programmes for the local community living around the NP, engaging them in monitoring programmes, encouraging them to develop home gardens and providing them information on installing bird nests and other accessories, would also help them appreciate biodiversity and help understand their immediate environment better (Persuading the sparrow to wing its way back to Bangalore). This would build tolerance levels towards wider forms of biodiversity in their backyards, which is
lacking now (Chapters 2 & 3). Constant interaction, exchange of knowledge, and developing relationships with the BBMP horticulture department, local community, ecological organizations and the local academic institutions will help address the complexities of the system, leading to a better ecosystem management within NPs (Figure 4.2).

![Figure 4.2: Hypothetical model linking multiple stakeholders for improved management of neighbourhood parks](image)

b. **Models for two dominant neighbourhood landscapes:**

1. **Neighbourhood matrix with high-density NPs:** Presence of high-density NPs requires collaboration between BBMP and RWA for maintaining them. Linking RWA’s of many NPs could help better monitoring of these pocket green spaces within the neighbourhood. A neighbourhood comprises avenue trees managed and maintained by the BBMP tree department and home gardens maintained by individual owners. Linking the entire neighbourhood green spaces could help enhance biodiversity within
the neighbourhood (Figure 4.3a).

2. **Neighbourhood matrix with low-density NPs and presence of large green spaces:**
   Bangalore city is popular for its large green spaces such as Lalbagh and Cubbon park. Linking the managements of these large green spaces with other multiple small green spaces within the neighbourhood, such as NPs and avenue trees, could help develop a green network to enhance the ecosystem services that these spaces provision (Figure 4.3b).

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**Figure 4.3:** Green networks developed in two neighbourhoods. (a) Presence of multiple neighbourhood parks and (b) Presence of large green spaces
Methods

Study area

Bangalore city is divided into 47 wards (henceforth administrative units) distributed across three belts: 1st belt is the city centre called Petta; 2nd zone consists of old residential areas and the 3rd belt comprises newer areas that have developed over the recent years (Bangalore Development Authority 2007). These three belts capture the variations in socio-economic classes within the city: lower middle class houses set in 6*9 m², which are generally cluttered; upper middle class houses set in 9*12 m² with reasonable living space; lower high class houses in 18*12 m² sites or apartments with more space for garden; and finally upper high class houses set in 18*24 m², which are luxury bungalows or apartments. Four administrative units within each belt, along the north, south, east and west cardinal directions were selected for the study, except for the 3rd zone, where only two administrative units were selected, as most of the areas were yet to be developed (Plate 2). Within each administrative unit, randomly six parks were sampled. Insufficient number of parks following the size criteria within a few administrative units resulted in a total sample of 37 NPs across 10 administrative units for this study. All the three belts come under the jurisdiction of the municipality “Bruhat Bengaluru Mahanagara Palike”. The period of study was between April 2010 and May 2011.

Managements around NPs

An exploratory survey was conducted in the 37 NPs, to identify the various governing structures that exist around them. Interviews with park users, who were representatives of residents in the park neighbourhood helped collect information about the park management (Chapter 2), and thus helped me identify the different managements around NPs. Also, since the NPs chosen represented a variation in socio-economic classes across the three belts, it helped assess if socio-economic factors determined the absence/presence of a certain governance structure around NPs.
This study focused on two dominant managements that exist around the 37 NPs.

1. Co-managed NPs (henceforth CoM NPs) – The tenure of all the parks within the BBMP boundary is managed and owned by the BBMP horticulture department. Through the ‘adoption policy’, as stated by the BBMP horticulture department, interested individuals within a few areas have formed a RWA, a statutory body, which has collaborated with the BBMP horticulture department in managing the parks within their neighbourhoods. While the BBMP horticulture department continues to facilitate the maintenance of NPs, the RWA monitors the cleanliness of the park. In a few cases, the RWA has taken additional interest and responsibility by collecting funds from the residents, to incorporate additional facilities such as play area for children within the NP (Anonymous 2001*). The RWA not only monitors the park, but also addresses other issues related to civic amenities such as water supply, electricity, etc., within the neighbourhood, with the respective departments in the city. The overall goal of RWAs is to make their neighbourhoods more livable.

