

Living Root Bridge Ecosystems of Meghalaya, India: Nature-based Infrastructure Solutions for Extreme Climate

By Sanjeev Shankar

Published in PEDRR (Ecosystems for Disaster Risk Reduction and Adaptation) Newsletter 2020

Article adapted from original article published in *Design with Life: Biotech Architecture and Resilient Cities* by Maria Aiolova and Mitchell Joachim



Figure 1. Double tier Living root bridge, Nongriat village, Meghalaya (2013)

Current research and discourse surrounding integration of natural - living systems within infrastructure and buildings is often perceived as speculative, niche and avant garde. While this outlook has many underpinnings, the case study of 'Ficus-based living root bridges of Meghalaya' can provide rare real life practical evidence in support of this field, and inspire the global community to re-imagine the 'built' environment as a living-nourishing environment.

Living Root Bridge Ecosystems are *Ficus elastica*¹-based infrastructure and landscape solutions within dense sub tropical moist broadleaf forest ecoregions of North Eastern Indian Himalayas (25° 30'N and 91° 00'E). As living plant-based structural ecosystems, these infrastructure solutions are grown and nurtured by indigenous Khasi and Jaintia tribes of Meghalaya over decades and perform as critical rural connectivity and landscape solutions for several centuries in extreme climatic conditions². With 1) low material and maintenance cost, 2) high robustness and longevity, 3) progressive increase in strength and performance, 4) community-led participatory design approach across multiple generations, 5) remedial impact on surrounding soil, water and air, 6) support for other plant and animal systems, 7) keystone role of *Ficus* plant species in local ecology, and 8) diverse morphologies including bridges, ladders, towers, viewing platforms and soil erosion/landslide prevention structures, *Ficus*-based living root structural ecosystems offer a compelling model for socio-ecological resilience and living plant-based sustainable infrastructure solutions.

With more than 100 living structures currently in active use through out Meghalaya, we have a unique opportunity to study the primary principles, which govern these structures and their underlying behaviour/performance. This knowledge can fundamentally shape our approach to 'designing with nature' and further inform the vision of nurturing resilient infrastructures. Each living root structural ecosystem is a unique site-specific response, which has emerged through interaction between humans, plants and the environment, offering a living test bed for empirical investigation. In-situ research over an extended time period in collaboration with indigenous communities can help us understand the interactions between various living and non-living agents across different scales and seasons. This will help us comprehend the emergent behaviour and ecosystem services provided by these structures. Such a comprehensive understanding will eventually inspire new improved living plant-based hybrid constructions, which nourish Earth's natural resources and address critical environmental challenges related to biodiversity loss, deforestation, environmental degradation, climate change, food and health.

Ficus genus has more than 850 species³ globally and testing/applying the knowledge of Living Root Bridge Ecosystems to other plant species and geographical contexts can potentially broaden its scope and impact. Exchange between indigenous communities and contemporary scientists will inform a shift in the nature of scientific inquiry and cultivate a balance between ancient intelligence and contemporary thought. As these living structures are revealed to the global community, we believe it will inspire a new sensitivity within society and eventually rejuvenate the relationship between humans and plants. Designing with nature is a compelling prospect and to leap into the future we have much to learn from the past.

REFERENCE

1. Native from the Himalayas to Malaysia, Sumatra and Java, *Ficus elastica* (or India rubber tree or India rubber fig) is a broadleaf evergreen shrub or tree that may grow to 50-100' tall in its native habitat.
<http://www.missouribotanicalgarden.org/gardens-gardening/your-garden/plant-finder/plant-details/kc/b597/ficus-elastica.aspx>
<http://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:60458499-2>
2. Mawsynram and Cherrapunji are the wettest regions on Earth, prone to extreme rainfall related disaster events including floods, landslides and severe storms. This region is also seismically active and categorised under Zone V (very high damage risk zone) based on Vulnerability atlas of India
<http://www.bmtpc.org/DataFiles/CMS/file/map%20of%20india/eq-india.pdf>
3. <http://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:327905-2>

CONTACT

For further information, please email author
sanjeev@sanjeevshankar.com