Restoring forests is the best policy for all stakeholders

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Jilin pond

EXECUTIVE SUMMARY

ESG policy too often relies on faulty understanding of complex biological terms, rules, and events. Reforestation, or forest recovery, is distinct from afforestation. Afforestation plants trees in areas where the native ecosystem does not normally support forest growth. This means afforestation can be a destructive activity. It replaces one native ecosystem with another when it is practiced on sites not suffering severe anthropogenic change. Reforestation grows forests where forests once grew naturally. It is regenerating a new version of what once was. The UN's 15th Sustainable Development Goal (SDG15) directs practitioners to "protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss." This directive precludes afforestation. When anthropogenic changes are severe, site reclamation is a good remedy. Reclamation establishes tree cover and increases biodiversity meeting SDG15.

Effective reforestation is restorative; it increases animal and plant biodiversity on restoration sites. An effective forest recovery project is carefully designed and has well defined scope, vision, targets, goals, objectives, and indicators of progress. It addresses social, ecological, and economic elements within the stakeholder community and in the planted forest. To accomplish these goals there are tradeoffs. A consensus around best practice in restoration has developed. Restoration should 1) protect existing forest and encourage natural reproduction; 2) maximize biodiversity recovery using native plants of known provenance and wide genetic diversity; 3) involve all stakeholders; 4) meet multiple goals – ecological, social, and economic; 5) restore multiple functions of an ecosystem; 6) be assessed against clear goals and objectives; 7) be managed adaptively for long-term resilience; and 8) protect the restored forest for the long-term.

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ESG

Planting trees isn't always an ecological positive. Sometimes forestry results in a net emission of carbon into the atmosphere. Other forestry projects reduce biodiversity while succeeding at growing trees. These outcomes are the opposite of most stated ESG policies. But it's possible to create investments that combat climate change. Understanding well defined best practices and terminology help.

ROOTS OF THE PROBLEM

We suffer the effects of climate change around the world. Anthropogenic activity, especially the burning of fossil fuels, have created this problem. In the past 275 years or so, humans have produced around 1,480 billion tons of carbon dioxide, mostly from fossil fuels (Scharf, 2017). And now we are asking forests to help fix this problem.

The historical scope of forest cutting is massive, covering hundreds of millions of hectares. There is only a tiny fraction of primeval forest left on the planet. Deforestation is a very old problem. As early as the 5th century BC, Plato complained that the demand for timber was denuding the hillsides and plains surrounding Athens. In Germany, reforestation began in 1309 when the King ordered the deforested land along the Pegnitz River returned to forest (Williams, 2003). In China, by the 13th century, deforestation and over-cultivation resulted in massive soil erosion. This caused destructive siltation in the Yangtze River.

> *When the timber by the streams was gone the wood cutters went into the midst of the valleys in crowds of a thousand or a hundred, covering the mountains and wilderness; axes fell like rain and shouts shook the mountain....the beautiful scenery of Ch'ing-liang became almost like a cow or horse pasture.*
>
> *published 1596 (Lowdermilk, 1938)*

China's forest cover decreased from 30-40% in the early 1950's to around 14% in the early 1980's before increasing to 21% in the 2010's. This means 90% of China's forests are younger than 65 years (Xuli Tang, 2018) . With China's 14th 5 Year Plan and other recent commitments to carbon neutrality have come redoubled forestation efforts and anticipated benefits for biodiversity. As one example, forests have been proven to help threatened populations of birds and other animals.

China has about 15% of total world bird population, or 1371 species (Hu, 2017). The lower and middle reaches of the Yangtze River, lying at the center of the East Asian–Australasian Flyway, have become even more important for birds with climate change (Liang, 2018).

UN Sustainable Development Goal 15
Protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

SDG15 is not complete in the protections it implies. Because planting trees can come at the cost of other native biology, such as non-forest ecosystems, protecting all native ecosystems is foundational.

By restoring where forests once were, reforestation is fundamentally concerned with revitalizing and protecting the environment. Changes, whether direct anthropogenic changes, such as deforestation, or those with more indirect origins in climate change, such as desertification, storms, and insect & disease infestations, all need ecosystem repair. Proper reforestation offers a solution, but execution is critical as mismanaged reforestation projects can do more damage than good.

