



Restoration Cases Flagship Collection

Case #20

Junglescapes: Restoring forests to
conserve wildlife in India's Western
Ghats

ETH zürich | CROWTHER LAB



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In brief

Overview

The Western Ghats in India are a global biodiversity hotspot, home to elephants, tigers, and many other endemic and iconic species. But forests and grasslands there are degraded from anthropogenic pressures including fuelwood harvesting, cattle grazing, and the proliferation of invasive plants. The result is poor wildlife habitats in and around many of the region's extensive wilderness areas. Traditional conservation efforts treated locals as a threat to forests.

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In 2007, Junglescapes, a local NGO, adopted a new approach that engaged local indigenous villagers as restoration partners and champions. Many of these communities had been displaced to create conservation areas. Junglescapes created accessible, low-cost restoration methods tailored to the region to remove invasive species and restore wildlife habitat. They also leveraged and helped conserve the extensive traditional ecological knowledge of the communities they work with.

Exemplary practices

Junglescapes learned from piloting and trying different techniques to make restoration low-cost and viable at larger scales. They gradually switched from focusing on tree planting to using assisted natural regeneration, a restoration approach focused on facilitating native forest regrowth. They combined traditional and scientific knowledge in an organic, pragmatic way, gradually giving communities a greater role in restoration planning and decision-making. Ultimately, this approach produced a number of innovative, locally-adapted restoration techniques that use local materials and know-how, implemented by communities that now self identify as environmental stewards. Junglescapes received the SER Full Circle Award in 2017,

in recognition of its success in integrating local communities in large-scale restoration.

Key lessons learned

- ▶ *Assisted natural regeneration can be a powerful tool to facilitate “restoration for rewilding.”*
- ▶ *Carrying out responsible restoration—using native species, fidelity to local ecosystems, working with nature, and monitoring progress—is critical for good ecological outcomes.*
- ▶ *Giving local indigenous and forest-based communities increasing autonomy and treating them as allies can build trust, stewardship, and robust restored ecosystems.*
- ▶ *Combining science with traditional ecological knowledge can produce a suite of social, cultural, and ecological benefits.*
- ▶ *Recognize the value of learning from nature, rather than about nature.*





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Restoration narrative

Visit restor.eco

Junglescapes: Restoring forests to conserve wildlife in India's Western Ghats

Visit and learn more about the project's ecological analytics here:

Junglescapes in the Western Ghats, India

RESTOR

Geography and ecological setting

The Western Ghats are a global biodiversity hotspot and UNESCO World Heritage site. The many national parks and reserves here provide critical habitat for iconic and highly endangered species, including tigers and Asiatic elephants. But major threats to these forests—such as rampant invasive species, fuelwood collection, cattle grazing—have left vast areas of forest degraded. Degraded forests have lower biodiversity and provide poor habitat for many forest animals. Forest-dwelling indigenous people were relocated to the peripheries of these parks when they were formed (Anand and Mulyani, 2020). In this context, in 2007, the local NGO Junglescapes began working with local communities to reverse degradation and restore wildlife habitat in and around parks and reserves.

Junglescapes works in the southern Western Ghats near Bandipur National Park (868km²) (Karnataka province), part of the Nilgiri Biosphere Reserve (5520 km²) (Figure 1). Forests range from 680 to 1,500 masl and include dry deciduous forests, moist deciduous forests, and shrublands.

Habitat for a number of endangered animals and plants, forests here are home to elephants, tigers, wild dogs, sloth bears, and many species of primates, deer, insects, birds, and reptiles (Venkataraman, 2015a; Chakraborti and Venkataraman, 2018). The Nilgiri Biosphere region houses the most sustainable tiger population in India.

A number of Junglescapes' interventions focus on the Lokkere Reserve Forest, adjacent to the Bandipur Tiger Reserve (Figure 1). The reserve is located ~1,100 masl, covers 6.4 km², and is part of a critical elephant migration corridor between the Eastern and Western Ghats (Shashidharan, 2012). An important buffer area for wildlife, this forest is heavily degraded and overrun with invasive species (mainly the shrub *Lantana camara*). Forests here are the tropical thorn forest type, with small trees, shrubs, and open areas. Droughts are common and rainfall is typically less than 600 mm annually (Venkataraman, 2015a).

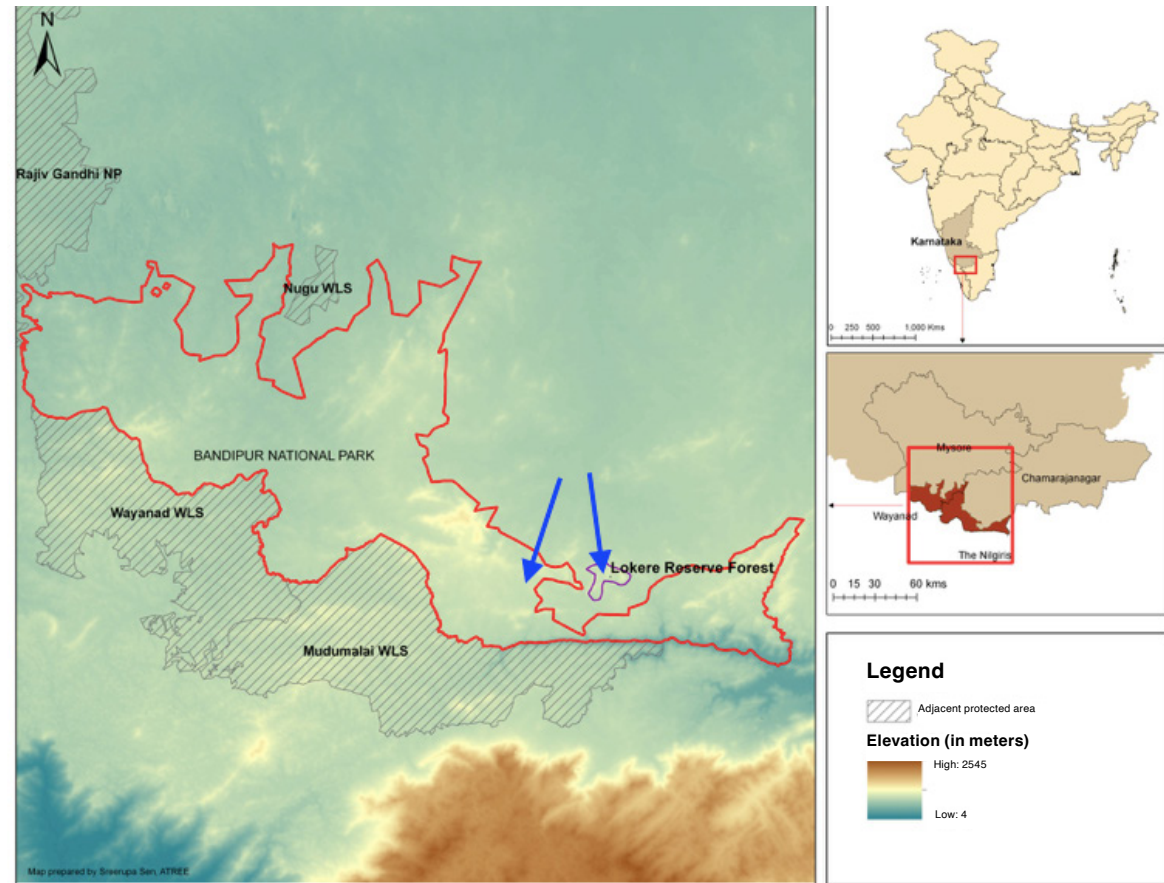


Figure 1. Junglescapes works in the Western Ghats, India, largely in and around Bandipur Tiger Reserve. Blue arrows indicate specific keystone communities that Junglescapes worked with early on.

