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Ecological restoration plays an integral role in permaculture design, and is an ongoing necessity in global land management. Over the years, I have seen numerous large- and small-scale restoration projects implemented—some with notable success, but the majority with marginal returns. By observing these results, we can look to permacultural principles to design a way to create more success on the landscape. Agroforestry, in its broadest definition, is a dynamic landscape restoration tool that has shown to be effective at solving many of these challenges. Agroforestry practices are not new, but creative assemblages of agroforestry systems have shown their dynamic ability to restore broad-scale landscapes. Agroforestry creates agriculturally productive systems while mimicking the biological structures of forest ecologies. These practices provide an approach to ecological restoration with economic incentives that display lasting results. By identifying how the design principles apply to the implementation of agroforestry as a restoration technique, we can design holistic systems that restore ecosystems and the communities that steward them.

Identifying the mechanisms of ecological restoration is a crucial first step in evaluating the effectiveness of our design. Agroforestry systems create stability in degraded landscapes in a number of ways, most of which are deemed essential for ecosystems to repair themselves. Enhancing ecosystem services plays an integral part in ecological restoration. These services include the creation of wildlife habitat and food sources, mitigating soil erosion, and maintaining moisture within the landscape. By establishing tree-based land management systems, our work has been able to achieve all of these results in a short period of time. Similarly, agroforestry has the ability to mitigate other areas of importance to ecological restoration and climate change. Maintaining soil ecology and fertility is a major component in regenerating degraded landscapes. Agroforestry systems manage soil resources through canopy cover and leaf drop, especially through the integration of nitrogen-fixing trees, to allow for nutrient cycling to occur, building soils, and regulating mois-
ture and temperature for soil micro-life. Many nitrogen-fixing trees that excel in our region also produce food. These include tamarind (*Tamarindus indica*), carob (*Ceratonia siliqua*), pigeon pea (*Cajanus cajan*), and ice cream bean (*Inga edulis*). With soil resources becoming more scarce and fertilizer use increasing at an astonishing rate, integrating nitrogen-fixing trees into agroforestry provides a durable alternative. Lastly, it is essential to design ecological restoration with the intent of managing the effects of climate change. Regulating surface temperatures and maintaining microclimates through the absorption and reflection of radiation with trees will be a vital part of stabilizing our atmosphere.

In the community of Camarones and the surrounding region where I work, land management is predominantly based on slash-and-burn agriculture and grazing cattle, thus slowly turning the landscape from a tropical forest to a mosaic of degraded grasslands. From my experience, the damaging effects of agriculture, forestry, and industry are similar between tropical and temperate zones. Likewise, the hurdles that affect the success of ecological restoration projects share a similar reality. Throughout various projects, I have observed some of the most important missing links in ecological restoration and why there is so much resistance to the restoration approaches that we design. To understand this, we must remind ourselves what permaculture stands for: “permanent agriculture” and most importantly “permanent culture.” No matter on what side of the world you reside, the concepts of permaculture are directly related to our ability to effectively restore ecosystems. Agroforestry applies the ideas of both permanent agriculture and culture for a regenerative approach to ecological restoration.

The foundation of agroforestry is the establishment of agriculturally productive systems based on perennial plants, which is the essence of permaculture itself. By integrating productive systems within intact forested landscapes, we provide ourselves incentives to manage these ecosystems effectively and in a healthy manner. There are many successful agroforestry projects around the world that have been able to provide real life examples of how we can restore our ecosystems through permanent agriculture. In contrast, “permanent culture” is the conundrum that we continue to struggle with, and I might argue is our biggest hurdle in ecological restoration. Designing ecological restoration without considering community incentives to develop and maintain these projects limits our ability to make a broad-scale, lasting impact. Agroforestry produces many ecosystem services, but equally important are the community and economic incentives that develop a culture of stewardship.

At the Jama Coaque Ecological Reserve, we are on the frontline of the stereotypical reality of rainforest conservation versus environmental degradation. Our communities consist of subsistence farmers who implement extractive agricultural practices and illegal logging to sustain a meager existence. These approaches to land management are a direct contradiction to the work that my organization conducts in the region. This reality seems to be a major contributor to the disappearance of tropical rain forests across the globe, but I remind myself that the problem is the solution. I have come to the realization that no matter how many trees we plant, and no matter how much land we purchase to put into conservation, none of our work will last if the inhabitants around us cannot develop community incentives for ecological restoration. Agroforestry practices provide communities a reason to steward their land. Agroforestry creates a system of economic incentives that produce high quality restoration work and a culture around sustainable land stewardship.

By producing an agricultural crop within a forested landscape, whether it is shade-grown coffee in a tropical rainforest or ginseng and goldenseal underneath a temperate forest in North America, agroforestry systems allow people to make a livelihood without destroying the forests. Some of our most degraded landscapes are agricultural, and by transitioning these sites to agroforestry production systems, we are maintaining our heritage of agri-CULTURE, or the culture around creating and harvesting food, while also restoring these landscapes. Agri-CULTURE encourages communities to invest in dynamic food production systems, to participate in the management and learning of landscape restoration, while enjoying the culture of food production and the economic sustenance that comes from these practices.