Field of small bushes needing reforestation

A SOLUTION

While restoring forests and afforestation are top priorities for China, they are not equal in form or effect. Afforestation establishes forest cover in ecosystems where historically no forest grew. Sites may require restoration because of ecosystem degradation, such as erosion and desertification. Many sites subjected to afforestation do not fit this description. Reforestation reestablishes forest where wild forest once grew. It rebuilds ecosystem function. It is forest recovery. Reforestation allows for the development of forest structure with renewed biodiversity. It creates a canopy to provide habitat, clean and abundant water, reduced erosion, and renewed soil biologic activity (Asmelash F, 2016) (Yang, 2013). Reforestation provides myriad other direct, tangible benefits, such as forest recreation opportunities for residents or new wood products for consumers, as well as societal benefits, such as countering greenhouse gas emissions through carbon sequestration.

Natural regeneration from on-site seed and genetic sources is a best practice goal but may not be an option for all sites. Tree planting is the best option when the seed source is lost

due to a natural disturbance, such as wildfire. Partnering with organizations that grow native, biologically appropriate seedlings adapted for out-planting on reforestation sites helps to meet biodiversity goals. This also assures that forest projects have the best chance of long-term success.

Seedlings in greenhouse

AFFORESTATION

Afforestation is the process of growing an artificial forest on a site where a forest has not previously been part of the natural ecosystem. An example could be planting trees into a grassland for wood products or to stop sandstorms. The trees may thrive but at the detriment of the native grass ecosystem they have replaced. Unless there has been severe and permanent ecological damage and change, afforestation can contribute to further damage. The primary objective of many afforestation projects is not biodiversity preservation. Many afforestation projects are economically driven by their carbon offset potential. Carbon stocks in afforested sites are lower than reforested, biologically diverse sites (Hong, 2020) (Yang, 2013) (Dass, 2018). When an ecosystem degrades beyond its point of repair, reclamation is needed. Ecological reclamation through tree planting is distinct, however. The practices of afforestation and reclamation should be split.

RECLAMATION

The regenerative act of reclamation establishes a forest on a site that is ecologically nonfunctional because it is severely degraded through various environmental or anthropogenic impacts. It has lost connection to its historical state. Reclamation has the reparative goal of establishing a new type of functional ecosystem. Reclamation is practiced after strip mining removes the soil from mountains for coal retrieval. In such a situation, there is no ecosystem to repair because the destruction is complete. Similarly, after deforestation, desertification can set in and extinguish the ecosystem. In these circumstances, the former ecosystem is lost permanently, and restorative reforestation is not possible. Desertified land is often only reclaimed with specialized revegetation that is unique to these situations (Adams, 2017).

REFORESTATION

Reforestation is the practice of establishing a forest where a forest grew in the past. When done well, this act serves to rebuild and strengthen the forest ecosystem, building

biodiversity. Reforestation should not harm existing relationships within the ecosystem and can be executed with varying intensity. Low impact restoration allows natural regeneration; intensive reforestation might start with site clearing and maintaining the trees for years or decades. Both approaches lead to increased carbon sequestration (Lewis, 2019) (Körner, 2017). All forms of reforestation, when protected for long periods of time, should also lead to natural forest regeneration and increased carbon sequestration (Díaz, 2009).

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PLANTATION FORESTRY

Plantation forestry cultivates trees in large farms from a single or a few species. This is done for various agroforestry uses in areas where natural forests once grew. Plantations produce timber, lumber, or pulp. To the outsider, this kind of forestry practice can seem benign. Afterall, what is wrong with harvesting a forest if it is replanted?

There are two main problems with this kind of forestry, however. Monoculture, cultivation of a single or only a few species on a site, is harmful to the biodiversity of plants and animals. It also increases the dangers that insects or disease will destroy the trees, further imperiling biodiversity. Plantation forestry is monoculture on a grand scale, and though the forest may seem full and green, it lacks the diversity in species a functional ecosystem contains. Further, many plantation forests are established using non-indigenous tree species, which create ecosystems that are non-functional for wildlife.

Additionally, the carbon budget in plantation forests is negative. Rather than capturing and storing carbon, plantation forests, and the agroforestry practices that go along with them, release more carbon into the atmosphere than the trees in the forest capture over

Beetles in Jiangsu

their lifetimes. This is due to tree cutting, decomposition, burning of residues, and soil carbon loss. Such results have been recorded in both north and south China (Díaz, 2009) (Körner, 2017) (Lewis, 2019) (Yang, 2013). Even compared to secondary forests, single species larch plantation forests lose soil carbon, and the soil becomes more acidic (Wang, 2018). These negative effects are felt on both the local and global scales. Research in in South China has shown that the soil in plantations, even 200 year old plantations, differs from undisturbed ancient soils (Ren, 2012). The goal of plantation forestry is only economic, not economic *and* biological.

