A status report on Assisted Natural Regeneration:
What, why, who, where, and how?

Executive Summary of the Assisted Natural Regeneration Alliance White Paper

ASSISTED NATURAL REGENERATION ALLIANCE

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Executive
Summary

Ecosystem restoration is urgently needed to mitigate and adapt to climate change; conserve and restore the planet's biodiversity, water, and soils; and to secure and enhance nature's contributions to people.

The United Nations Decade on Ecosystem Restoration (2021 – 2030) is a global movement to engage all sectors of society to participate in restoring ecosystems using a wide range of approaches and to achieve multiple objectives.

This document summarizes the current "state of the art" of one of these approaches—assisted natural regeneration (ANR) – with an emphasis on forest, woodland, and savanna ecosystems in the world's tropical and subtropical regions. It summarizes foundational literature, articulates regional perspectives and provides a conceptual framework for considering ANR practices within a broad set of nature-based solutions.

Our intended audience is broad, including restoration practitioners and implementers, policy makers, and researchers.

We aim to present a common vocabulary to stimulate collaborative activities among all stakeholders and to enable effective decision making and favorable conditions for implementation.

The mission, goals and functions of the Assisted Natural Regeneration Alliance

The ANR Alliance is a newly formed network with the mission to globally advance and amplify the practice and efficacy of ANR, fostering the recovery and vitality of natural and managed ecosystems for equitable and sustainable livelihoods and multiple socio-environmental benefits.

The main goals of the ANR Alliance are to:
1. stimulate wider awareness and knowledge regarding ANR practices;
2. support enabling policies and incentives for ANR implementation; and
3. facilitate access to evidence, technical support and monitoring capacity.

The ANR Alliance aims to strengthen and align local ANR efforts within the context of subnational, national and global agendas focused on nature-based solutions, ecosystem restoration, integrated landscape management and sustainable agriculture. Regional and global multi-sector platforms provide mechanisms to overcome barriers to ANR implementation, synthesize information and propose solutions and actions at subnational, national and international scales and to raise awareness of issues of common interest around the world.

We advocate prioritizing consideration of ANR practices where and when they are feasible, while fully supporting responsible tree planting where and when it is required for socio-economic or environmental reasons.

The Assisted Natural Regeneration Alliance was created in 2022 by the World Resources Institute, with support of WRI Brasil, Instituto Centro de Vida, Imazon and Suzano as an initial contribution of the project "Catalyzing and Implementing Assisted Natural Regeneration in Mato Grosso and Pará, Brazil."

Although ANR has strong links to agriculture, forestry, conservation and sustainable development (Figure 1), it is not formally integrated into these sectors and lacks adequate financial, political, and technical support from donors, investors, and governments to achieve its full potential.

Currently, the ANR "community" is highly fragmented across disciplines, sectors, and geographic regions, with no unifying platform. To bring this community together, the ANR Alliance aims to function as a multi-sector professional network and knowledge/technical facility among practitioners, implementing organizations, decision-makers, funders, and researchers.

The ANR Alliance began activities through establishing three regional networks in Asia-Pacific, Africa, and Latin America-Caribbean. Following regional surveys of practitioners, policy-makers, and researchers, a series of virtual workshops were held in March and April 2023 to engage a diversity of ANR stakeholders, gathering 130 participants from 43 countries and 90 organizations. These regional workshops were followed by an in-person workshop with regional co-leaders in August 2023 to highlight priority activities and begin developing a Strategy and Short-term Action plan. The ANR Alliance will initiate targeted outreach activities to foster wider adoption of ANR practices and to engage multiple regional and global actors and partners.

We invite engagement and partnership of individuals and organizations in these early steps of the Assisted Natural Regeneration Alliance.

Assisted Natural Regeneration demonstration plot in Zambia (2021)

What is Assisted Natural Regeneration?

Assisted natural regeneration (ANR) is a set of practices and interventions designed to enhance and accelerate the recovery of natural and managed ecosystems. These practices can be applied to ecological restoration, ecosystem restoration, land restoration, landscape restoration, forest management, agroforestry, and sustainable landscape management (Figure 1). Indigenous and traditional knowledge provide essential contributions to current ANR practices [1].

