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## The role of ex-situ conservation in restoration practice: lessons from 25 years of plant conservation at the Gurukula Botanical Sanctuary, Wayanad, Kerala

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The Gurukula Botanical Sanctuary (GBS) has been concerned with plant conservation in the Western Ghats since 1981. Our model combats species erosion and habitat degradation through ecosystem gardening and forest-based community education for people from all walks of life. Its effectiveness is evident in the rising regional demand (Kerala, Karnataka and Tamil Nadu) for plant material, habitat restoration methods and education programmes.

GBS's central intention is to restore endangered species and habitats in a highly fragmented landscape, in which only a fraction of original forest remains, and high numbers of species are extracted for human use (up to 50% in areas like Wayanad and Coorg). We estimate that 20% of native species are under threat of extinction within the next 20 years.

Whereas the medicinal plant industry has managed to successfully cultivate less than 100 species in total between all the big nurseries (Dabur, Kottakal, Himalaya etc), GBS has built up extensive populations for 30% of the region's flora (2000 indigenous species across 100 families), through a strategy that involves: high intervention and, a high degree of protection or "leaving alone". Many of the species found in GBS lands are rare and endangered and for some the Sanctuary may be their last refuge. Forty percent of our gene pool is endemic, including orchids, impatiens, peppers, grasses, aroids, acanthus, gingers,

mosses and ferns. GBS's location (at the edge of a reserve forest), elevation (at 750 metres), and climate (8 months of rain/year) allow us to grow rich and complex semi-natural plant communities representing a wide range of habitats/conditions across the Ghats.

Many botanical gardens are able to grow species under highly controlled situations and most tend to have a higher proportion of exotic flora than native species. These exotics tend to be sturdy representatives from their own regions and moreover, are easy to grow as they have undergone decades of cultivation. However, the collection at GBS is unusual, in terms of both the diversity of native species and the numbers of each species propagated. Wild species are notoriously difficult to propagate in large numbers, yet that is precisely what is needed for ensuring their survival.

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Success through ex-situ means requires an understanding of the complexity of the problem and of the diversity of techniques required, including detailed long-term observation, scientific knowledge, sound horticultural practice, rigorous experimentation. Our team has developed a broad knowledge base of 100 plant families covering ecology, biogeography, taxonomy, plant pathology and horticulture. Primary to the whole process is the understanding that ex-situ cannot be divorced from habitat protection. The principle is actually very simple: plants require the forests, and forests require the plants. Where habitat protection has failed then the rescue and conservation of plants attains paramount urgency. Furthermore ex-situ conservation can only work when rigorous standards of plant care and propagation and re-introduction are maintained. Data has to be maintained over a long period of time to observe how accessions, ecotypes and species behave in the wild, semi-wild or cultivated situations.

At GBS we propagate horticulturally challenging (largely herbaceous) plants that occupy highly specialized niches in the wild. These species are not just confined to nursery areas, but

occur in regenerating populations (sometimes of several thousand individuals) in recreated habitats along with hundreds of other species that grow without assistance. This is the largest representation of native species in the region and includes both flowering and non-flowering taxa. The plant database, maintained since 1981, has taxonomic, biogeographic, ecological and horticultural data for every species, accession and ecotype. It is an up-to-date groundtruthed statement on the status and distribution of 2000 plant species through the Western Ghats.

Ecosystem gardening involves nudging natural succession processes as well as removing invasive exotics, tending, reseeding and reconstructing habitat structure in a variety of native ecosystems. Re-introduction of species to degraded places where once they were found meets the twin targets of habitat restoration and species conservation and is particularly effective when habitat fragments are grossly reduced and disjunct.

Enriching spaces to fill 'all niches' in complex and relatively mysterious ecosystems like the rainforest, requires strong observational skills and sound theoretical basis. We consider a habitat to be on the way to successful reconstruction when the processes of self-regulation become evident for any population or assemblage of species. The closer we can mimic specific settings in the wild the more likely it is that independent communities will establish themselves.

At GBS it is possible to see two ecosystem mimics: medium elevation wet evergreen rainforest: and montane grassland. In both areas species representation is high. Moreover ecosystem structure and diversity is clearly evident. If at 750 metres we are able to demonstrate an ecosystem mimic from higher elevation, then surely it will be far easier, for example, to restore grassland in the degraded edges of Mukurthi National Park.

At GBS, we also adopt degraded areas and protect them while monitoring the species recovery process over several decades. Over the years we have acquired small parcels of degraded land and restored them piece-by-piece to

native forest. Within 55 acres of land, some 35 are left largely alone. In a few, we have removed exotic plantations to allow native species quick access, and have seen species diversity and forest structure return in areas that have been completely devastated. In 5 acres we intervene in great detail; every plant is known and carefully tended as part of our experiments in habitat reconstruction. A final 5 acres, distributed amongst the rest, provide us with over 50 crop plants including wild edible species, grown in the traditional style of forest farming. This multi-tiered approach maintains the structural and functional elements of the natural forest, with the distinction between healing areas, natural forest, and farm diminishing over time. This is a working model to demonstrate integrated land use to small landholders at a time when cash crop economies are brutally affected by world prices.

It must be remembered that ex-situ conservation for animals poses very different issues and challenges than ex-situ conservation of plants. For example, plants naturally form hybrids. The Impatiens genus and most of the Pteridophytes are prone to hybridization in the wild. Secondly, the vast majority of the planet's land area and therefore its vegetation structure has been massively altered through 10,000 years of agriculture and human intervention. We now have to search for pristine wilderness, if indeed it exists anymore. Humanity (and the rest of life) inhabits a landscape of its own making, where natural areas have already been invaded by alien species.

Restoration ecology (including ex-situ conservation) presents alternatives in this context, that we must now deliberate over and consciously implement. This depends on what we value and what we wish our landscapes to be. Do we choose wattle over grassland? Coffee over forest? When 90% of the Western Ghats is under exotic industrial plantation, what will areas recover to when left alone? What is the standard that we can work towards? As an integral part of this comprehensive strategy, sound ex-situ conservation gives us the possibility to broaden our scope.

Suprabha Seshan has lived and worked at the Gurukula Botanical

Sanctuary, Wayanad, Kerala, since 1993, prior to which she studied Agro-ecosystem ecology in USA and Earth sciences in the UK. She is the founder of GBS's School in the Forest, a broad collaborative initiative with educators across the region that runs day-programmes on biodiversity (for 40 private or government schools and 30 colleges mostly from North Kerala) and residential programmes (for 15 rural and urban schools from Karnataka, Tamil Nadu and beyond). She has designed and directed several research and restoration projects both at GBS and elsewhere such as Mukurthi National Park and Talacavery Temple Sanctuary. She is an affiliate with Ashoka Innovators for Social Change. In May 2006, on behalf of the team at the Gurukula Botanical Sanctuary, Suprabha received the 2006 Whitley Award for Nature sponsored by WWF-UK , in London.

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