SCIENCE PANEL FOR THE AMAZON

POLICY BRIEF

THE AMAZON WE WANT
Science Panel for the Amazon

TRANSFORMING THE AMAZON THROUGH "ARCS OF RESTORATION"

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KEY MESSAGES

(i) There is an urgent need for large-scale restoration across the Amazon, which has suffered decades of deteriorating ecological conditions and is fragile in the face of climate change.

(ii) Restoration encompasses a mix of strategies that increase the extent and permanence of tree cover and contribute towards the delivery of multiple benefits from climate change mitigation, biodiversity conservation, and social well-being.

(iii) Restoration at scale can be achieved through seven complementary targets: (a) Achieve zero deforestation by 2030; (b) Avoiding forest degradation; (c) Restoring forests in protected areas; (d) Restoring forests in undesignated lands; (e) Restoring areas that have been cleared above the legal allowance on private lands; (f) Restoring forest cover beyond legal compliance; and (g) Sustainable restoration of degraded farmland.

(iv) These targets can be achieved through manipulating seven different levers: (a) Strengthen existing public policies and develop new ones; (b) Improve implementation and enforcement of policies and support with adequate governance systems; (c) Clarify land tenure and resolve conflicts; (d) Improve the commitments and policies of the private sector and import countries; (e) Empower local communities, women, and youth; (f) Support innovation and offer technical assistance; and (g) Effective monitoring.

(v) Levers need to be applied at multiple scales, from landscapes to regions, incorporating local socio-ecological conditions and considering benefits for biodiversity, water, production systems, and local people.

(vi) The risks of restoration can be addressed by taking an equitable approach. Restoration is very unlikely to be successful unless it is carried out with strategic plans that secure both the support of a broad range of local stakeholders, innovative approaches, and long-term funding, which should also cover its development monitoring and measures that prevent leakage or other perverse outcomes.

RECOMMENDATIONS

(i) Achieve zero deforestation by 2030. Based on an average of the past five years, business-as-usual deforestation would lead to an additional 8 M ha of deforestation by 2030 in the Brazilian Amazon alone. Reducing this by 50% would save 4 M hectares of primary forest.

(ii) Avoiding further forest degradation could allow over 100 M ha of degraded forests to recover their carbon stocks, biodiversity, and provisioning of ecosystem services. It will also protect undisturbed primary forests from being degraded. Without urgent action, a return to El Niño conditions will almost certainly see a return of

the megafires that seriously diminished the ecological value of millions of hectares in 2015 alone.

(iii) Restore forests in protected areas. Deforestation in protected areas and Indigenous territories has increased markedly in recent years. Focusing restoration efforts on the areas that were felled since 2015 would provide over 0.8 M ha for restoration, with diverse high-carbon forests returning without the need for expensive tree planting.

(iv) Restore forests in undesignated lands. Over 2.8 M ha of forest have been cleared from undesignated public lands in the Brazilian Amazon. Much of that clearance has occurred recently, and even a narrow focus on areas cleared since 2015 would provide over 1.8 M ha for large scale passive restoration.

(v) Restore areas that have been cleared above the legal allowance on private lands.

(vi) Restore forest cover beyond legal compliance. There are many ecologically important lands that are not fully protected by legal compliance. For example, riparian forest widths mandated by Brazil's Native Vegetation Protection Law (NVPL) are insufficient to protect aquatic ecosystems or provide habitat or movement corridors for many terrestrial species.

(vii) Sustainable restoration of degraded farmland. Restoration practices could be applied to c. 24M ha of moderately or severely degraded pastures that exist across the Brazilian Amazon, with further opportunities in other Amazonian countries. Degraded pastures generate little income and could be significantly improved by incorporating soil conservation measures and silvi-pastoral approaches, forestry systems, and agroforestry.

(viii) Restoration will be most effective if it is implemented at the landscape or catchment scale, with the broad range of social and environmental benefits outlined in Section D.

A. THE URGENT NEED FOR LARGE-SCALE ACTION ACROSS THE AMAZON

Business-as-usual patterns of development have created highly deforested Amazonian landscapes that have deteriorating ecological conditions and are fragile in the face of climate change (Figure 1). Climate change and deforestation are bringing about a very real risk of large-scale forest dieback[1]. This large scale forest dieback will lead to sharp declines in agricultural productivity within and outside the Amazonian region, an increase in extreme climatic events, risks of emerging zoonotic diseases affecting both rural and urban populations, and increasingly severe fires. Such changes also compromise restoration success itself – the sooner we start restoring, the greater the chance that the restoration will be successful.