REFORESTATION AS BEST ESG SOLUTION

Selecting forestation practices that fit close with corporate ESG goals and align with SDG 15 will benefit ecosystem health and biodiversity. Reforestation, and not afforestation, best serves to meet ESG goals. Afforestation poses a threat to ecological wellbeing in antagonism to SDG 15. Reclamation forestry is a specialized practice. When it follows anthropogenic changes, some critics see it as enabling the original ecosystem destruction.

REFORESTATION IMPLEMENTATION

When well planned, executed, and protected for the long-term, a planted forest regenerates to a natural forest. It recognizes and promotes complexity and autonomy in the ecosystem. Wild forests are dynamic and planted forests must also be. Biodiversity increases with good reforestation, and good forestry implementation first protects existing forests and then aims to maximize biodiversity recovery across the representative ecosystem (Perino, 2019). In good forestry practice, appropriate areas are selected for restoration, with species chosen to maximize biodiversity. Trees planted should have

variable genetics and provenance. When possible, reforestation works with all stakeholders to craft practices beneficial to all (Lewis, 2019) (Di Sacco, 2021). Forest landscape restoration aims to regain ecological functionality and enhance human well-being. The approach has three key objectives of biodiversity recovery, sustainable livelihoods, and enhancing ecological benefits.

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Plant trees.

Do no harm to local communities of people, plants, or animals.

Projects described with diverse names such as ecological restoration, forest landscape restoration, rewilding, and assisted natural regeneration all have the same basic goal of creating a healthy, long-standing forest with a host of eco-benefits. In each case, there is a consensus around best practice for forestry and in best case outcomes. Similarly, the concept of rewilding aims to restore self-sustaining and complex ecosystems with interlinked ecological processes that promote and support one another while minimizing or reducing human intervention (Perino, 2019).

	DiSacco	Besseau	Gann	Lewis	Conservation Measures Partnership	(IUCN, 2021)
Protect existing ecosystem	X	X	X	X		X
Biodiversity recovery	X	X	X	X		X
Stakeholder engagement	X	X	X			X
Bring ecological, social, economic value	X	X	X			
Restores multiple functions	X	X	X			X
Assessment metric			X		X	
Adaptive Management	X				X	X
Long-term forest protection	X					

Figure 1. Comparison of reforestation and restoration implementation standards

Six reforestation and restoration project implementation standards were reviewed in trying to determine the best practices in the industry. Recently published work from a wide assortment of the world's climate change, restoration, and forestry scientists recommends to first protect the local ecosystems. The axiom put forth by DiSacco, "Plant trees, do no harm to local communities of people, plants, or animals" summarizes the way work should be planned, implemented, and measured. This advice is followed by recommendations to support biodiversity recovery and focus on the genetic integrity of restored forests by using native plants of local provenance from as wide a genetic pool as possible (Di Sacco, 2021) (Lewis, 2019). The use of a native reference ecosystem in planning will help establish baseline biodiversity and a goal for recovery assessment (Gann, 2019). A reference ecosystem is an intact functioning ecosystem which acts as role model for the restoration being undertaken.

Biodiversity serves as proxy for all eco-system services. Successfully increasing biodiversity is not possible without functioning eco-systems providing all their requisite benefits. The various benefits of a functioning ecosystem are not a direct part of the reforestation project parameters. Increasing biodiversity builds ecological value. Eco-system services such as habitat, pollination, water runoff, and carbon sequestration come with increasing biodiversity. Successful restoration creates a healthy environment which results in increased eco-benefits, and social value is found in all eco-benefits. Liu et al conducted research that demonstrates that with every increase in a species there was an

increase of 6.4% stored carbon in the representative system (Liu, 2018). Economic value is created in stored carbon, removed pollution, and climate stabilization. Eco-benefits have no direct connection in the restoration protocol. Successful biodiverse reforestation is more profitable because biodiversity and eco-benefits are linked.

Stakeholder involvement is a key part of the restoration protocol. Management practices, land tenure, and governance should involve the local community in every phase of the project (Besseau, 2018) (Di Sacco, 2021). Ecological, social, and economic outcomes are all part of meeting multiple goals, and for one to be successful, all three must succeed (Di Sacco, 2021) (Besseau, 2018) (Gann, 2019). This assures a multidisciplined approach that shouldn't neglect important components to success.