Members of the association are residents of the neighbourhood and they pay an annual fee which is utilized for the maintenance of the area, of which a portion is utilised for NPs. Those living on temporary basis/on rent within the neighbourhood are allowed to be part of the RWA, but do not have electoral powers. The RWA consists of office bearers (henceforth core members), who form the main decision-making body. Decisions on management are taken up by members with the support of the committee members. The RWA does not have a stringent management structure, as it completely depends on the number of core members.

2. City-managed NPs (henceforth CiM NPs): The BBMP horticulture department manages and maintains the NP through its employees who are gardeners and landscape contractors. The facilities provided in a park, along with landscaping and designs are all dependent on the funds allocated to the horticulture department for individual parks. Each belt has its own park management representatives, i.e., superintendent, engineer, contractor, etc. (Figure 4.4).
Network sampling

Of the 37 NPs sampled in this study, three were CoM NPs, while the remaining 34 parks were CiM NPs. In order to have equal representations of the two managements, three replicates each were chosen, thus a total of six parks (henceforth focal NPs) was selected for this study. Although the replicates for the CoM NPs represented two different socio-economic classes, this could not be avoided due to lack of representation of the other classes.

![Diagram](image)

**Figure 4.4:** Hierarchical chart of people-in-charge within the BBMP horticulture department

While exploring the managements around the focal NPs, I have interviewed the president of a CoM NP, and the contractor of a CiM NP. These initial interviews provided information on the subsequent actors within the network through their social contacts (Darren *et al.* 2008). Thus, the size of the network grows through the snowball effect of continuously finding more persons who participate in the network. This allows one to gather information on all the actors who play their roles within the management. All actors found within the network were approached and a semi-structured interview was conducted. In this interview, each respondent reported his/her
relations with the other actors within the management; frequency of interaction; type of discussion between each other; power to make decisions and finally if affiliated or linked to other similar managements/organizations (Wasserman and Faust 1994). In addition to social relations, data on personal attributes such as gender, age, position within the management and qualification among others were collected for each respondent (Crona and Bodin 2006; Annexure 5).

Generally in network analysis, the ties that are found are deemed as being the result of longer-term stable patterns of social interactions (Ernstson et al. 2008). To analyse these relationships that exist within the managements, questionnaire surveys were conducted. Information about the relationship among actors within the management was captured through a multiple choice questionnaire, wherein each choice was attached to a rank. Thus, through a series of questions, each actor helped generate a matrix of numbers against the actors he/she was in contact with. These numbers were then used as weights to measure strength of the ties, which is depicted as thickness of the line in the networks (Annexure 5). For example: (A) to build ties between actors, each actor was asked to rank his/her relationship with a subsequent close contact within the management – Colleagues and good friends = rank 3; Colleagues and friends = 2; Colleagues only = 1; (B) to measure the strength of the ties, actors were asked, how often they met – Daily = rank 4; twice or thrice a week = rank 3; twice or thrice a month = rank 2; once a month = rank 1. This process helped build links between all the actors within the network.

As this study aims at strengthening the existing management to enhance the ESs that NPs provision, the focus was on biodiversity support service which was least valued among communities (Chapter 2). There exists enough recognition of the role that green spaces play in providing cultural services such as aesthetics and recreation. The biodiversity service could act as a surrogate to various other ESs that the NPs provision such as presence of many trees and shrubs within NPs, reduce the temperature in the surroundings, reduce noise pollution, increase carbon sequestration and much more (Nagendra and Gopal 2010). Thus, it is essential to evaluate the
knowledge that actors possess on the ecological aspects of NPs. Along with the social network questionnaire survey, actors’ knowledge on biodiversity services were also assessed such as – listing species from various taxa that they encounter within NPs. Through a ranking system that was adopted for bird sightings, they were categorized as follows and the biodiversity knowledge was assessed: ubiquitous species, such as House/Jungle crow and Myna were ranked No. 1; common species, such as Sunbird, Flowerpecker and Tailor bird were ranked No. 2; uncommon species such as Sparrow and Barbet were ranked No. 3 and finally rare species such as Oriole and Paradise Flycatcher were ranked No. 4. We also enquired about the type of landscape they preferred within NPs through a multiple choice questionnaire – Open type = 1; Mixed type = 2 and Compact type = 3.