An ambitious program of conservation and large scale forest restoration with socio-economic benefits is needed to build an alternative future for the Amazon. Achieving this requires avoiding further deforestation and forest degradation, restoring forest conditions and extent in public and private lands, and supporting restoration with the socio-economic benefits of degraded lands. If applied at scale, these actions have the potential to make the Amazon more resilient to climate change, empower local people, create new jobs and grow rural economies, and contribute to biodiversity conservation and the provision of key ecosystem services such as clean water, foods, and carbon storage and sequestration (Figure 1). They need to be applied across the Amazon, as each region unlocks different specific benefits.

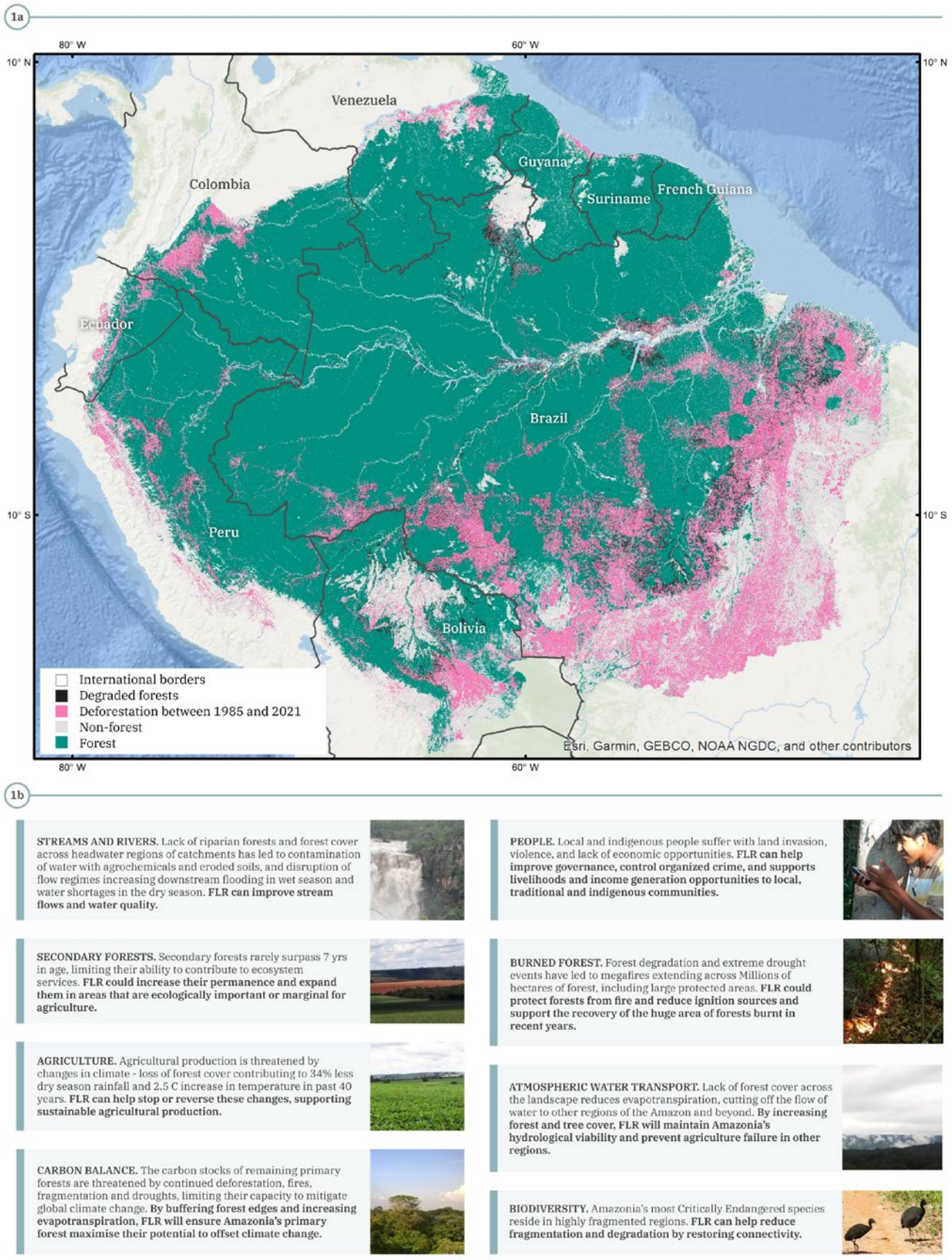

FIGURE 1. a) The Arcs of deforestation and degradation across the Amazon basin, highlighting regions where restoration is urgently needed. b) The diverse set of challenges created by business-as-usual approaches to development, and how Forest Landscape