Figure 1. Assisted natural regeneration practices can be applied to many nature-based solutions
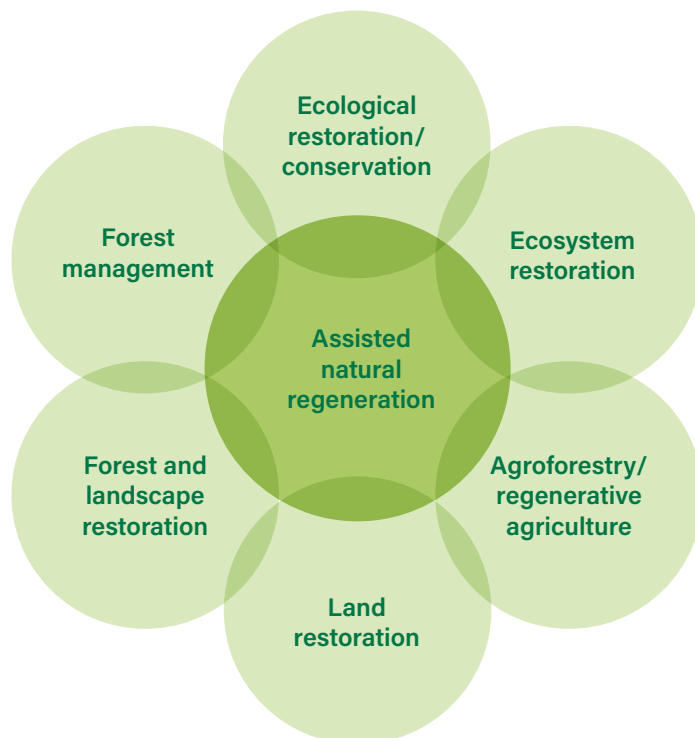
ANR practices can be implemented in combination with other restoration and sustainable land-use practices at local and landscape scales.

Enrichment planting and reintroduction can be appropriate elements of ANR practice if the primary emphasis of restorative actions is on promoting natural regeneration. Natural regeneration is a core component of conservation, restoration, and sustainable management efforts.

ANR approaches are inherently flexible, as they address conditions specific to sites and landscapes context. The relatively lower cost than other methods and the multiple benefits offered make ANR a highly effective and economically viable restoration approach[2].

Assisted natural regeneration interventions can be implemented at different spatial scales and with different objectives: 1) restoration of degraded forest, shrublands, pasturelands and grasslands, within the context of ecological and ecosystem restoration; 2) forest regeneration and management for production and commercial value (including in post-logging forests); and 3) regeneration of trees on farms and rangelands. The first two of these modalities focus on regeneration at the stand or ecosystem level whereas regeneration of individual trees or small patches of trees within farms and rangelands aligns closely with integrated landscape management and agroforestry.

The practice of ANR has tremendous promise in ecosystem restoration, sustainable land management, and forest and landscape restoration and needs to be better utilized and appreciated by people on the ground, by NGOs, government agencies and high-level decision-makers.

Patrick Durst

ANR study tour.
Bohol, Philippines

Why does ANR offer many benefits?

Satellite images and land cover data show that forests are regenerating naturally all over the world[3].

ANR harnesses the natural potential for recovery within ecosystems and landscapes. Naturally regenerating forests offer rich opportunities for substantial recovery within only a few decades, although complete recovery of native ecosystems can take centuries[4]. Compared to monoculture tree plantations, natural regeneration of forests is more effective for recovery of native biodiversity, regulatory ecosystem services, and for enhancing resilience to climate change impacts[5]. Naturally regenerating ecosystems are also important resources for ecotourism, environmental education and recreation, helping to support local businesses, community-based enterprises, cultural practices, and local conservation efforts. ANR interventions can reduce soil erosion and improve water quality within a few years.

As natural forest regeneration is the most effective approach for long-term storage of carbon, ANR is of particular interest for its importance in mitigating global warming[6]. ANR practices are closely aligned with nature-based solutions for infrastructure, disaster-risk reduction and climate adaptation.

Nature-based solutions can be applied in the context of urban reforestation, wetland restoration and forest restoration, to reduce risks of flooding and soil erosion, stabilize water flows and improve water quality, and moderate local temperatures.

Azuero Panama monitoring

In agricultural landscapes where ANR practices can reinforce the resilience of ecosystems in order to prevent, reduce, respond to, or adapt to existing or anticipated stressors, including climate change and extreme events[7].

Who are the implementers of ANR?

The implementers and practitioners of ANR are the actors who provide the assistance that helps trees, ecosystems, and landscapes regenerate. ANR implementation provides a way to bring together local communities, farmers and land managers to engage intimately with restoration efforts, while building multiple components of community capital.

The tools and practices of ANR are relatively inexpensive and do not require extensive training or supply chains[8]. Weeding, thinning, pressing grasses, fencing, tree pruning, creating fire breaks, and watering or fertilizing trees can be done by individuals, families, community or faith-based groups, smallholder farmers, and forest or reserve managers[9].