The permaculture principles of establishing interfunctional relationships and relative location, which are inherent in agroforestry practices, provide a recipe for success within restoration...
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Agroforestry systems, such as the ones we are implementing within our nature reserve and the nearby community, are developing into a mosaic of multi-use landscapes. Throughout our work, my organization has been able to effectively restore degraded cow pastures to diverse production systems, which increase tree cover, provide food for our programs, and create a diversified income that supports our conservation and restoration efforts. Establishing tree-based agriculture is essential in our communities, as many producers deal with the challenges of degraded tropical soils and drought. These practices allow producers to create microclimates, increase soil fertility, and conserve water. Our program provides a multi-faceted approach to incentivize agroforestry. We are working with producers who own large properties to design and implement agroforestry within their pastures and forested land to provide them an economic return. Shade-grown coffee, cacao, banana, plantain, papaya, and other products help transition their growing practices to a more perennial infrastructure that requires lower inputs and a higher return. These approaches provide an incentive to producers to maintain forested cover, as the highest quality coffee and cacao are grown in shady forested zones. We also provide incentives for community members to install small coffee plantations around their rural homes and plant native and food-producing trees as an over-story to provide shade for their coffee. These home production systems will contribute to food security and provide supplemental income as the community continues to develop an agricultural cooperative. The coffee “gardens” will dramatically change the landscape around the village, which is currently dry and degraded due to grazing and deforestation. These gardens will provide an income source for many of the single mothers and unemployed community members who spend much of their time around their homes. Demonstrating to...
the community that they can restore previously degraded areas to productive systems and gain an economic return is integral to success. Projects like these are gaining traction amongst the community, to cultivate and restore the land around their homes, and we are sure that this sentiment will resonate through the region.

Similarly, we are implementing silvopastoral systems, or planting native trees for wood production within pastures, providing producers the opportunity to maintain these spaces as grazing pastures for cows, but in return provide tree cover and wildlife habitat while they grow. Integrating nitrogen-fixing tree species, such as Leucaena, can provide multiple functions in these systems. Leucaena provides valuable timber, nitrogen fixation, and livestock fodder for cows in times of drought. These practices will ultimately provide a harvest of timber for the producer to use domestically or for sale, lessening the pressure from illegal logging in the surrounding forest. As we continue this work, we are seeing that providing an accessible land management approach with incentives for the community is paramount to create a new culture around ecological restoration and to broaden the organization’s goals of reforestation.

Temperate climates have the capacity to adopt agroforestry practices just as much as the tropics. Temperate zones are home to numerous fruit and nut trees. Nitrogen-fixing trees like honeylocust (Gleditsia triacanthos) and black locust (Robinia pseudoacacia) produce quality wood and can be used to feed livestock. These are fantastic options in temperate applications. By creating incentives for large-scale agricultural producers to establish more diversified tree-based farming systems, we will be able to make an impact on a large scale. The community and city levels also present numerous opportunities to rebuild the urban forest with green belts, community orchards, and backyard food forests to provide the much needed renewal within the urban setting. These applications will not only localize sources of food, but also potentially offer alternatives for local economies. These approaches within the temperate zones allow us to rebuild corridors for wildlife and develop intact forested zones in a very fragmented and degraded landscape. Examples of successful temperate agroforestry are arising every day through the work of the Association for Temperate Agroforestry and producers such as Mark Shepard of New Forest Farm, Don Tipping of Seven Seeds Farm, and many other forest farmers who are leading the way in developing a new agri-CULTURE within the temperate zones.

Agroforestry practices provide us an opportunity to restore our ecosystems at every level. Ecological restoration work should not be left to large tracts of land never to be touched again, nor should it be left to ecologists. Ecological restoration should be made accessible to all. Restoration work should permeate into every crevice of our built environment, both urban and rural. Agroforestry as a tool for ecological restoration creates cascading effects that are difficult to see at first glance. Providing habitat, sequestering carbon, regulating climate change, and creating more fresh air and water are the perks of designing beautiful and productive tree-based systems.

Ultimately, agroforestry practices allow us to produce a yield. This is an essential concept in creating a culture around ecological restoration. Many restoration projects spend unbelievable amounts of resources, with the sole return being intrinsic ecosystem services. Restoration projects, like other endeavors, need to provide a return for the effort invested. Agroforestry provides us an alternative perspective to the traditional restoration paradigm. Agroforestry practices develop stable and resilient landscapes, while providing us the food, fuel, and fiber that we need. In return, these practices limit our need to extract virgin resources and degrade more landscapes in the process. In the past, human civilization managed the resources of the forest for their subsistence, and in return were able to maintain healthy fruitful landscapes for generations. It is as if agroforestry allows us to “re-wild” the landscape while also “re-wilding” the way that we provide for our sustenance. For much of history, we have depended on forests for survival. Forests have served as our hardware stores, pharmacies, and grocery stores since the dawn of civilization. Forests have provided us the firewood and biofuels necessary to maintain the advancement of our society. By establishing agroforestry production systems, we are building into the landscape the mechanisms that will allow us to restore our ecosystems for generations to come. Now we must use the patterns of the past to advance our society into a future of ecological restoration.

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Jama Coaque Ranger, Ediberto Marquez, holds native tree seedlings during a community restoration day.