Source: Junglescapes, 2010

Deforestation and forest degradation

The Western Ghats experienced extensive deforestation over the past century. Once nearly covered in evergreen and semi-evergreen tropical forest, forest cover declined since 1920 by 35%, and forests now occupy less than 50% of the region (Reddy et al., 2016). Many natural forests were replaced by plantations or agriculture. Forest clearing rates were especially high in the mid 20th century. In the 1940s, India's "Grow More Food" campaign led people to clear large areas of forest for crops. Waves of colonization followed in the 1950s and 1960s, bringing new infrastructure like dams and roads and subsequent deforestation (George and Chattopadhyay, 2001).

Although forest clearing has slowed in recent years (Reddy et al., 2016), the forests where Junglescapes works continue to be degraded by firewood harvesting, cattle grazing, and the spread of invasive species (Anand and Mulyani, 2020; Figure 2). Many communal and fallow lands surrounding the forest reserves have been converted to modern agriculture, reducing available fuelwood in non-park lands. But families still use large amounts of fuelwood for cooking and heating water. Traditional cookstoves (*chulas*) require an average of 10–15 kg of wood *per* day to meet family needs, putting significant pressure on nearby forests (Venkataraman, 2021).

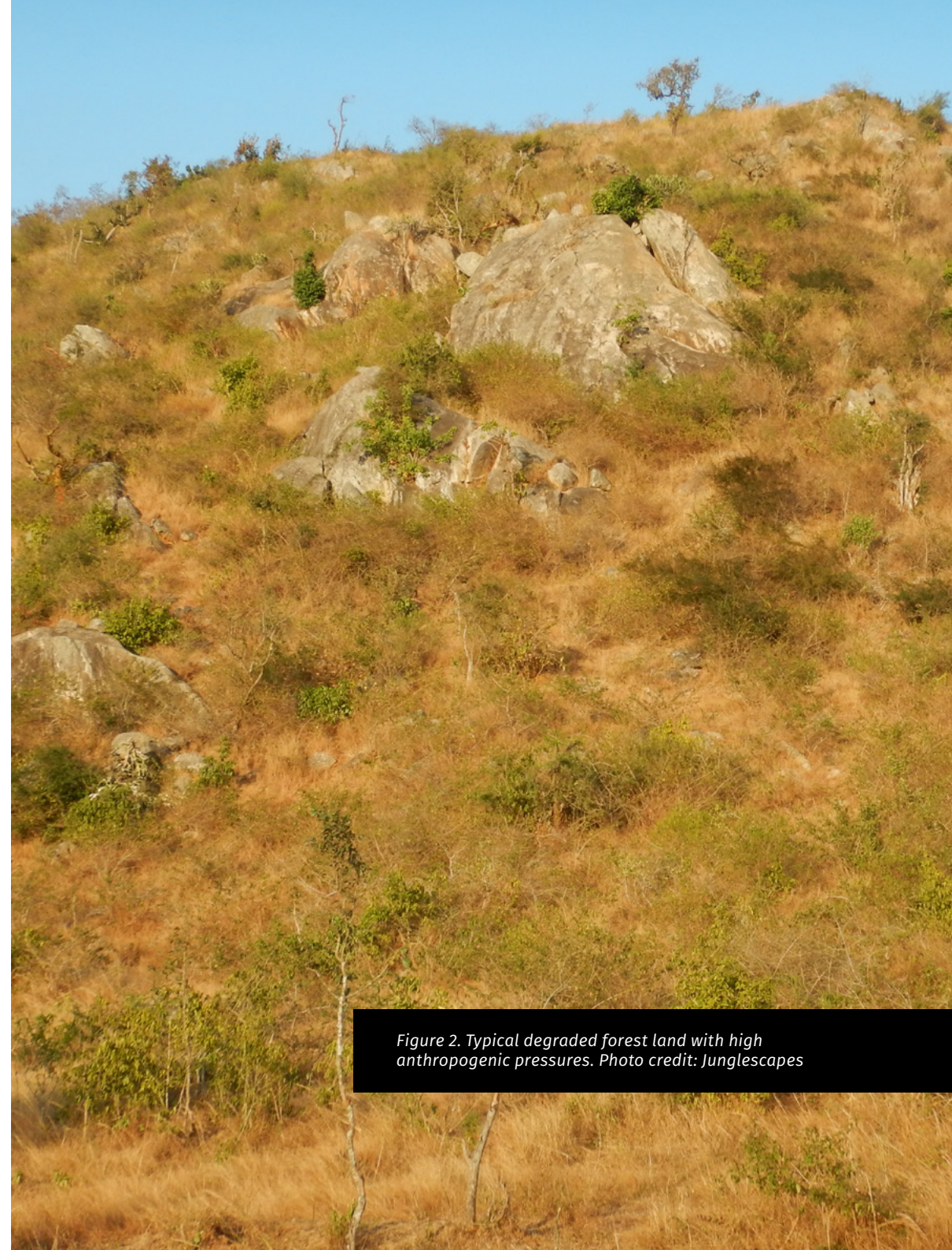


Figure 2. Typical degraded forest land with high anthropogenic pressures. Photo credit: Junglescapes

As fuelwood becomes scarce, unsustainable practices, such as cutting branches off small trees, become more common. Many species used for fuelwood have important roles in the ecosystem, including as food sources for elephants and pollinators (Venkataraman, 2021).

Many degraded forests are overrun with invasive species. The Lokkere Reserve Forest and Bandipur, for example, have large areas (approximately 50–60% and ~50%, respectively) dominated by the invasive shrub *Lantana camara*, which produces copious amounts of fruits but offers little food value to many wildlife species (Chakraborti and Venkataraman, 2018; Sundaram et al., 2012; Venkataraman, 2015a). *Lantana* was introduced from the UK 200 years ago, and although generally not palatable to herbivores, its berries are readily dispersed by birds. It establishes easily around the edges of forests and then into the understory, where it grows in dense thickets and prevents native species from growing (Niphadkar, 2018; Figure 3, 4). Because *Lantana* displaces native species, populations of palatable plants are low and overgrazed, further reducing their abundance. Invaded areas are now dominated by “non-browsing tree species” with low food value to herbivores like elephants and deer (Junglescapes, 2017).



Figure 3. A forest with dense thickets of the invasive shrub *Lantana camara*. Photo credit: Junglescapes