B. LARGE-SCALE OPPORTUNITIES FOR RESTORATION

Forest restoration is sometimes characterized as planting trees, but it is actually much broader in scope as it is about restoring "a balance of the ecological, social, and economic benefits of forests and trees within a broader pattern of land uses"[2]. Forest restoration, therefore, encompasses a mix of strategies that increase the extent and permanence of tree cover and contribute towards the delivery of multiple benefits from climate change mitigation, biodiversity conservation, and social well-being. Restoration needs to be mixed with conservation, as a narrow focus on increasing forest cover would not compensate for the ongoing large scale deforestation and degradation. It also involves the conservation and restoration of non-forest native ecosystems such as savannas, which occur in many regions of the Amazon, harbor unique biodiversity, and provide important ecosystem services.

Large-scale restoration can be achieved by aiming for **seven complementary targets** that include avoiding further environmental losses from deforestation or degradation, restoring forest cover on public and private lands, and enhancing the economic viability of degraded lands. The targets and their potential extent are:

1. Achieve zero deforestation by 2030. Based on an average of the past five years, the business-as-usual scenario of deforestation would lead to an additional 8 M ha of deforestation by 2030 in the Brazilian Amazon alone. **Reducing this by 50% would save 4 M hectares of primary forest.**

2. Avoid forest degradation. Avoiding further degradation could allow **over 100 M ha of degraded forests**[3] to recover their carbon stocks, biodiversity, and their provisioning of ecosystem services. It will also protect undisturbed primary forests from being degraded. It is important to remember that the last three years have seen La Niña conditions, which makes the Amazon wetter than normal, helping limit the extent of forest fires. Without urgent action, a return to El Niño conditions will almost certainly see a return of the megafires that seriously diminished the ecological value of **millions of hectares in 2015 alone**[4,5]**.**

3. Restore forests in protected areas. Deforestation in protected areas and Indigenousterritories has increased markedly in recent years. Focusing restoration efforts on the areas that were felled since 2015[6] **would provide over 0.8 M ha for restoration.** Crucially, recently deforested lands were not used intensively and are close to old-growth forests; therefore, restoration can be passive, and diverse high-carbon forests can return without expensive tree planting.

4. Restore forests in undesignated lands. Over 2.8 M ha of forest have been cleared from undesignated public lands in the Brazilian Amazon[6]. Much of that clearance

has occurred recently, and **even a narrow focus on areas cleared since 2015 would provide over 1.8 M ha for large-scale restoration.** As with the restoration of protected areas and Indigenous territories, proximity to old-growth forests and low land-use intensitiy means this restoration can be passive.

5. Restore areas that have been cleared above the legal allowance on private lands. Under Brazilian law, two mechanisms can support restoration of private lands. First, the Brazilian Native Vegetation Protection Law (NVPL) mandates that Areas of Permanent Preservation (i.e., areas with steep slopes and in riparian zones) must not be cleared. Where deforestation has exceeded this, restoration must occur. **In the municipality of Paragominas (Pará, Brazilian Amazon) alone, there are 522 km of rivers and 904 springs requiring restoration[7].** Second, the law requires properties to retain native vegetation on a proportion of their land as "Legal Reserves". Although the areas of property-level forest deficits are large, restoration of these areas is currently difficult due to the many options for off-site compensation.

