

Appendix 2.

Detailed description of the SES attributes of the seven lakes studied in Bangalore, focusing largely on the time period between 2007 and 2012.

In the case of urban lakes, the variable that varied the most between different lakes was their size (RS3). Bellandur and Varthur are among the largest lakes in Bangalore, collecting water from a number of lakes in the network; indeed, Bellandur is the largest lake in the city limits, with an area just over 360 ha, while Varthur Lake is over 120 ha. The estimated cost of restoration of these lakes is Rs. 900,000,000 (approximately USD 16, 556, 291 at current rates of exchange) and Rs. 150,000,000 (approximately USD 2, 759, 381) respectively (BBMP 2010). Agara and Kaikondanahalli are moderate in size and extend to about 20 ha, while Ambalipura, Parappana Agrahara, and Mestripalya are small lakes with areas of 3–6 ha. Ambalipura and Kaikondanahalli have been recently restored at an approximate cost of Rs. 15,200,000 (approximately USD 279,617) and Rs. 108,500,000 (approximately USD 1,995,952) respectively (BBMP 2010), and do not have substantial amounts of sewage currently.

The number of actors (A2) is lowest in Mestripalya, with exclusion of socio-economic groups (A2a). This former lake has dried completely, and was converted into a park and nursery, with some encroachments for construction. A Public Interest Litigation filed by local residents and pursued diligently over a couple of decades resulted in a court ruling that the area was a lake, and could not be developed for any other purpose. A relatively small and reasonably cohesive group of local residents have worked with technical experts, and developed a plan for restoration that incorporates social and ecological considerations. This group is largely comprised of a small group of middle class and affluent residents, and does not include the inhabitants of adjacent villages in their deliberations. Restoration of the lake has recently begun in 2013 and is now in progress.

In Ambalipura, Kaikondanahalli, and Parappana Agrahara, the group of actors is moderate in size, and includes the original residents of the villages around these lakes – representing a diversity of uses including commercial and subsistence fishing, grazing, fodder collection, cattle washing, clothes washing, and firewood collection – and urban residents, both poor and wealthy, who access the lake for a range of purposes, from washing of clothes to urban recreation and exercise. The set of actors expands further in Bellandur and Varthur to additionally include a number of industries and some hospitals located around these lakes, which also impact the lake by polluting it and encroaching on the lake bed as well as the lake channels that drain into and out of the lake. Attempts at planning have included a diversity of actors including original village inhabitants, as well as actors belonging to educational institutions, and corporate establishments.

Strong local leadership (A5) exists in all four lakes where collective-action levels are high – Ambalipura, Bellandur, Kaikondanahalli, and Mestripalya. The leadership does not vest with one strong (and therefore possibly autocratic) individual, but instead, a relatively small group of individuals have led different initiatives at different points of time, who may interact informally (as in the case of Kaikondanahalli Lake) or through a tightly linked, formalized network with defined responsibilities (as in the case of Mestripalya). In Agara, Parappana Agrahara, and Varthur, there have been sporadic efforts by influential local residents and groups to organize

protests, but in Parappana Agrahara and Varthur these have not been sustained due to a lack of influential, widely accepted leadership. In Agara, a recent initiative by local residents in 2013 has led to cleaning up of the periphery of the lake, and the initiation of a new cycle of lake protection and restoration.

Norms of trust and social capital (A6) are low in Agara, Bellandur, and Varthur, where connections have not been established between older residents from different socioeconomic groups, and between residents from surrounding villages and relatively recent urban residents. In Mestripalya, although the local residents' association has worked together to reclaim the area from encroachment and to devise a community plan for restoration, there are some conflicts between members of this group, thus social capital is characterized as moderate in this lake. Ambalipura represents a landlocked lake surrounded by high-end apartments and layouts, and the social capital there is quite high. In Parappana Agrahara, at the periphery of the city where urbanization is relatively limited, the opposite holds true – social capital within the village is fairly high, and the involvement of urban residents is fairly low. In Kaikondanahalli, the group that works for restoration of the lake includes representation from older villages as well as from more recent houses and apartments, and social capital can be characterized as high.

Current dependence on the lake (A8) is low in Agara, where the lake has been degraded for the past few years, as well as in Mestripalya, where the lake bed has been dry for decades. In Ambalipura and Kaikondanahalli, the lake has become an important location for urban exercise and recreation in recent months, following their restoration. These lakes are also important for restoring the rapidly depleting water tables in this area. Their dependence on these lakes is, therefore, moderate. In Bellandur and Varthur, although recreation and exercise are not possible due to the high levels of pollution, the villages near these lakes depend on them for agriculture and cattle fodder (although these dependencies have decreased over time). Their drinking water also comes from wells that are linked to these lakes through a shared groundwater table, which results in pollution of their groundwater. Parappana Agrahara Lake has become extremely polluted in recent years due to sewage from the adjacent Bangalore Central Jail, but the village still depends on this water for agriculture, cattle fodder collection, cattle washing and other domestic uses. There are a number of wells linked to the groundwater supply that the adjacent villages rely on that have become polluted as a consequence of the lake pollution. Thus, the dependence of the residents surrounding these three lakes is extremely high.

In Ambalipura and Kaikondanahalli, just prior to restoration, there were no commonly accepted operational community rules (GS5) that placed a limit on the types of activities permitted in the lake. After restoration, however, the community associations maintaining the lake have developed an informal and evolving set of adaptive guidelines that indicate, for instance, how much fodder can be extracted from the lake during which seasons, and limit activities such as washing of clothes, dumping of solid waste, and input of sewage. In Agara, Bellandur, and Varthur, there is a current absence of operational rules, although such rules may have been in place earlier. In Mestripalya, since the lake bed was dry for several years and the park in existence in this area was overgrown with weeds and rarely visited, there was no need for the development or enforcement of operational rules. Once restoration is complete, this may change. In Parappana Agrahara, although there were operational rules and norms in place until recently that indicated permissible types of use and extraction by adjacent villages in line, many of these

practices such as fishing and washing of cattle have been discontinued or heavily scaled down after the lake became polluted, and such use of the lake is so infrequent that again, there is no need for the maintenance or enforcement of operational rules.

Ambalipura and Kaikondanahalli have been especially successful at networking with government agencies (I8a). These are the two lakes where restoration has proceeded in a manner that pays attention to the social as well as the ecological requirements of residents, and where ecological outcomes are highest – indicating the importance of this variable. Informal norms related to monitoring (I9) are only in existence in two of the seven lakes – Ambalipura and Kaikondanahalli.

In terms of Outcome variables (O1), collective action is high in Ambalipura, Bellandur, Kaikondanahalli, and Mestripalya; moderate in Agara and Varthur, where some efforts have been made by local groups to protect and restore the lake; and low in Parappana Agrahara, where local residents have tried to organize to protest against the pollution of their lake by the Bangalore Central Jail, but have been unable to do this effectively and in a sustained manner. Ambalipura and Kaikondanahalli are relatively high in environmental condition (O2). The other lakes are all low in environmental condition, as explained further in Appendix 1.