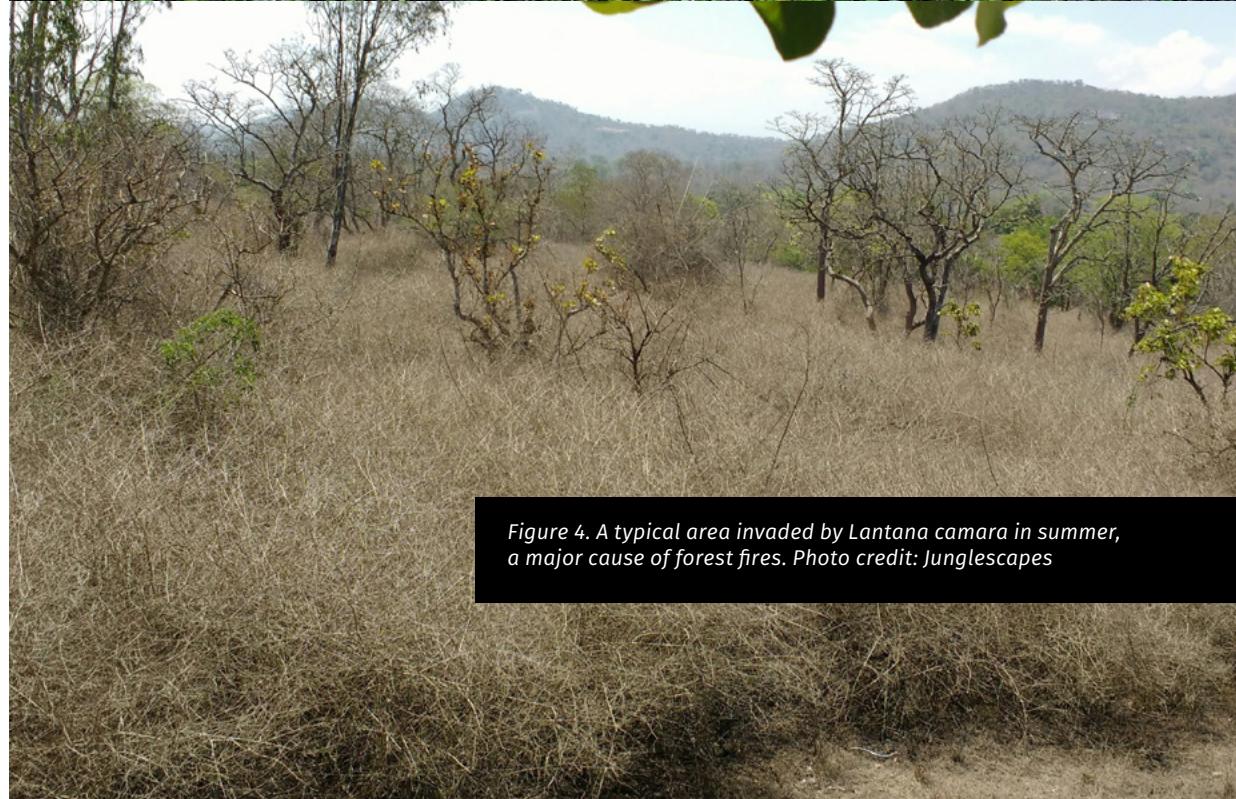


Figure 4. A typical area invaded by *Lantana camara* in summer, a major cause of forest fires. Photo credit: Junglescapes

Livelihoods

Many villages near Bandipur are in dry agro-pastoral land. The communities surrounding the parks are mostly indigenous peoples with a long history of forest use and dwelling. People from several castes live here, including General castes, Scheduled castes, and Scheduled Tribes. The main tribes are the Soligas, Jenu Kurubas, and Betta Kurubas. The Jenu Kuruba, for example, are traditionally “honey harvesters” who lived as hunter-gatherers in the forests for centuries (Anand and Mulyani, 2020; Mahesha, 2016).

In a village consultation with the Guddukere community, where Junglescapes works, participants identified a number of benefits from their forests:

“We traditionally have a good relationship with the forest and have a lot of respect and love for the forests. The forest is an important part of our lives as it provides a number of benefits to our community like grazing lands, firewood, collection of forest produce, like Gooseberry and resin, source of medicinal herbs and honey, etc. When the forests are good the rainfall is also good. Also, when the forests are good and the food/prey availability is good the incidence of wild animals coming into the village is lower.”

Source: Mahesha, 2016, p. 1

Indigenous groups were relocated outside the park boundaries and provided with small houses and landholdings in the early 1970s when the Bandipur Tiger Reserve was created. Forest use was heavily restricted (Venkataraman, 2022).

Today, most landholdings of indigenous families are small – typically less than 0.5 to 2 ha – and small one-room houses are common (Sundaram et al., 2012; Venkataraman, 2015b; Junglescapes, 2010). Because most households are not traditionally agriculturalists, landholdings are often uncultivated. Many villagers have livestock for sale and to produce milk for subsistence (goats and sheep for sale and less commonly cows for milk). Livestock graze on both village and forest lands. Many households work as day laborers on nearby, larger commercial farms, seasonal positions associated with monsoons (often only 3-4 months a year) that are fraught with uncertainty. Non-tribal communities have started working seasonally on coffee and tea plantations in adjacent states like Kerala and Tamil Nadu, but tribal communities work closer to home (Venkataraman, 2015a). Traditional forest knowledge is rapidly being lost with the shift to agricultural livelihoods and restricted forest access (Venkataraman, 2022).

The turning point

People in communities around the reserves were typically seen as a threat to conservation. The history of displacement and loss of traditional livelihoods meant that many people were disempowered and hesitant to work with environmental-oriented organizations. They also lacked options for meaningful work and stable livelihoods.

Junglescapes brought people on board by listening to them and asking them what the forest was like and how it had changed, valuing their knowledge, and responding to real needs. “The . . . thing that to me was very pivotal was we could talk to the community and ask them what the forest was like before,” says Dr. K. Anand, a member of the Project Governance Committee at Junglescapes. “So they could kind of go back and talk about this area having so many trees and the forests are full of life then, and they could talk about timescales. [For example]...we stumbled upon one hill which was next to a village that did not have cattle and the landscape there was completely different. So we could really get to understand what could be, a reference site for an undisturbed habitat . . . Because of what we heard from them and what we saw, we built trust with them by essentially doing things which are useful to them,” says Anand.

To people in these relocated communities this approach was radical.

Tribal peoples often voiced that they preferred healthy, non-degraded forests around their villages. This innate desire to have forest helped motivate people to participate in restoration (Junglescapes, 2014). But there were several critical challenges, including 1) a lack of trust of conservation organizations based on past ‘fines and fences’ approaches; 2) ongoing forest degradation to meet the needs of the communities, especially with respect to fuel gathering; and 3) a lack of support for forest-based work.

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Communities around the wildlife reserves were using large amounts of fuelwood. So, Junglescapes introduced a stove distribution program to reduce forest impacts and provide an ‘in’ with communities by lightening the burden of collecting fuel. “Ramesh [Junglescapes’ founder] had this idea of bringing in these ‘eco-chulhas,’ eco-friendly cookstoves that use less firewood and that also required somebody in the local community to build and assemble them,” says Anand (Figure 5). “So, there was also a livelihood model and we subsidized it and had it installed in many homes.



Figure 5. A community member cooks on an eco-chulha.
Photo credit: Junglescapes

The women could see clearly the benefits in terms of speed of cooking, and less smoke inside the house and so on. And they got to see Junglescapes as somebody who's a friend, you know, somebody who would actually help them out" (K. Anand, personal communication, 2023). In 2009, Junglescapes piloted five 'eco-chulhas' in one of the communities in which they work (Figure 5). The response was positive, so they trained two young people to manufacture them locally using a design by the Philips company. By 2013, 350 stoves had been distributed to local households across 18 villages (Venkataraman, 2013).

Reducing fuelwood needs was an important step to relieve pressure on the reserve's forests. But more important was how Junglescapes engaged with people, providing positive, win-win solutions, training people to do things 'in-house' when possible, and providing local opportunities (Figure 6).

Charismatic local leadership and word of mouth also played a key role. "We met with one community that had a village forest committee. It had an enterprising leader named Mahadevappa, and he suggested restoring a degraded piece of forest adjacent to the village," says Ramesh Venkataraman, a founding trustee of Junglescapes.