6. Restore forest cover beyond legal compliance. Many ecologically important lands are insufficiently protected. For example, the riparian forest widths mandated by Brazil's NVPL are insufficient to protect aquatic ecosystems or provide habitat or movement corridors for many terrestrial species, and the state of Pará alone has **over 5 M ha of cleared riparian areas that do not need to be restored by law[8].**

7. Sustainable restoration of degraded farmland. Restoration practices could be applied to c. **24 M ha of moderately or severely degraded pastures[9]** across the Brazilian Amazon, with further opportunities in other Amazonian countries. This could be achieved while maintaining livelihoods and economies, by incorporating socially-beneficial aspects of restoration into existing farming systems. This is particularly relevant in the Amazon Basin where degraded pastures generate little income,[10] and could be significantly improved by incorporating soil conservation measures and silvi-pastoral approaches, forestry systems, and agroforestry. Many of these practices have been shown to be a huge success in terms of economic returns and food production diversity.

These seven targets are highly complementary and need to be addressed together as there are many synergies and cross-cutting benefits that exist between the targets, and many targets can be addressed by focusing on similar leverage points (Figure 2). There are also important economies of scale from upscaling, as it could support the development of viable carbon sequestration and/or timber production markets and enhance understanding of best practices. In the next section, we explore some of the key leverage points that need to be applied.