Collected data was analysed for social network using UCINET 7, and NETDRAW was used for visualization of the networks (Borgatti 2002).

**Exploratory survey on dominant neighbourhood landscapes**

Areas within the 10 administrative units were explored to identify the two DNLs based on density of NPs within the city. Presence of high-density NPs has influenced biodiversity within the city (Chapter 3) for which the second belt was chosen as most administrative wards within this belt consisted of this DNL. For low-density NPs in the presence of large green spaces, wards within the first and the second belts were chosen. Interviews conducted with the residents within the first and second administrative units helped identify the managements around green spaces in the chosen DNLs.

**Results**

Presence of only three CoMs in the 37 sampled NPs, demonstrates that this is relatively a new type of management. Also, poor representation of CoMs could suggest that there is still a lack of stewardship by the neighbourhood community around small green spaces within the city. Existence of CoM NPs has emerged as a community’s initiative and they largely belong to the elderly group (>45 years old), who have ample time to supervise the
neighbourhood on a daily basis. Representation of the younger age groups is near-absent as they belong to the working class and do not have time to participate.

**Structural variations**

The number of actors within the CoM NPs seem to differ across the replicates; hence allowing for structural variations, unlike CiM NPs, which are uniform (Figure 4.5a and 4.5b). The variation within the CoM NPs suggests that the RWA management is flexible to incorporating individuals other than the office bearers, who are interested and/or have an expertise in a related field such as botany or forestry, which is seen in CoM NP replicate 2. This interpretation, although derived from low-density sampling, suggests that CoM is an emergent practice and different forms of such organizations should be studied. This allows for a comparative study between other forms of managements. Given the newness, this study is an exploratory attempt to describe the managements that exist, and allows for comparison with the dominant management that is present within the sampling area. The CiM replicates show that the links between all actors are one-way. Absence of two-way links clearly demonstrates the strict hierarchical system within the BBMP horticulture department (Figure 4.4) in governance and management; hence, showing a linear top-down relationship within CiM NPs and among the BBMP actors belonging to CoM NPs (Figure 4.4).

**Relationship and communication network between actors**

The relationship networks show that a few actors within the CoM network play an important role in keeping the entire network connected, critically by maintaining connections between the BBMP and the RWA, which is crucial for the functioning of the NP management. For example, the CoM replicate 2 shows that actor R2 (secretary of the RWA) is centrally connected to all the other actors within the network (Figure 4.5 a2). Absence of R2, could fragment the network (Figure 4.6 2) between the two institutions. Also, the relationship and communication networks show that there are several two-way relationships between the RWA members (83%), which is absent between the RWA and BBMP actors and also within the CoM networks. Since, the BBMP horticulture department owns the parks, the RWA actors are expected to communicate and interact with the BBMP and not vice versa; hence, leading to one-way communication between
RWA actors and BBMP actors within the CoM network (Figure 4.7). Hence, the role of R2 is fundamental in keeping the two groups connected within the CoM replicate 2. The CoM replicate 3 is not included as there is no secretary within its RWA.

**Figure 4.5:** Structural variations across and within replicates of (a) CoM neighbourhood parks and (b) CiM neighbourhood parks. R (in red) represents actors within the RWA and B (in blue) represents actors who belong to the BBMP horticulture department

**Figure 4.6:** Co-Managed neighbourhood park networks in the absence of the secretary – R2
Figure 4.7: Communication network across the three replicates of Co-Managed neighbourhood parks

Biodiversity knowledge and landscape preference

There is significant difference in biodiversity knowledge between the actors within the CoM NPs and the CiM NPs ($U = 0.4267, p = 0.05$). Although, the network structures demonstrate that the biodiversity knowledge varies across the replicates of the CoM NPs, the Mann Whitney $U$ test did not show any significant difference ($U = 111.5, p = 0.556$). Within the CoM NPs, the RWA actors seem to possess more biodiversity knowledge than the BBMP actors, because of their number of resident years in the same neighbourhood (Table 4.1). Also, actor R2 within CoM NP replicate 2 seems to possess more knowledge on biodiversity compared to the other actors within the network; hence, he could be identified as a key individual to increase biodiversity-related knowledge amongst the others in the network. A comparison between the landscape preferences between the two managements show a significant difference, where the RWA actors within CoM NP largely prefer the mixed landscape type which supports more biodiversity, while the BBMP actors within CoM NPs and CiM NPs prefer the open type of landscape within NPs ($U = 13.873, p = 0.01$).