Jake Brennan

Clearing pasture grass for restoration, Ecuador

Practicing ANR involves a conceptual orientation toward evaluating the current state of degradation in the focal area and assessing options to promote a recovery trajectory based on promoting establishment and growth of native vegetation and species interactions. ANR approaches will require a change of mindset from business-as-usual tree planting schemes toward protecting, tending and managing naturally regenerating trees to enhance recovery of ecosystem processes.

where

Where are the best opportunities for ANR?

As an approach to restoring ecosystem functions, ANR is most viable and cost-effective where natural regeneration of forest, woodland and savanna ecosystems has a moderate- to high potential and where opportunity costs of land use are low, as in cases where land has been abandoned due to poor economic returns of farming or ranching. Where opportunity costs are higher, economic incentives can tip the balance toward adoption of ANR practices. Spatial predictive models can be used to identify suitable areas for assisted natural regeneration with high certainty, based on locations where natural regeneration has already occurred and persisted. Applying these methods across the Brazilian Atlantic Forest found that 21.8 million hectares, 30% of the entire restorable area, presented good opportunities for ANR[10].

A recent global analysis using a similar methodology estimates that 215 million hectares of tropical and subtropical areas have potential for assisted natural regeneration. The top three countries with highest potential for ANR are Brazil (43.7 Mha), Indonesia (29.3 Mha), and China (15.5 Mha)[11].

how

How can ANR be integrated within forestry and agricultural production systems?

Enrichment planting of naturally regenerating forests with native and non-native tree species can increase their commercial value, biodiversity, and carbon stocks.

Forest management using ANR approaches can be applied to promote regeneration of tree species in logged or degraded forest parcels or to promote timber species in naturally regrowing forests on formerly cleared land[12].

The practice of farmer managed natural regeneration (FMNR) is based on the selection of tree stumps and rootstocks of particular species used for food, fuel, or fodder. **FMNR practices have been introduced in 27 countries and extend over an estimated 18.2 million hectares worldwide[13].**

ANR approaches can also be applied in shifting cultivation systems to manage fallows and to transition towards sustainable agroforestry systems.

Silvopastoral systems, which combine livestock raising with use of trees and shrubs, can also integrate ANR practices. Pastures can be managed to promote the natural regeneration of trees and shrubs, through protection of isolated remnant trees and use of living fences where seed dispersing animals forage and perch[14].

What are the major barriers and challenges to ANR implementation?

In addition to biophysical barriers such as uncontrolled fires, invasive species and excessive grazing, nurturing a forest transition through ANR approaches presents immense policy and institutional challenges.

The policy context of ANR is complex, due to the variable nature of ANR interventions, their spatial scale, and livelihood challenges. Major barriers to adoption of ANR are: 1) lack of land or tree tenure; 2) restrictions on harvesting and marketing timber from naturally regenerating forests on private or community-held land; 3) uniform taxation policies for abandoned farmland; and 4) reforestation or restoration policies that do not recognize ANR as an approved and viable method of ecosystem restoration.

Strict conservation policies intended to protect vulnerable species or prevent forest loss and degradation can also have perverse outcomes for promoting ANR, as smallholders have difficulties complying with legal requirements for permits for tree harvesting[15].

In many countries, production and sale of timber and fuelwood products from regenerating forests face serious obstacles due to legal restrictions, lack of appropriate government incentives for timber and non-timber production through ANR, and limited dissemination of information regarding the contributions of regenerating forests to sustaining rural livelihoods.[16] Sustainable harvest of products from ANR sites can enhance the value and persistence of regenerating forest ecosystems and provide an important economic incentive for people assisting natural regeneration.

If ANR is to fulfill its potential for providing a diversity of environmental goods and services and sustainable livelihoods, policies will need to foster multiple-use management of regenerating forests that support legal instruments for supply chains for timber and non-timber products.

It is important to overcome perceptions of policy makers and the general public that the only way to restore forests or degraded lands is through tree planting. Another misconception is that natural regeneration should not require assistance (as it will happen anyway), and therefore should not be incentivized or supported by payments. Farmers also have persistent beliefs that trees and shrubs compete with crops for water and soil nutrients and should be removed from their farms.

Monitoring the progress of natural regenerating vegetation apart from planted vegetation and its impacts on people's lives is also a challenge, as most monitoring programs focus only on tracking survival and growth of planted forests.

How to finance ANR?

Data for modeling the costs, benefits and risks of ANR in different contexts are patchy at best, but are critical for developing effective incentives and financing arrangements.

Implementation costs for ANR (including fencing and enrichment planting) in Brazil were 33% and 32% of costs of full-scale planting of native tree species in Atlantic Forest and Amazonia, respectively[17].