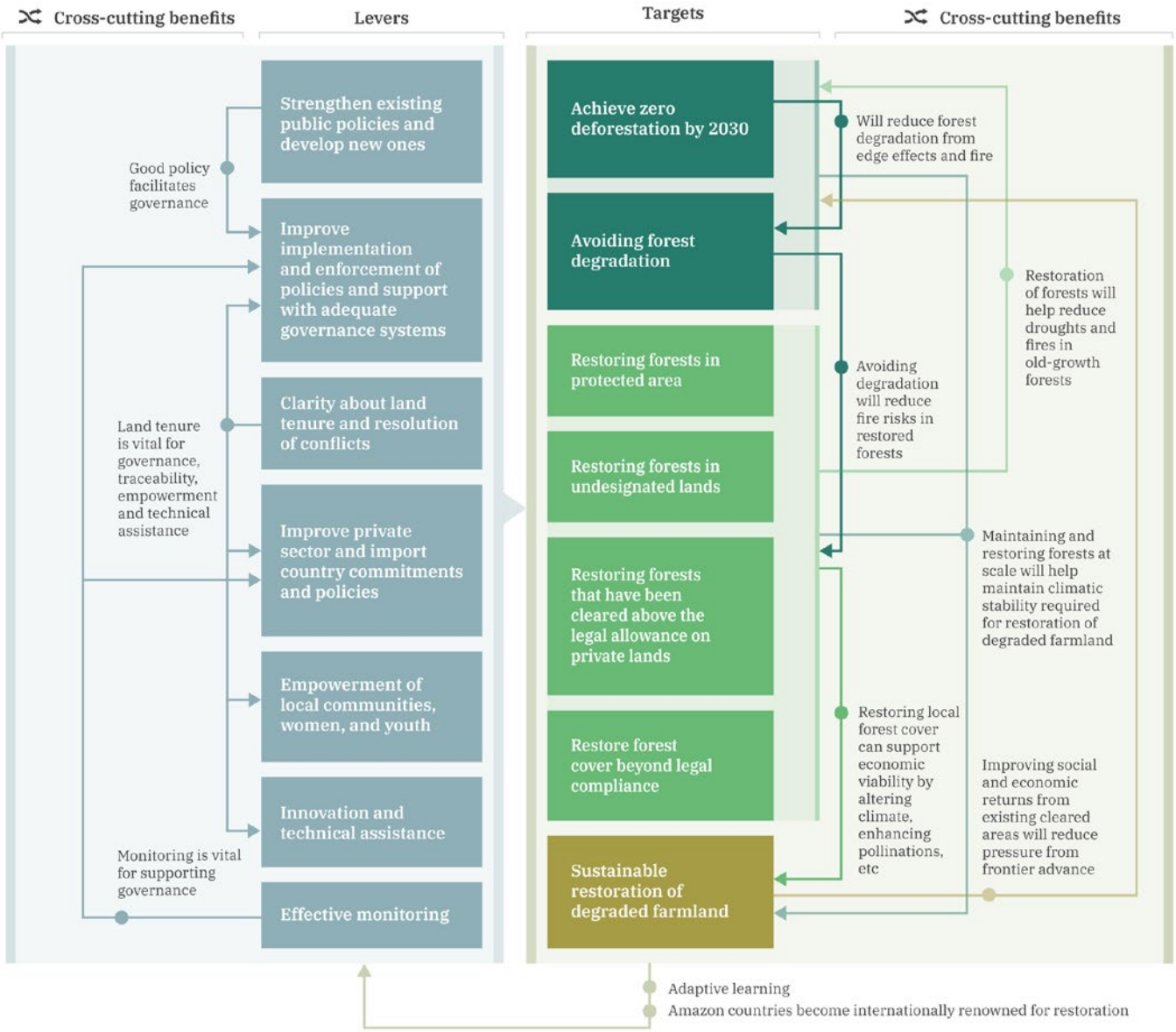

FIGURE2. Seven complementary restoration and conservation targets, and the policy and management levers that can help achieve them. Manipulating levers and achieving targets bring about a broad suite of cross-cutting benefits, all helping support the broader aim of a positive transformation of the Amazon basin. The levers and cross cutting benefits are non-exhaustive, and there are other actions and links that we do not map out here.

C. TRANSFORMING THE AMAZON - WHAT ARE THE LEVERAGE POINTS?

Large-scale restoration can be achieved through the following leverage points (Figure 2):

Strengthen existing public policies and develop new ones

(a) A first key step for large-scale restoration is the establishment of appropriate policies to promote it at scale. Some jurisdictions provide useful examples, such as the Brazilian NVPL that sets the minimum area of native vegetation for legal reserves and in ecologically-sensitive settings (e.g., along watercourses). State-level decrees that set out restoration targets, such as Pará's 'State Plan for Amazonia Now', are also likely to be key.

(b) Less obvious policies may have important indirect effects on restoration dynamics. These

include (i) The Brazilian School Meal Program which has been fundamental in encouraging the consolidation of agroforestry systems and agrobiodiversity in some areas of the eastern Amazon; (ii) The Brazilian Bolsa Verde program, which provided financial subsidies to populations experiencing extreme poverty and living within protected areas, encouraging the sustainable use of natural resources while also ensuring the reduction of social vulnerability; (iii) forest concessions for timber production, which may create favorable economic and tenure conditions for securing forest protection against land grabbing and illegal logging; and (iv) awarding legal rights to nature, as has occurred in Bolivia and Ecuador.

(c) Many of the targets will benefit from revisions to existing policies. For example, restoration based on legal compliance within private properties will be encouraged if compensation options are more stringent, and most occur in the same municipality. Avoiding degradation will be supported by implementing a proposed revision to the federal laws governing fire use, providing regional mechanisms to limit fire use during periods of high risk.

(d) Restoration on agricultural lands will only succeed if policies are established to ensure adequate credit structures, technical assistance, and cooperative networks for the production of seeds and seedlings of native species, and appropriate facilities for processing native products (e.g., timber, bioactive ingredients, food) to aggregate value and achieve the scale and quality required by industries. In addition, credit policies should consider soil quality recovery and forest restoration as an investment in environmental health, which require longer grace periods for positive returns.

Improve implementation and enforcement of policies and support with adequate governance systems

(a) Without implementation, stringent policies are merely greenwashing. For example, although Brazil has relatively stringent deforestation laws and state-of-the-art monitoring capacities compared to most countries, these have been undermined by a sustained reduction in funding for enforcement. Avoiding illegal deforestation, mining, and logging requires funding and personnel for environmental governance bodies, so they can more effectively approve forest management plans, check licenses, apprehend equipment and goods involved in illegal practices, and protect reserves and Indigenous territories against invaders. Governance across the region requires a well-coordinated plan to combat organized crime in the region, which should include an increase in the investigative capacity, including forensic accounting to identify and prosecute those funding illegal activities, and collaboration across country borders.

(b) Good governance involves setting up effective integration between scales, linking monitoring systems and alerts based on remote sensing to actions by law enforcement, and collaboration among different organizations. For fires, rapid response coordination requires creating, training, and maintaining a viable fire-fighting force that can be called out at short notice to suppress forest fires when they are

first detected. Finally, good governance requires investment in prevention actions, including education and alternatives to illegal activities.

Clarity about land tenure and resolution of conflicts

Land tenure has a strong influence on the likelihood, feasibility, and success of all conservation and restoration efforts. Conflicting tenure regimes and tenure insecurity act as a disincentive to invest in or undertake restoration and undermine efforts to punish illegal activities. As restoration is a long-term activity, requiring decades to provide attractive returns from carbon and timber commercialization, resolving land tenure issues is a pre-requisite for restoration investment and the sustainable use of forest resources.