Several of the reforestation prescriptions neglect a serious analysis of success or of evaluation along the way. The *International Principles & Standards for the Practice of Ecological Restoration*, second edition, has as one of its eight tenants the use of measurable indicators to assess progress toward restoration objectives (Gann, 2019). Similarly, *Open Standards for the Practice of Conservation*, v4, builds formal monitoring and evaluation into its plan (Conservation Measures Partnership, 2020). Implementation steps must be measured and need specific attention to help ensure the most beneficial outcome. Each phase of a reforestation or restoration project, from planning through monitoring, needs to address social and ecological elements and implement adaptive management with feedback from ongoing assessment. Learning from the representative system, knowledgeable stakeholders will change methods with success and failures. DiSacco calls this, "learn by doing" (Di Sacco, 2021). Each attribute of recovery needs a specific and measurable indicator to assess the site and condition prior to initiation, during implementation, and on an ongoing basis (Conservation Measures Partnership, 2020) (Di Sacco, 2021) (Gann, 2019).

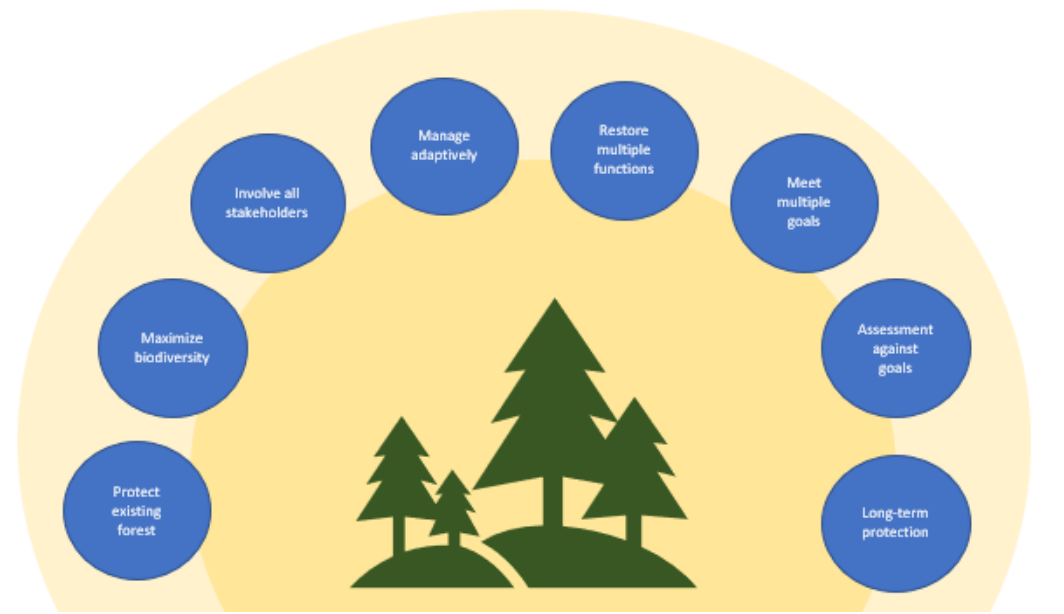

Figure 2. The eight best practice project steps for reforestation.

The eight best practice project implementation standards are synthesized from the best tenets in the reviewed literature. Restoration practice should :

1) protect existing forest and encourage natural reproduction;
2) maximize biodiversity recovery using native plants of known provenance and wide genetic diversity;
3) involve all stakeholders;
4) meet multiple goals – ecological, social, and economic;
5) restore multiple functions of an ecosystem;
6) set and assess against clear goals and objectives;
7) manage adaptively for long term resilience;
8) protect the restored forest for the long-term.

Implementing a project with these steps will preserve existing biodiversity. The project will involve all the stakeholders and engage them to develop the best social, ecological, economic outcomes with multiple function in the ecosystem. Review and assessment of successes and failures in the project is critical and should not be ignored. Learning as part of this process will lead to adaptive management. The project will end looking different (and better) than it was designed at the start.

Summary

Implementing best practice across corporate actions is mandatory and should extend to ESG policy. Investing in nature needs to follow the rule, first do no harm. Investments made to offset existing or historical carbon emissions must increase biodiversity to best accomplish project goals. Planting trees can meet these investment metrics. Reforestation builds biodiversity and increases the accrual of eco-benefits. Planting and protecting a forest for the long-term will result in a regenerative forest, increased biodiversity, and more carbon capture.

Jilin river

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