The economic benefits of FMNR have been evaluated more than for other types of ANR practices. Trees on farms increase water infiltration into soils, reduce soil temperature, and protect crops from wind damage. In addition, non-timber forest products such as fruits, nuts, fuel wood, forage and thatch bolster the economies of rural households in sub-Saharan Africa. Farmers who adopt FMNR practices – intercropping with nitrogen-fixing trees, crop rotations, higher tree densities, tree pruning and exclusion of fire – have higher crop yields[18]. The economic value of regulating ecosystem services (carbon sinks and carbon stocks) provided by secondary tropical forests comes at the expense of provisioning ecosystem services (fodder and timber)[19].

The most commonly utilized approach for financing ANR initiatives is based on payments for environmental services (PES) to farmers and landowners. These payments have generally been used in programs managed by state or national governments.

If policy restrictions are removed and access to better markets and credit are improved, income from sustainably managed timber and non-timber products and agroforestry products can also lead to self-sustaining ANR projects.

A third avenue for financing ANR comes from direct payments to landowners or communities that generate sales of verified carbon credits. Although several initiatives are underway to market carbon credits through ANR, serious challenges face the use of ANR sites for verified carbon credits, including issues of additionality, leakage and permanence[20].

What factors enable ANR implementation and effective outcomes?

When ANR practices are incorporated into forestry and agricultural production systems, conventional sectoral policies can provide an enabling environment for implementation of a variety of approaches. Case studies of ANR show that important factors for motivating, enabling and implementing ANR are the environmental benefits for local communities. These benefits include improving forest and soil quality, and biodiversity; increasing and regulating water supplies and pollination services; reducing erosion; and storing carbon in naturally regenerating vegetation[21]. Economic incentives, effective coordination and governance within ANR projects are also important enabling factors. Clear assignment of roles and responsibilities and consideration of distinct needs of stakeholders involved led to more successful implementation of ANR and building of trust and communication among stakeholders. Additional enabling factors for ANR include effective local and national leaders; broad community support; rural extension and technical training on ANR practices; and incentives and rewards for practicing ANR[22].

"Seeing is believing" remains the most compelling evidence for the effectiveness of ANR. The evidence base for effectiveness of ANR needs to grow and provide robust documentation of local and global benefits that will capture the interest of communities together with investors, donors, organizations, corporations, and decision makers. A concerted communications campaign is needed to build awareness of the potential of ANR, with dedicated resources for study tours to successful project sites, farmer-to-farmer and forester-to-forester exchanges, and production of awareness-raising products such as videos, brochures, posters, and feature articles. These issues are central to the strategy of the ANR Alliance.

Endnotes

1. Wangpakapattanawong, P., N. Kavinchan, C. Vaidhayakarn, D. Schmidt-Vogt, and S. Elliott. 2010. Fallow to forest: Applying indigenous and scientific knowledge of swidden cultivation to tropical forest restoration. Forest Ecology and Management 260:1399-1406.

2. Shono, K., R. Chazdon, B. Bodin, S. J. Wilson, and P. Durst. 2020. Assisted natural regeneration: harnessing nature for restoration. Unasylva 252 71:71-81

3. Fagan, M. E., D.-H. Kim, W. Settle, L. Ferry, J. Drew, H. Carlson, J. Slaughter, J. Schaferbien, A. Tyukavina, and N. L. Harris. 2022. The expansion of tree plantations across tropical biomes. Nature Sustainability 5:681–688

4. Poorter, L., D. Craven, C. C. Jakovac, M. T. van der Sande, L. Amissah, F. Bongers, R. L. Chazdon, C. E. Farrior, S. Kambach, and J. A. Meave. 2021. Multidimensional tropical forest recovery. Science 374:1370-1376.

5. Hua, F., L. A. Bruijnzeel, P. Meli, P. A. Martin, J. Zhang, S. Nakagawa, X. Miao, W. Wang, C. McEvoy, and J. L. Peña-Arancibia. 2022. The biodiversity and ecosystem service contributions and trade-offs of forest restoration approaches. Science:eabl4649

6. Lewis, S. L., C. E. Wheeler, E. T. Mitchard, and A. Koch. 2019. Restoring natural forests is the best way to remove atmospheric carbon. Nature 568:25-28.

7. Simelton, E., J. Carew-Reid, M. Coulier, B. Damen, J. Howell, C. Pottinger-Glass, H. V. Tran, and M. Van Der Meiren. 2021. NBS Framework for agricultural landscapes. Frontiers in Environmental Science 9.