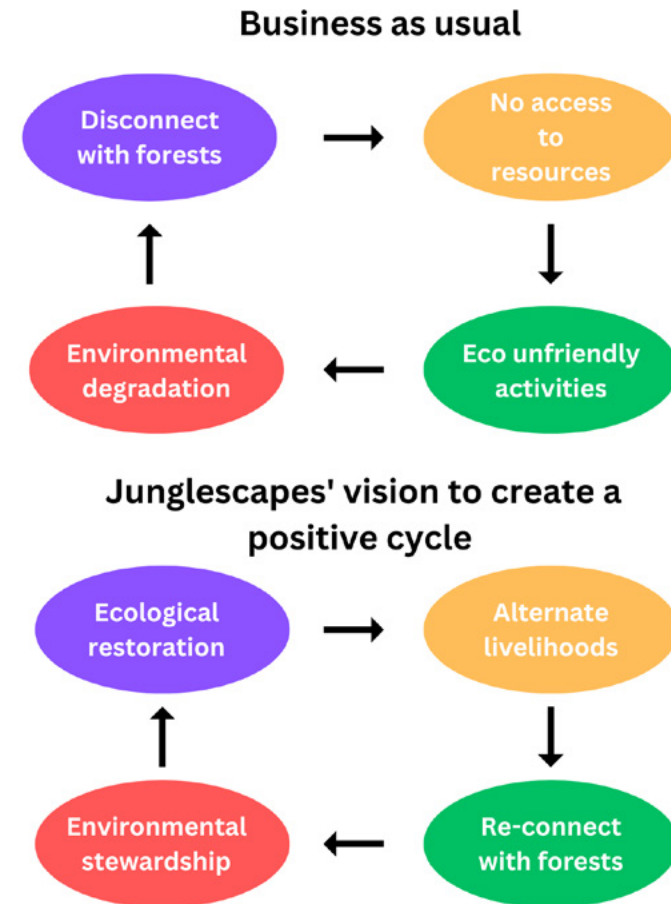


Figure 6. Junglescapes' vision for a paradigm shift: from communities as conservation adversaries (top) to conservation allies (bottom). Source: Modified from Junglescapes

The leader was able to engage 10–15 villagers and move things along quickly, and this first village acted as a pilot. By word of mouth, the project spread. “Then we contacted the next village, which is... very close by. And they knew that this was happening in [the first village], and ...another 15 people came from that village. Gradually, village to village, they all participated” (R. Venkataraman, personal communication, 2023). This early success also helped them engage a key sponsor critical to jump-starting the initiative. “This was not only about winning trust with our communities, we also had to win the trust of the sponsor,” says Ramesh.

Despite these early successes, Junglescapes was not able to establish a core team of engaged community members until 2013, when they began to have more consistent, year-round work. Higher earnings also helped. The project paid about Rs 280–300 per day and provided 15–20 days of employment per month, whereas nearby farm labor paid about Rs 200 for far fewer days a month. Plus, by this time communities could see that “these folks seem to mean well,” as Anand put it. “Sometimes [organizations] are gonna just come in and go away, but [Junglescapes] is here to stay” (K. Anand, personal communication, 2023).

Actors and arrangements

Working in close co-ordination with the Karnataka Forest Department, Junglescapes initiated the restoration work and made connections with communities. They initially lacked scientific expertise in restoration, so they worked with other organizations to develop restoration plans and technical approaches. The Centre for Environmental Management of Degraded Ecosystems helped with science-based strategies to remove *Lantana camara*. The French Institute of Pondicherry provided a list of native species in the area, used to identify candidate species for restoration. The Ashoka Trust for Research in Ecology and the Environment, an environmental non-profit that has run a *Lantana* craft program with indigenous communities in the Eastern Ghats since 2013, helped to train Lakkere community members to make *Lantana* products and design strategies to catalyze community engagement (Venkataraman, 2015b).

Saplings for various projects were procured from Arulagam, an NGO which runs community-managed nurseries based in Tamil Nadu (Junglescapes, 2014). Private sector companies funded the work

through Corporate Social Responsibility investments (Anand and Mulyanai, 2020). Junglescapes also worked with other non-profits on specific projects, including Paadhai, a non-profit focused on improving health, education and the environment for under-privileged people (Venkataraman, 2015a). A grant under the Western Ghats program of the global Critical Ecosystem Partnership Fund helped test methods to manage Lantana.

Planning and engagement

Junglescapes engages communities as allies to restore forests (Figure 5). Ramesh says, “We are joining forces with everyone from corporates to the student community to children and adults to help us in our quest to restore the green cover in high-risk areas in Karnataka and Tamil Nadu. By inspiring people to restore degraded areas on a large scale, creating eco-friendly *chulhas* and disseminating information about carbon credits and how they can be purchased, we are doing our bit to help increase the green cover in affected areas.” Projects are planned, developed and implemented with input from local stakeholders, including forest managers and departments, and local

community organizations (Junglescapes, n.d.).

Prior to Junglescapes, conservation efforts did not focus on the needs of local communities: conservation authorities viewed local people as a threat, and local people viewed conservation work as conflicting with their livelihood needs. The Junglescapes’ model involved transitioning from adversaries to partners, from conflict to collaboration. The core of this paradigm-shifting approach is that indigenous communities are not only beneficiaries of restoration but are vital to its success. “What Junglescapes has found is that the contribution of Indigenous community members is invaluable in achieving restoration outcomes . . . ecological restoration needs Indigenous communities and their knowledge more than the other way around” (Venkataraman, 2022, pg. 7).

The main ecological objectives of the restoration were 1) to restore native plant diversity and 2) create high quality habitat for wild animals in the region. Critical to their approach was using science-based restoration techniques that produced ecosystems as close as possible to previous conditions. Junglescapes consulted with communities and outside experts to develop specific goals, plans, and techniques, including the Forest Department and other agencies. For example, they organized a workshop of

Lantana experts in 2013 at Bandipur, who made different recommendations based on experience (Venkataraman, 2015a). They also held discussions with the Lokkere and Guddukere village communities to understand their interests before developing an implementation plan.

Activities in and near nationally protected areas must comply with national policies. These include the Wild Life Protection Act (1972), which forbids access to the Bandipur Tiger Reserve, and the Karnataka State Forest Department Act, which forbids cattle grazing and collecting forest products in the Reserve Forest region (Anand and Mulyani, 2020). Local governance operates through local Village Forest Committees. Formed in 2003 to decentralize governance (working with the Forest Department on local management plans) and encourage local stewardship (mainly through alternative livelihoods), in practice many Committees failed to adequately engage communities or halt forest degradation (Anand and Mulyani, 2020). Junglescapes used this structure, improving its function by building trust and empowering communities.

Initially, Junglescapes designed restoration plans with community input, who then implemented the plan.

Over time, this relationship evolved to give more decision-making autonomy and control to local communities. They formed “restoration self-help groups,” groups formally registered with the government with their own governance frameworks, which has been a key step in this progression (Figure 7).

All Junglescapes projects go through gate-keeping by its Project Governance Committee, which uses a unique 3-way test (all must be answered in the affirmative) to approve project ideas:

1. *Does the project benefit biodiversity and wildlife?*
2. *Does the project create a win-win situation between the wildlife and biodiversity that they are aiming to restore or conserve and the local communities?*

3. Is the project sustainable?

Costs, funding, and other support

Junglescapes works to keep overhead costs low and transfers the bulk of donations to on-the-ground work with communities. They spend less than 15% on overhead costs, a figure made possible in part because of a lean organization structure, committee members working on a *pro bono* basis, and reliance on volunteers. Most activities are funded by India's corporate social responsibility mandate, wherein corporations are required to give a percentage of their profits to a charitable cause. Biodiversity conservation is one acceptable area of giving (R. Venkataraman, personal communication, 2023). They also receive small grants from other organizations, for example,



Figure 7. Indigenous members of the restoration self-help group of Guddukere village. Photo credit: Junglescapes

from the Critical Ecosystem Partnership Fund for invasive species removal and forest restoration in the Lokkere Reserve Forest.