Priority actions include:

(a) Guaranteeing rights to Indigenous peoples and local communities (IPLCs). IPLCs' land rights need to be urgently ensured[11], and claims overlapping with their own to be immediately revoked. In addition, IPLCs and landowners who lived within protected areas before their demarcation were kept out of territorial planning, resulting in land conflicts. These unsuccessful expropriations need to be resolved.

(b) Resolving the legal definition of the protection status of undesignated public lands. While this is a highly contentious issue, 2.8 M ha of undesignated forests (nao destinadas in Portuguese) have been cleared in Brazil; a zero-tolerance policy to land speculation on these lands is absolutely central to avoiding further deforestation. All undesignated forests need to be designated for conservation or sustainable use, ensuring rights for sustainable extractivism by IPLCs where territories overlap. Deforested undesignated lands should be set aside for restoration where occupation is recent, or awarded to IPLCs where they can show long-term use.

(c) Clarity about land tenure is also essential for assessing legal reserve deficits on private lands. Within Brazil, this requires the completion of the Rural Environmental Registry (CAR, from the Portuguese acronym), as well as analyzing the information declared in the registry, prioritizing regions earmarked for restoration.

Improve private sector and import country commitments and policies

The private sector and import countries cannot substitute for effective domestic governance. However, they can strengthen the limited capacities of public systems through supply chain policies or jurisdictional approaches and can offset low political will. The positive influence of the private sector and import countries will be supported if:

(a) More companies implement strict zero-deforestation commitments by refusing to source products produced in recently-cleared areas while also implementing agroforestry and restoration programs through seedling distribution and payments for environmental services (PES).

(b) Countries across the world implement due diligence requirements for companies seeking to sell products in their markets (e.g., requiring zero deforestation, no slave labor, and other activities that fail to adhere to the UN Declaration of Human Rights) and expand and/or develop carbon and biodiversity markets to incentivize restoration through the supply chain.

(c) Investments in restoration are encouraged by cataloging restoration opportunities for the private sector and international investors, putting the Amazon at the forefront of global restoration efforts.

(d) Restoration costs are borne by incentive-based payment mechanisms involving the private sector, such as carbon and/or biodiversity offsetting, PES, and/or certification schemes used to support agricultural and forest management best practices, which would include zero-deforestation supply chains.

Empowerment of local communities, women, and youth

Conservation and restoration targets will only be met if a wide range of local communities, Indigenous peoples, women, and youth are empowered and benefit.

(a) Many restoration actions will occur within vulnerable social contexts; here, the restoration chain must include local and marginalized populations, be socially just and respectful of biocultural diversity, and aim to improve livelihoods over the long term.

(b) Restoration on large properties may benefit from engagement strategies that communicate the full suite of socio-economic benefits to all stakeholders. For example, the climatic benefits of increasing forest cover could mitigate some of the higher temperatures associated with climate change, supporting the continuation of important agricultural activities such as 'double cropping' systems.

Innovation and technical assistance

Technical assistance programs are grossly understaffed in the Amazon and heavily biased toward existing agricultural production systems (e.g. cattle, soy).

(a) Restoration goals will only succeed if policies are established to ensure adequate technical assistance, with greater staffing and financing to support farmers and other stakeholders to implement restoration. Technical assistance should also support regional networks for the production of seeds and seedlings of useful native species.

(b) Technical assistance will be supported by research into more effective and economical restoration approaches, including alternative sustainable production systems, agroforestry systems, and best practices for forest management.

Effective monitoring

Landscape restoration requires efficient tools to monitor and verify environmental and social

performance at plot, farm, landscape, and catchment levels.

(a) While monitoring is core to all actions, it has particular relevance for avoiding deforestation, fire, or illegal logging when it contributes to effective governance by providing near-real-time assessments of threat (i.e., forest flammability, the proximity of logging) or the activity itself (presence of deforestation, logging, or fires). We recommend renewed support for official monitoring programs, such as the Brazilian Amazon Deforestation Monitoring Program (PRODES), the near-real-time deforestation detection system (DETER), and their integration within enforcement and risk evaluation activities. We also recommend the exchange of technology on monitoring programs among Amazonian countries.

(b) Large-scale monitoring beyond jurisdictions is key to avoiding potential perverse effects, such as the leakage of deforestation to other regions. Open-source Pan-Amazonian approaches, such as Mapbiomas, provide a useful means for assessing threats at scale. Standardized products would enable better comparison over time and geography.