Dominant neighbourhood landscapes

Across both the DNLS, each of the green spaces is managed by individual bodies. For example, in the presence of high-density NPs, only one is managed by the BBMP and RWA while all the others are managed only by the BBMP in the neighbourhood. The avenue trees are managed by the BBMP tree group and the home gardens are managed by individual house owners. There is no link either across the managements or even
within the BBMP, between the tree group and the horticulture department. Lack of collaborations across the managements has led to fragmented efforts, which are insufficient to enhance and conserve biodiversity within residential neighbourhoods.

**Discussion**

Poor representations of the CoM NPs across the eight administrative units sampled in Bangalore city, suggest a lack of citizenry participation towards NPs. Interestingly, families who share a common workplace, have similar socio-economic backgrounds and stay within the same neighbourhood, such as retired employees from Canara Bank, seem to form RWAs within residential neighbourhoods. Also, studies have shown that similarity in attributes such as age, class and social group can give rise to cohesive groups (Granovetter 1973). CoM replicate 2 is the only example, which comprises RWA actors with diverse backgrounds, age groups and socio-economic classes. This variation within attributes across the replicates of CoM NPs demonstrates that formation of CoM NPs occurs dominantly in the presence of similar social groups, but can also occur in the presence of diverse cultures, socio-economic status and age groups. Such diversity and tightly knit network, is absent within the BBMP actors, thus making CiM a weak network. All actors belonging to the CoMs are mostly retired or males above 45 years of age, lacking women representatives as they are occupied with household chores.

Such a high degree of similarity in attributes such as age, qualifications, social class and interests amongst the RWA actors of the CoMs, has shown to facilitate communication and reduce conflict resulting in homogeneity, thereby increasing cohesiveness (Reagans and McEvily 2003; Krackhardt and Stern 1988). Studies have shown that such homogeneous, tightly knit network is not the best form of management (Ernstson et al. 2008) as it can lack diversity in knowledge, and is hence incapable of interpreting and adapting to the pace at which the system is changing. Most studies dealing with network refer to governance structures that have evolved over several years and are currently proving to be good case studies to learn from, such as the adaptive co-management of Kristianstads Vattenrike Biosphere Reserve, which
evolved over time. This study by Olsson *et al.* (2007) clearly demonstrates the management structure that evolved from a few concerned individuals to several diverse stakeholders at a subsequent stage through a well-connected multilevel governance structure within the SES framework. These networks help build a benchmark for developing a successful management, which states that similar attributes build a homogeneous group which is essential for the formation of networks in the initial stages. Although this is just one such study, it provides valuable information which allows for some critical thinking on evolution of the networks. More such studies using network analysis are essential, for more conclusive outcomes to build a base for foundational statements. For example, the RWA within CoM NP replicate 2 was formed as a result of a threat to the park area being replaced by an local academic institution and the permission was granted by the municipality (Ravindran 2007; **Anonymous 2001). In spite of being a small group of stewards participating and protesting against the conversion to alternative use, they were successful in protecting the area that was earmarked for a park. They also, took the initiative to develop the park by raising funds within the neighbourhood, while the municipality ignored them and did not provide any support. This clearly demonstrates that involvement of a few stewards can help conserve NPs within neighbourhoods (Bodin *et al.* 2006; Olsson *et al.* 2007; Ernstson *et al.* 2008). Since formation of groups in most cases is initiated between people with similar attributes (Ernstson *et al.* 2010a), stressing on the need for heterogeneity, diverse knowledge, and multi-stakeholder involvement for developing a successful management (Reagans and McEvily 2003; Krackhardt and Stern 1988) would certainly strengthen the existing governance structures around NPs, but such an evolution would occur only over a period of time.