Implementation

Junglescapes used different interventions at different times, responding to the needs of specific degradation scenarios, the resources available, and their own experiences of what works best. Local people did much of the on-the-ground implementation work, often paid through grants to the self-help groups which in turn paid their members. Junglescapes also used local materials, craftsmanship, and non-mechanized techniques whenever possible.

Interventions aimed to address and reverse the two main causes of degradation—anthropogenic pressure and invasive species. Their first site, the Lokkere Reserve Forest, suffered from fuelwood collection and livestock overgrazing, which compacted, depleted, and eroded soils, and caused rainwater run-off. Planted saplings could not survive under these conditions. So Junglescapes implemented a bottom-up approach to reduce degradation by providing efficient cookstoves and restoration actions to reverse soil erosion, restore soil health, and increase water retention. These actions

were crucial for supporting new and natural vegetation growth, which led to the shift to assisting natural regeneration as the primary restoration technique. Saplings were planted selectively to fill important species gaps. In 2013, Junglescapes also began removing *Lantana* in the buffer areas of the Bandipur Tiger Reserve. Sixty percent of the reserve interior is impacted by low food value, invasive plant species. They also began training locals to create and sell marketable crafts from the invasive *Lantana*.

Improved cookstoves and water boilers.

Junglescapes began piloting, and then constructing and distributing, fuel-efficient cook stoves in 2009. These 'eco-chulhas' used 50–60% less wood (Venkataraman, 2021). They could burn *Lantana* effectively, reducing wood collection even more and providing an incentive to harvest *Lantana*. Stoves were distributed to nearly 350 households by 2013 (Venkataraman, 2013). People paid about 20% of the cost; their investment encouraged people to use them.

Heating water is another major source of wood consumption. 89% of the fuel used to heat water in the region was wood, much of it from native species with important roles in the ecosystem (Venkataraman, 2021). So, in 2020, Junglescapes introduced fuel-efficient

water heaters (Figure 8) that used nearly 85% less wood and could efficiently burn small sticks and agricultural waste, which meant villagers did not have to harvest live branches from the forest (Venkataraman, 2021). As of 2022, over 1600 heaters had been distributed to forest-abutting villages (R. Venkataraman, personal communication 2023).

Restoring forests and harvesting water:

Forest restoration activities include collecting seeds of native plants, growing saplings, and protecting existing flora, as well as halting erosion and collecting rainwater (Box 1; Venkataraman, 2022). They initially focused on tree planting but began to work more with assisted natural regeneration (ANR) after a few years to alter the ecosystem as little as possible. The area was amenable to ANR in part because sites had not been plowed for agriculture, preserving soil structure, rootstocks, and seed bank. “Natural regeneration helps because there is a natural organization taking place, remnant seed-bank potential is not suppressed by planting too many trees, species’ succession occurs, and costs are significantly lower than sapling planting methods. So that is something we learned. But whenever we go to any sponsor, they would say how many trees



Figure 8. A villager using the fuel-efficient water heater. Photo credit: Junglescapes

Box 1: Water harvesting structures used by Junglescapes to support existing or planted vegetation.

A) Trenches are often used on slopes to collect rainwater near existing vegetation, or to create depressions where saplings can be planted. They are usually made on slopes, measure 4 ft long and $\frac{3}{4}$ ft deep, and “can harvest over 40 litres of water in a 10-minute shower” (Junglescapes, 2014, p. 5).

B) Check-dams are created on existing streams to capture water in pools. These help improve the water table and attract wild animals which act as seed dispersers. Creating them involves manually digging a pond with a stone-and-mud dam across one end, with a channel for surplus water to run downstream. Check dams are 4 ft high and are dug next to mid-sized streams to hold water. They are built manually, take approximately 3 days to complete, and cost around Rs 10,000–15,000 to construct (Junglescapes, 2014).

C) Kal Keres are stone overflows used to create small pools in existing depressions in streams. People build a small stone wall across the stream on a sloped angle, allowing overflow water to flow smoothly down slope. These help to increase water tables without digging in the stream. Like most interventions, Kal Keres are made by hand and cost about Rs 6000 each (Junglescapes, 2014). All of these follow Junglescapes’ philosophy of using human-oriented methods instead of machine-oriented ones. A diagram of a Kal Keres, a Kal Kere made in 2014.

A) Trenches



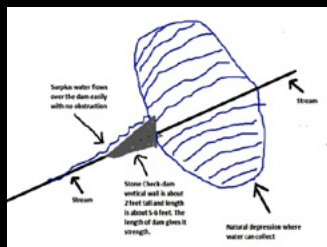
Source: Junglescapes, 2014

B) Small check dams



Photo credit: Junglescapes

C) Kal Keres



Source: Junglescapes, 2014. Photo credit: Junglescapes

are you planting? Not only sponsors, a lot of other people, including conservation NGOs, are focusing on tree planting and paying less attention to the natural regeneration potential of the site,” says Ramesh.

The evolution from tree planting to ANR occurred as Junglescapes incorporated more local knowledge and autonomy in decision making (Anand and Mulyani, 2020). During the first few years the communities carried out restoration work according to a plan set by Junglescapes. In subsequent years, communities were given time, space, and flexibility to adjust the work according to their observations and experience. Local leaders acted as a connection between communities and Junglescapes. As one leader put it: “You need to decide how to do an activity in joint decisions with them (community members), treat them with respect, and take the input of elders into consideration” (Anand and Mulyani, 2020, p. 111). This process and ethos allowed community members to learn from each other and develop context-specific and appropriate strategies.

They also moved from planting saplings to direct seeding. “When you plant a sapling, there is a kind of a human scent on it which agitates elephants,” says Ramesh. “And we found that even in the case of non-palatable plants, because of the human scent, the

elephants come and trample[d] upon them. It’s a very, very bitter experience where we spent a lot of money, brought about 3000 saplings of rare species and planted them, and within two days, elephants just trampled upon without consuming anything. The seed route is far less expensive ... there is strength in numbers ... and because there is no human scent on them then nothing agitates the elephants and survival rates are much higher.”

Dry conditions often limited planting seedling survival. Communities began creating water collection structures (Box 1) to help planted and naturally regenerating vegetation to survive. Improved moisture increased soil microbial content as well as insect diversity and abundance. Grass cover also returned, which prevented erosion, reduced rainwater runoff, and nurtured seedlings of other species. Water collection strategies were co-designed between Junglescapes and local communities, which suggested for example, that shorter water collection trenches would distribute water more evenly than long trenches (Box 1). They also opted for less dense plantings over larger areas and for planting each sapling in a depression in the mud (Anand and Mulyani, 2020).

Water harvesting plans are made after

consulting maps and community members to understand the watershed. All harvesting structures are based on the principle of minimum intervention that does not impact the watershed or animal movement.

For example, the short trenches are shallow and have a life of less than 18 months, by which time they are filled with soil but have served their purpose. Rock detention structures are small and permeable, aimed at slowing water flow, not stopping it (R. Venkataraman, personal communication, 2023).

Restoring invaded areas: Junglescapes adopted an innovative “Cut root-stock method” for removing *Lantana* (Figure 9). This involved chopping the tap root 2–3 inches below the soil and leaving the shrub to dry in the sun. They experimented and found that technique removed and prevented *Lantana* from regenerating very effectively, so much so that community members now train forest service staff to use it. It took time to master it to avoid damaging native plants, but as one villager put it: “this is the correct method. While using fire or a machine is easier, the (dormant) seed will get released, and in place of one plant, ten of them will come up” (Anand and Mulyani 2020, p. 112).