(c) Monitoring enables us to learn from successful or unsuccessful restoration actions and create a robust evidence base for the future. This is crucial for assessing and monitoring the ecological integrity of regrowth (for legal compliance, the definition of priority areas, compensation of legal reserve, etc.) guaranteeing the ecological efficiency of restoration (ensuring failed restoration attempts are not counted as successes), and allowing for adaptive management, which will reduce risk, increase efficiency, and support technical advances in restoration practice. Monitoring can also help track changing socio-economic conditions, such as a producer's willingness to engage in restoration.

(d) Monitoring is needed to understand costs and benefits. There is great variability in the costs of restoration (from tens to thousands of dollars per hectare depending on the approach, e.g., tree planting versus natural regeneration), opportunity costs (often defined as the production value of the land for agriculture), the costs involved in purchasing, preparing, and maintaining the land, and any external costs borne by those outside the project. Understanding the long-term costs and benefits of restoration is important for guiding prioritization. Finally, monitoring requires investment in research programs to analyze the data and advance the science and practice of socio-ecological restoration.

D. RESTORATION MUST BE IMPLEMENTED ACROSS LANDSCAPES OR CATCHMENTS

Restoration will be most effective if it is implemented at the landscape or catchment scale. Some of the potential benefits of landscape planning include:

(a) Undertaking active, assisted, and passive restoration where it will be most effective – leaving the more expensive approaches to specific, highly degraded sites, and relying on natural forest regeneration for large-scale regrowth.

(b) Providing important co-benefits for aquatic systems; restoring riparian vegetation and preventing access from livestock have been shown to improve water quality and reduce a range of negative outcomes, from soil and nutrient runoff to excessive instream temperatures and flood risks.

(c) Using secondary vegetation to buffer old-growth edges from the hotter and drier non-forest landscapes.

(d) Minimizing the loss of agricultural production by focusing on the least productive and most degraded lands.

(e) Increasing well-being and livelihoods by enhancing the availability of forest products, increasing food supplies, improving water security, and supporting the diverse cultural values people place on landscapes.

(f) Maximizing biodiversity benefits by enhancing connectivity between old-growth fragments, allowing movement and gene flow between populations.

(g) Cooling cities, by mitigating the urban heat island effects. Peri-urban restoration aimed at providing climatic benefits for cities could also provide important social benefits, such as space for recreation or food for local consumption.

(h) Reducing the risk of forest fires by suppressing the growth of grasses that help spread fires and buffering primary forest edges from ignition sources and the hotter and drier non-forest landscape.

(i) Decreasing pressure on timber in natural forests by meeting some of the timber demand, allowing larger areas to be set aside for conservation or other sustainable uses, and for lower-intensity forest management in areas already defined for permanent forest management (e.g., forest concessions).

E. SAFEGUARDS AND RISKS

Social inclusion is essential for the viability and permanence of restoration. The urgency of the need for restoration cannot override the need to co-develop plans locally, engaging with a wide range of stakeholders – or the need to avoid elite capture, whereby smallholders and traditional peoples are marginalized. The wide range of restoration strategies means that there are different options for different stakeholders. Restoration will help maintain production by supporting a viable climate and other ecosystem services.

The cost of restoration is important, but it should not limit our options. If we always minimize costs, the most degraded areas are unlikely to be a priority, as the near-zero opportunity costs of the land are offset by the very high costs of implementation and assisted restoration. A focus on long-term benefits is more relevant than a narrow focus on costs. Restoration actions will incur higher risks if they focus on narrow sets of benefits (e.g., carbon) and spatial scales (e.g., single properties), without considering the broader impact and consequences of the actions (e.g., leakage, social inclusion, etc.).

Care must be taken to ensure that restoration itself does not make landscapes more flammable. For example, secondary forest understories tend to be hotter and drier in the day than primary forests, and, depending on what systems they replace, have the potential to aid the spread of fire across landscapes. Forest restoration requires additional measures to reduce fire risk.

F. CONCLUSION.

Since the 1970s, the history of Amazonian development has been centered on deforestation. This can be reversed by seeking a broad range of conservation and restoration targets that replace forest loss with 'arcs of restoration', ensuring a better future for the forests, rivers, and people that depend on their ecosystem services.

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