8. Wilson, S. J., R. Smith, R. Chazdon, P. Durst, R. Metzel, S. Sprenkle-Hyppolite, S. Begeladze, and I. Hillman. 2022. Assisted natural regeneration: A guide for restoring tropical forests Conservation International Washington, D.C.; https://www.conservation.org/research/guide-assisted-natural-regeneration.

9. Belem, B., F. Kaguembega-Mueller, R. Bellefontaine, J. R. Sorg, U. Bloesch, and E. Graf. 2017. Assisted natural regeneration with fencing central and northern zones of Burkina Faso. Tropicultura 35:73-86

10. Crouzeilles, R., H. L. Beyer, L. M. Monteiro, R. Feltran-Barbieri, A. C. Pessôa, F. S. Barros, D. B. Lindenmayer, E. D. Lino, C. E. Grelle, and R. L. Chazdon. 2020. Achieving cost-effective landscape-scale forest restoration through targeted natural regeneration. Conservation Letters 13:e12709.

11. Williams, B., H. Beyer, M. Fagan, R. Chazdon, M. Schmoeller, S. Sprenkle-Hyppolite, B. Griscom, J. Watson, A. M. Tedesco, M. Gonzalez-Roglich, G. A. Daldegan, B. Bodin, D. Celentano, S. Wilson, N. S. Alexandre, D.-H. Kim, D. Bastos, and R. Crouzeilles. 2023. The global potential for natural regeneration in deforested tropical regions. PREPRINT. Research Square [https://doi.org/10.21203/rs.3.rs-3235955/v1].

12. Kassaye, M., A. Nigatu, B. Gedamu, Y. Derebe, M. Tamer, F. Ayne, E. Emiru, and B. Belay. 2023. Assisted natural regeneration of selected tree species through silviculture interventions as a tool for restoring degraded natural forests in northwestern Ethiopia. Forest Science and Technology:1-9.

13. https://news.mongabay.com/2022/08/let-it-grow-qa-with-reforestation-and-land-restoration-visionary-tony-rinaudo/

14. Insfrán Ortiz, A., J. M. Rey Benayas, and L. Cayuela. 2022. Establishment and natural regeneration of native trees in agroforestry systems in the Paraguayan Atlantic Forest. Forests 13:2045.

15. Yatich, T., A. Kalinganire, J. Weber, K. Alinon, J. Dakouo, O. Samaké, and S. Sangaré. 2014. How do forestry codes affect access, use and management of protected indigenous tree species: evidence from West African Sahel. Occasional Paper 15.

16. Sears, R. R., P. Cronkleton, M. Miranda Ruiz, and M. Pérez-Ojeda del Arco. 2021. Hiding in plain sight: How a fallow forestry supply chain remains illegitimate in the eyes of the state. Front. For. Glob. Chang 4.

17. Escolhas, I. 2016. Quanto custa reflorestar 12 milhões de hectares na Amazônia e Mata Atlântica? https://www.escolhas.org/wp-content/uploads/2016/09/Quanto-o-Brasil-precisa-investir-para-recuperar-12-milhoes-de-hectares-de-floresta_SUMARIO-EXECUTIVO.pdf

18. Westerberg, V., A. Doku, L. Damnyag, G. Kranjac-Berisavljevic, S. Owusu, G. Jasaw, and S. Di Falco. 2019. Reversing Land Degradation in Dry lands: The Case for Farmer Managed Natural Regeneration (FMNR) in the Upper West Region of Ghana. Report for the Economics of Land Degradation Initiative.

19. Naime, J., F. Mora, M. Sánchez-Martínez, F. Arreola, and P. Balvanera. 2020. Economic valuation of ecosystem services from secondary tropical forests: trade-offs and implications for policy making. Forest Ecology and Management 473:118294.

20. Pan, C., A. Shrestha, J. L. Innes, G. Zhou, N. Li, J. Li, Y. He, C. Sheng, J.-O. Niles, and G. Wang. 2022. Key challenges and approaches to addressing barriers in forest carbon offset projects. Journal of Forestry Research 33:1109-1122.

21. Alves, J., M. Oliveira, R. Chazdon, M. Calmon, A. Pinto, E. Darvin, and B. Pereira. 2022. The Role of Assisted Natural Regeneration in Accelerating Forest and Landscape Restoration. Practice Note. São Paulo: WRI Brasil.

22. Reij, C., N. Pasiecznik, S. Mahamoudou, H. Kassa, R. Winterbottom, and J. Livingstone. 2020. Dryland restoration successes in the Sahel and Greater Horn of Africa show how to increase scale and impact. ETFRN News.

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