After invasives are removed, removal sites must be restored, typically by: 1) making

trenches around young native plants to harvest rainwater; 2) making small dams, ponds, etc. elsewhere to harvest rainwater; 3) planting or dispersing seeds of native tree and shrub species and maintaining them (mulching, etc.); 4) broadcasting grass seeds (including bamboo), which prevents invasive species from growing back and helps natives to re-establish; 5) removing any other invasive species moving in; 6) harvesting dried *Lantana* to use for handicrafts and fuel; and 7) removing any *Lantana* that is growing back, often about 15% in the second year and 5% in the third year. Junglescapes conducted a survey of other native plants that might be absent from ANR processes and require seeding.

Other invasive species tended to invade sites where *Lantana* was removed. These plots thus require longer term maintenance (4–5 years instead of 2–3) than restoration plots without invasives to ensure native plant communities recover. *Lantana* removal plots are strategically situated to lower the chances of re-invasion and encroachment of other invasive plants. “We try to not locate our plots adjacent to a road or a village, where chances of secondary invasion are higher, and select our plots judiciously and make sure that they’re all contiguous to each other” (R. Venkataraman, personal communication, 2023). This strategy also

Alternative livelihood activities:

Junglescapes' grants to the self-groups provide higher daily wages than those paid by nearby farms. When Junglescapes mainly planted trees, restoration work was seasonal and mostly limited to the wet season. But as Junglescapes moved to an ANR-centered approach, restoration activities could be dispersed year-round, creating more continuous and stable employment, a critical feature for success (Venkataraman, 2022). They created a 'restoration calendar' with activities appropriate for each season.

Starting in 2014, Junglescapes trained 12 people to make handicrafts and furniture from dried *Lantana*, for a stipend of 150 R/day. *Lantana* is harvested by the restoration team, then made into handicrafts by another specialized team. The market for *Lantana* goods is decent and increasing, and the activity is attractive to various sponsors. Products are sold to local domestic markets at local stands and through contracts with conservation agencies, including one to supply furniture for offices and cottages at the Bandipur Tiger Reserve (Venkataraman, 2015c). They are exploring opportunities to sell to corporations.

creates a larger expanse of native plants that functions as a wildlife corridor.



Figure 9. Removing *Lantana* using the Cut Root stock method. Photo credit: Junglescapes

Outcomes and impacts

“The community . . . has protected the reforested region from grazing and cutting resulting in significant growth of vegetation, and therefore improved canopy cover. This unique model of conservation thus creates a win- win situation between the forest dwelling communities and the wildlife that surrounds them.”

(Junglescapes, 2014).

Junglescapes started in 2007 with one village and ten community members and has expanded to seven villages and over 60 members. As of 2023, they restored over 1,300 ha of degraded forest and were employing 45–70 community members year-round (Venkataraman, 2022; SER, 2023). They provided 1500+ subsidized eco-boilers and 350 cookstoves to households.

Box 2: Timeline

2008: Community actively engaged in restoration with GE grants (R. Venkataraman, personal communication, 2023)

2009: Eco-chulhas introduced

2010: Shifted strategy from tree planting to assisted natural regeneration (R. Venkataraman, personal communication, 2023)

2013: Grant to work on invasive species from CEPF

October 2013: Workshop of experts on *Lantana camara* held as part of invasives project

2013: Ashirvadam Trust funded project for community-managed reforestation in Lakkere Reserve Forest begins

April-June 2014: *Lantana* removal carried out on pilot site of 5.2 acres

2014–16: Develop cut root-stock method and post-removal restoration methodologies

2017: Junglescapes receives SER’s Full Circle Award

2017–22: Expanded area under restoration to 1300 hectares; over 60 community members participate

2021–2022: Eco-boilers project; 1600 boilers distributed (Junglescapes, 2022; L&T Technology Services, 2022)

Forest recovery: Forests have begun to recover across areas where restoration was practiced (tree planting, water retention, and ANR) and where *Lantana* has been removed (Figure 10, 11). Between 2015 and 2019, vegetation in areas where trenches were made is more densely vegetated and “in stark contrast” to the conditions before (Anand and Mulyani, 2020). “The community is very proud of how they have been able to improve the health of the forests,” says a report documenting the consultation of the Guddekere village, reflecting on the restoration process (Mahesha, 2016, p. 7).



Figure 10. A recovering forest patch in Lokkere Reserve Forest in 2019, with vegetation typical of a tropical thorn forest ecosystem. Photo credit: Junglescapes



Figure 11. A grassland restored after removal of *Lantana camara* in Bandipur Tiger Reserve in 2019. Photo credit: Junglescapes

19.12.2019

Where *Lantana* has been cleared it tends to grow back only a little (5–15%) and in many sites native regrowth was much better than anticipated. Many native plants persist during clearing, including Tansi (*Maytenus emarginata*), Kakkorle (*Canthium dicoccum*), and Kagalimara (*Acacia chundra*) (Venkataraman, 2015c), and community members noted that “many native saplings and even big trees come back” (Anand and Mulyani, 2020, p. 112). Regeneration has been observed even where no seed-bearing adult trees are present within a 10-km radius. Seeds have migrated through long-range seed dispersers like elephants, sloth bears, and birds. Plots are monitored every three to six months, and the forest service has adopted this technique of managing invasive species.

Villagers noted that forests are more resilient following restoration. In 2019, a restored forest was burned in a forest fire, but only one month later, it began to recover. “If the forest still had *Lantana*, the impacts of the fire would have been much worse,” notes a villager (Anand and Mulyani, 2020, p. 112). “The saplings have not been too badly affected only because of the trenches” (Anand and Mulyani, 2020, p. 112).

Species Compositions — All Plots

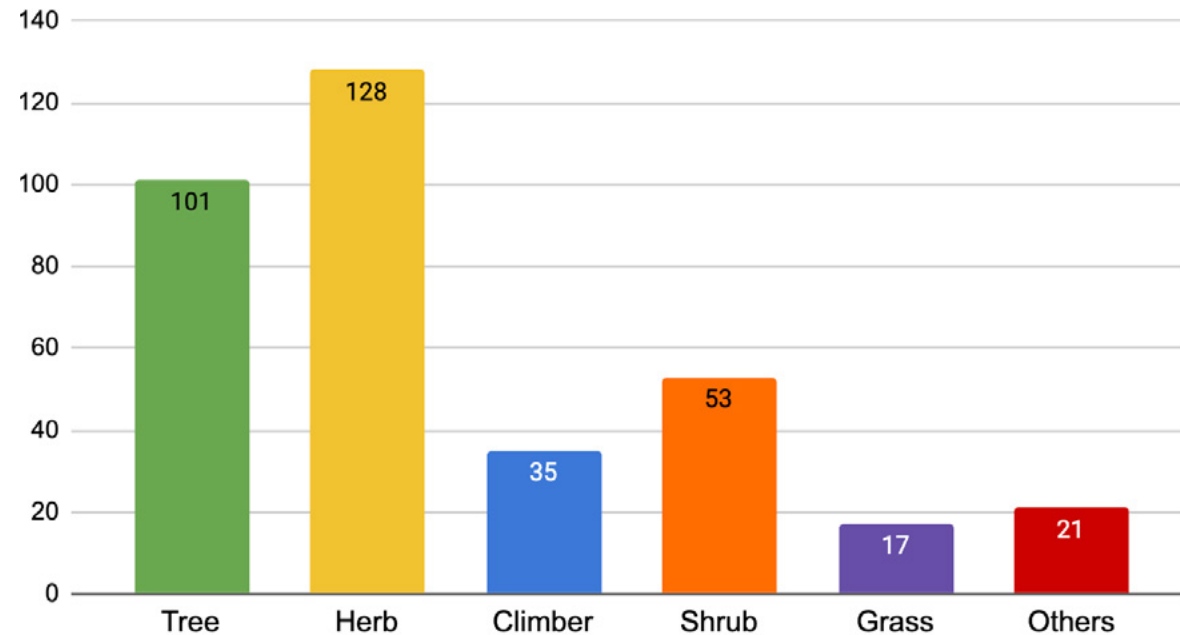


Figure 12. Vegetation recovering in plots restored between 2008–2020. The category “others” includes ferns (5), orchids (3), lichens and lianas (3), mosses (1), sedges (3) and parasitic plants (6). Source: Ganesh Babu and Hegde, 2022

In 2022, an independent survey in some of the older restoration plots found 355 plant species across a wide range of plant habits, of which 22 were endemic and 7 threatened (Figure 12). This shows good recovery of both species and structural diversity, in line with the reference ecosystem (Ganesh Babu and Hegde, 2022).

