



## Integration of blue, green, and grey infrastructure in Urban campuses as a Nature based Solution for resilience and harnessing co-benefits

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One of the pressing challenges we observe in fast expanding urban areas especially in Global South are linked to the retreat of nature, infrastructure development negatively impacting urban blue and green spaces (BGS), along with growing vulnerability due to climate change. With the rapid rate of urbanisation, there is growing interest in protecting BGS as important Nature based Solutions (NbS) by securing ecosystem services and refuge to biodiversity.

Unlike energy and water efficiency, which yield clear financial benefits, ecological services and biodiversity co-benefits are often undervalued. This undervaluation reduces incentives for institutions to prioritize them. A promising NbS approach in fast sprawling urban areas is to implement biodiversity friendly practices in stable land-use areas such as large privately or publicly owned/managed campuses. There is evidence that a very large proportion of the country's birds, bats and butterflies are reported to be found in educational campuses across India. While, there are evidence that these campuses help in mitigating heat stress besides sequestering carbon and helping in reducing urban risks due to lack of sufficient evidence, campus-based biodiversity conservation is likely to be seen as a co-benefit rather than a primary driver of impact. To fill the gap present stud we summarize evidence from across India and bring in insights from two Indian urban educational campuses viz. National Environmental Engineering Research Institute, Nagpur and the *Indian Institute for Human Settlements*, Bengaluru.

We use satellite derived land surface temperature (LST) to quantify and map negative temperature anomalies (cooling) with respect to spatial average in these campuses in years with different levels of summer temperature. Observations and measurements on biodiversity, ecosystem services including carbon sequestration, microclimate, and ground water from these campuses are linked to campus management including integration of blue, green and grey infrastructure.

Several such campuses can include educational, governmental and defence establishments, multinational corporations as well as hospitality and other service providers can function as long term urban ecological observatories to understand the long-term impact and benefits of NbS apart being early warning networks for tracking environmental and ecological change across time

and space, thereby enabling large areas as pivotal NbS at the city and country level. This improves the ease of implementation and have a positive impact on biodiversity, a key indicator of ecological health to promote ecosystem services, and also human health. We endorse urban campuses and their role as potential NbS by serving as catalysts for transformational urban development. This approach links biodiversity conservation with climate adaptation and deep decarbonisation, crucial for sustainable economic development. A network of several campuses should be developed through the formulation and implementation of Ecosystem-based Adaptation (EbA) that focuses on climate action. Designating campuses under a new category of conservation area called other Effective Area-based Conservation Measures (OECM) will help emphasizing the relevance of campuses and, driving policy and investment changes for resilience building following NbS. An NbS roadmap leveraging the integration of blue, green, and grey infrastructure and emphasizing the concepts of co-existence with biodiversity and ecological restoration can emerge from campuses.