Power of citizenry has proved to be fruitful in conservation of NPs and bringing about changes within their neighbourhoods. Although the tenurial rights of NPs are vested with the BBMP horticulture department which maintains NPs within Bangalore city, NPs have succumbed to developmental activities such as civic amenity centres and institutions, which are carried out without consulting the neighbourhood communities (Chapter 2). This demonstrates that management only by the BBMP horticulture
department is prone to the risk of NPs being put to alternative use. Also, since the organizational structure of government institutions hinders collective action (Steins and Edwards 1999; Ostrom 2000), this study suggests that CoM NPs is a better management than CiM NPs, for conserving and managing NPs across Bangalore city.

Studies have indicated that not only do large green spaces provision a range of ESs, but a cluster of small green spaces can also cumulatively contribute a substantial level of services (Bodin et al. 2006: Chapter 3). Although, the services that the community expects does not go beyond recreational facilities, NPs have proven to support 50% and more faunal diversity that large green spaces within Bangalore city support (Chapters 2 & 3). With capacity-building of the RWA actors within the CoM NPs and linking with ecological institutes, one can build a vibrant citizen science, which will contribute to the maintenance and management, as well as help serve as an important feedback loop for NPs (Quader and Raza 2008). Elevating NPs from its present state to the hypothetical state would help incorporate the community’s requirements and enhance the biodiversity support services within NPs (Figure 4.8).

**Figure 4.8:** Green network within residential neighbourhoods in the presence of neighbourhood parks
To achieve biodiversity conservation within the city, just enhancing localized small green spaces such as NPs is not sufficient (Colding 2007); a green network within the neighbourhood should follow, by creating and linking multiple green groups such as a home/community garden club, municipality for NPs and avenue trees and an RWA within the residential neighbourhood (Figure 4.8). A study by Swamy and Devy 2012 (under review) shows that neighbourhoods with high density of NPs and sparse NPs in the presence of a large green space can support rich biodiversity. Thus, a two-scale governance – one which would link low-density NPs and neighbourhood green spaces with large green spaces – and the other which would be linking several NPs with neighbourhood green spaces, could help enhance biodiversity support services within residential neighbourhoods (Figure 4.3a and 4.3b). Other than presence of large green spaces, suburbs of cities, which once were dominated by natural vegetation have now over the recent years transformed into a mixed landscape comprising managed and natural green spaces. It is in such landscape configuration that have intermediate disturbance biodiversity is said to peak (Blair 1999). Therefore linking peri-urban areas, would require linkages with diverse institutions such as forestry, private plantation owners, farmers and gated communities. Using the SES framework, by involving multiple stakeholders such as ecologists, the community representing public and private groups and developing green networks in biodiversity-rich neighbourhoods, could help achieve the goal of urban biodiversity conservation.

The application of SNA helped identify de facto social groups, essential ties and potential to strengthen existing managements to instigate collective action for a successful co-

Table 4.1: Relationship between the number of an actor’s resident years within the CoM neighbourhood parks and knowledge on existing and lost biodiversity

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<thead>
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<th>Park</th>
<th>Category</th>
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<th>R</th>
<th>df</th>
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<td></td>
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<td>0.8873</td>
<td>4</td>
<td>0.811</td>
<td>S</td>
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</tbody>
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management around small green spaces. This study identifies that citizenry participation would help maintain and conserve small green spaces within neighbourhoods. Also, involvement of multiple stakeholders such as ecologists and local academic institutions can strengthen and enhance services that the community requires as well as increase biodiversity support services that NPs provision. Green networks at the neighbourhood scale will help reconnect humans with backyard green spaces, which are rapidly disappearing in developing cities (Bodin et al. 2006; Bodin & Crona 2009; Borgström et al. 2006; Chapter 2). Increased interaction and appreciation of such socio-ecological systems in the neighbourhood could generate society’s involvement for a better urban green space management (Ernstson et al. 2010a).

References

Comprehensive Development Plan.


**List of websites and newspaper articles referred #:**

1. Biodiversity in patches (2012):
   http://www.deccanherald.com/content/256159/biodiversity-patches.html.
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