Wildlife recovery: In the restored forests, animal signs (scats and tracks) increased, and field workers are reporting more animals including leopards, sloth bear, chital, and wild boar (Junglescapes, 2014). The diversity of nesting birds has increased, and six years post-restoration (in 2014) they saw the first signs of tigers in the restored area.

Tigers likely returned because the forest structure had improved. The density and diversity of ground level vegetation improved, and taller young trees created more cover. Water availability and the absence of cattle grazing (and thus people in general) were also key factors (Junglescapes, 2014).

Restoration for rewilding is only effective if the vegetation growing back provides suitable food for different animals. Removing *Lantana* created space for native vegetation to recover, and ANR facilitated the return of native species.

Creating small trenches and water sources also starts a “virtuous cycle—a small area of rainwater collection attracts animals, seed dispersers,” says Ramesh. “Then wildlife return as participants in restoring the ecosystem. Better vegetation in the forest means fewer animals coming out of the forest” (R. Venkataraman, personal communication, 2023).

Restoring forests and removing *Lantana* also reduced human-wildlife conflict. The area is one of the largest elephant habitats in India. Prior to restoration, elephant crop raids were intense. “As the forest is gradually improving due to restoration, the necessity for wild animals to come out for food and water has reduced very much,” reported villagers from Guddukere (Mahesha, 2016, p. 5). In an area where 10 square km were restored, people noticed a sharp decline in crop raids because elephants could forage on the trees and plants in the restored areas (Figure 13).

Livelihoods and empowering communities:

One of the major social impacts was providing a meaningful livelihood for local communities. Prior to Junglescapes, displaced forest peoples were limited to agricultural work, without a means to use their traditional knowledge base and culture. “There has been a disconnect between the people and the forests,” says Anand.

“The traditional ecological knowledge, which is primarily lying with illiterate people, where it is transferred by word of mouth or by experiential learning, we found that that is gradually vanishing and therefore the restoration was able to bring back the connecting with the forest and help ... bring back the traditional ecological knowledge” (K. Anand, personal communication, 2023). Junglescapes provided indigenous people with an opportunity to return to forest work. “You look at tribal living in the forest to a few generations back, he or she would have had far greater traditional knowledge than tribal living there now,” says Ramesh. “But we hope to bring back 60% of the traditional knowledge. The concept that we are providing livelihoods gradually changed because we found that they were bringing more value to the restoration than the livelihood was providing to them.”

Autonomy and governance: Many villagers now have a sense of ownership and responsibility for their restored forests (Anand and Mulyani, 2020; Figure 14). “Criminal activities cannot occur in our forest,” says one villager (Anand and Mulyani, 2020, p. 111). “If outsiders cut trees the restoration community will prohibit them and report it” (Anand and Mulyani, 2020, p. 111). Now, many villagers have “a lot of decision-making autonomy,” says Ramesh.

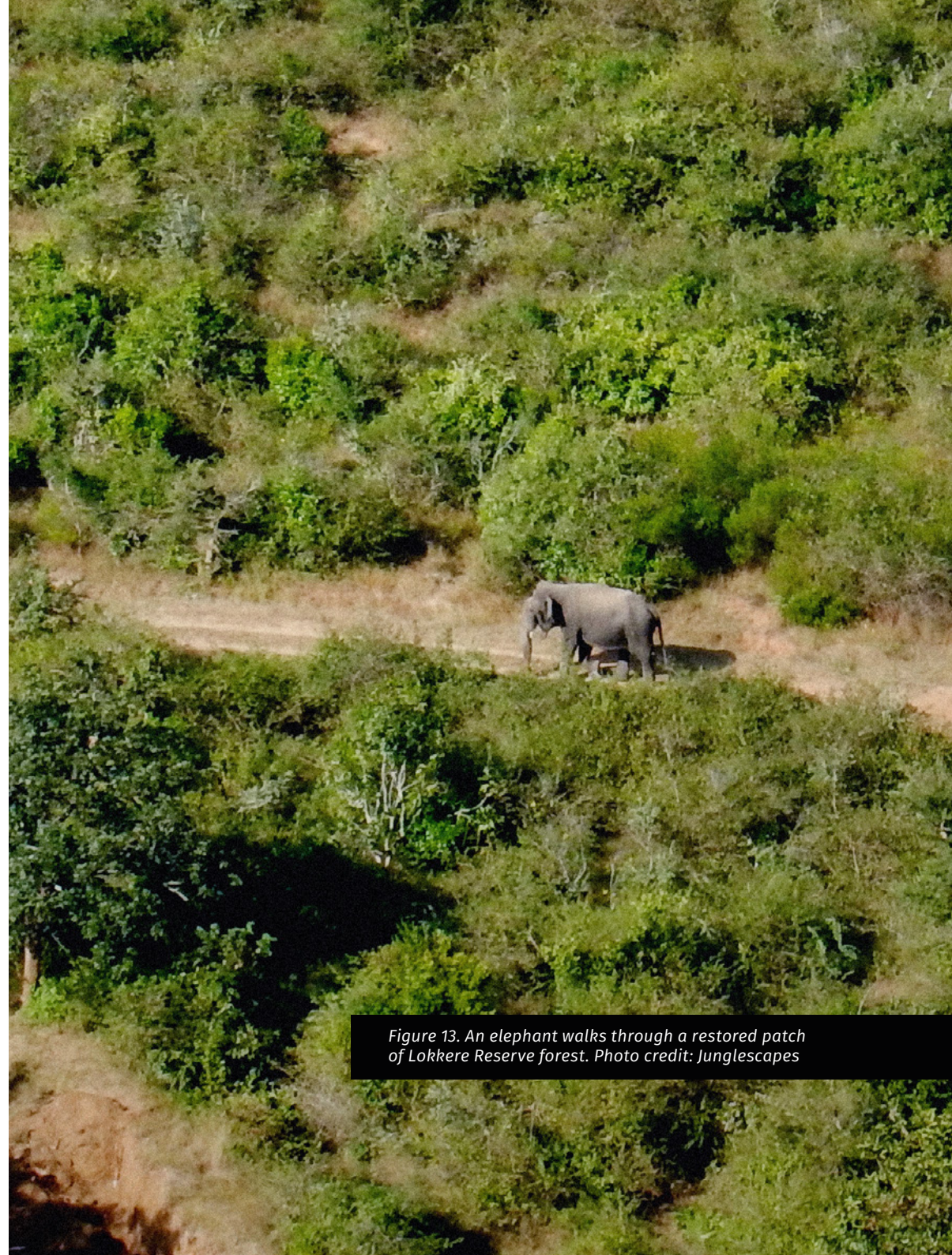


Figure 13. An elephant walks through a restored patch of Lokkere Reserve forest. Photo credit: Junglescapes

“So, they don’t need to talk to us ... to understand what they need to do on this plot x. They know what they want to do. And they take their decisions very organically. Keep moving forward. That autonomy of local decision making in getting the job done, you know, just gives them that empowerment” (R. Venkataraman, personal communication, 2023). “These are the people who have very intimate knowledge of the local ecology,” adds Anand. “Interacting with these community members, we ourselves have learned the value of learning from nature, as opposed to learning about nature.”

Villagers were also able to train others. For example, in 2014 a group of 14 people were trained to remove *Lantana* and restore the removal site by creating water harvesting structures, planting saplings, and so forth. The group was then able to work with and teach the method to the Forest Department (Junglescapes, 2014). Recently, Junglescapes has initiated a “barefoot restorer” program where experienced community members will train around 100 new community members in different aspects of restoration.

The level of autonomy, ownership, and innovation differed notably between people who participated in *Lantana* craft production and those who practiced restoration.

Lantana craftspeople are now skilled at producing handicrafts, but did not innovate nor become forest stewards in the same way as restoration implementers (Anand and Mulyani, 2020). Their interactions with the forest were limited and many saw the *Lantana* they were working with as a raw material only. But villagers working in restoration went into the forest daily, were responsible for day-to-day decision making, and participated in a ‘living laboratory’ which led to more autonomy, ownership, and the desire to conserve the forest (Anand and Mulyani, 2020).

Key challenges

It took time to engage communities. Past negative experiences with conservation efforts had eroded trust, and many villagers felt at odds with conservation. Junglescapes had to work hard to build trust and introduce the paradigm shift that local people can be a positive—and critical—force in restoration and conservation. Junglescapes sought and respected local forest knowledge, listened to community needs and preferences, and demonstrated that they were in it ‘for the long haul.’

Retaining local people for multiple seasons was also a challenge. When people would not return after participating in one season, it made granting autonomy to communities difficult. Shifting restoration to ANR and a sustained, year-round restoration calendar meant more steady employment and more people participated for multiple years (Anand and Mulyani, 2020).

Assisted natural regeneration has been difficult to fund and to explain to donors. “There are no major supporters for natural regeneration . . . whenever we would go to any sponsor, they would say “how many trees are you planting?” And if we said “we are planting no trees at all” they would be shocked. A lot of other people, a lot of conservation NGOs, etc., only focus on tree planting,” says Ramesh.

Demonstrating results and educating donors is still a work in progress. Bringing back populations of palatable native plants has been challenging. In recovering ecosystems local grazers will not eat *Lantana* and avoid non-palatable plants but feed heavily on edible species. Edible species thus need to be intentionally stocked. But elephants often trample planted trees. To address this, Junglescapes shifted to seed-based restoration, which is less expensive, produces a high number of seedlings, and does not agitate the elephants.

Scaling up presents another suit of challenges. “Scaling up doesn’t mean just more of everything,” says Ramesh. Although Junglescapes has found that livelihood opportunities can motivate and enable people to engage, the science behind scaling up is patchy, and there are more ecological and social challenges than we are aware of. Connectivity, case studies, and knowledge sharing between projects could help identify additional key factors.

Enabling factors and innovations

The communities surrounding the reserve were traditionally forest dwellers with an appreciation for the forest and a deep understanding of its ecology, a critical asset for their engagement in restoration activities. Junglescapes collaborated with communities and valued this knowledge in an innovative way. They combined scientific knowledge on invasive species management, tree planting, and processing and storing seeds with local knowledge of communities with regard to ecological processes, species interactions, local environments, and wildlife habitats. “This kind of place-based local knowledge is rarely available from formal documents and would normally take restoration managers years to collect” (Venkataraman, 2022, p. 5). Junglescapes granted increasing autonomy to communities, for example, allowing them to decide what to do to keep a given plot progressing during restoration.

A key innovation was enabling the community to use local materials to make the infrastructure needed for the project, including cookstoves, water conservation structures (rocks, logs), and collecting local seeds for tree nurseries. People, rather than machines, did the work. This created jobs, autonomy, and local capacities, kept funding dollars local, and helped tailor methods

to the local ecological and cultural context. Hand-powered interventions also allow for a delicate touch, avoiding damage to soils and vegetation. (Venkataraman, 2022).



Lantana craft makers. Photo credit: Junglescapes, 2015



Figure 14. Community members proudly displaying the Full Circle Award from the Society for Ecological Restoration in 2017. Photo credit: Junglescapes

Parting shot

“These are the people who have very intimate knowledge of the local ecology. Interacting with these community members, we ourselves have learned the value of learning from nature, as opposed to learning about nature.”

—K. Anand, personal communication, 2023

Figure 15. A local community participant planting native trees to restore forests.





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**Key lessons
learned**

- ▶ **Assisted Natural Regeneration (ANR) can be a powerful tool to facilitate ‘restoration for rewilding.’** Rewilding involves creating habitats where native animals can thrive. ANR can be an effective tool to bring back native species suitable for native fauna. Junglescapes found that rainwater collection structures attracted seed-dispersing animals. Wildlife recovery accelerated ecosystem restoration in a ‘virtuous cycle.’
- ▶ **‘Responsible restoration’ is critical for creating functional native forests.** This includes not altering the local ecosystem, using native species, allowing natural succession, working with nature, developing baseline studies and reference models, and monitoring progress.
- ▶ **Treating local indigenous and forest-based communities as allies and giving them increasing autonomy can create environmental stewards and robust ecosystems.** Forest communities had been treated as problematic in the past, but Junglescapes introduced a new way of thinking about their role in conservation. Gradually allowing local people to take more control produced restoration that was tailored to the local context and promoted feelings of ownership and commitment.
- ▶ **Combining science with traditional ecological knowledge (TEK) can produce a suite of social, cultural, and ecological benefits.** Integrating TEK in restoration practice helped people assume a stewardship role for nature and connect to their traditional roots. It helped them to see conservation in a positive way—as an action that benefits them and requires their participation. It also helped other conservation organizations to recognize local indigenous communities as allies rather than an inconvenience. Communities knew different soil types, watersheds, native plants and trees, and what would grow where. They received training on more technical elements, like how to remove invasives and build water structures. Now they do the training.
- ▶ **ANR can provide more consistent, year-around employment and help to retain workers.** Whereas tree planting is highly seasonal, ANR work can be more evenly spaced throughout the year and helps to build a long-term workforce.
- ▶ **Recognize the value of learning from nature, rather than about nature.** Learn from nature, listen to it, and work with it to achieve outcomes.



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**Learn
more**

Further information and resources

Websites

Junglescapes website: <https://www.junglescapes.org/>

Videos

Junglescapes YouTube Channel: <https://www.youtube.com/@junglescapes1106/videos>

Integrated Management of Lantana in Lakkere Reserve Forest: https://www.youtube.com/watch?v=WMLqURq4_-g

Planet Outlook Talk: Forest Restoration: <https://youtu.be/HPwd3ezl0lU>

Green Flames: <https://youtu.be/x5oR1U8x03M>

Junglescapes' Presentation on Assisted Natural Regeneration at the SER World Conference 2021: <https://youtu.be/HoL5S17QPIw>

Junglescapes' Eco-chulha movie: <https://youtu.be/XaLcioRjYf0>

Junglescapes' Restoration Based Livelihoods Model: <https://youtu.be/yDaN9YRnNag>

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