Forest landscape restoration interventions

Mano River Union

James McBreen and Nicolas Jewell

INTERNATIONAL UNION FOR CONSERVATION OF NATURE

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Executive summary

Under the GEF-funded "Mano River Ecosystem Conservation and International Water Resources Management (IWRM) Project", teams of national committees and consultants in Mano River Union (MRU) countries Cote d'Ivoire, Guinea, Liberia, and Sierra Leone applied the Restoration Opportunities Assessment Methodology (ROAM) framework. ROAM is a flexible and adaptable framework for identifying and assessing forest landscape restoration (FLR) opportunities and identifying high-value and priority FLR interventions at national or subnational levels. Comprehensive cross-sector policies will be critical to effectively manage and govern the diverse but linked land uses, including various forms of forest use, agriculture and settlements, and the dynamics within the MRU transboundary landscapes.

The present document emphasises the FLR approach and provides guidance on its potential to contribute to integrated water and forest resources management that provides tangible benefits for people, nature, and climate in the Mano River Union. It builds on the national ROAM activity reports in the four MRU countries that outline a roadmap for restoration action by identifying priority areas and the most effective FLR interventions[1] to be implemented to address drivers of deforestation and degradation in the priority MRU transboundary landscapes by increasing the productivity of degraded lands, providing habitat and connectivity for biodiversity, and continuing to sequester and store vast amounts of CO2.

Determining where, when, how and with whom to implement appropriate approaches to FLR is a major step in moving from commitments to action. An important step towards operationalising these restoration commitments is by applying the ROAM – a stakeholder driven process to support decision-making and ensure the design and implementation of restoration is firmly rooted in the needs of local communities.

Under the Bonn Challenge, three of the four MRU countries[2] have already committed to restore 8 million hectares of degraded and deforested landscapes. The MRU transboundary ROAM identified approximately 250,000 hectares of FLR opportunity areas; this is 3.2% of the collective total of degraded land that the three Mano River signatory countries to the Bonn Challenge have committed to bring into restoration by 2030. Representing a small proportion of the total restoration commitment for MRU countries under the Bonn Challenge, the FLR opportunity, especially in relation to safeguarding high conservation value and biodiversity rich transboundary forest landscapes whilst improving local livelihoods in MRU, is especially significant.

1 For further details see national consultancy activity reports (1.4) in Guinea (Maison Guinéenne de l'Entrepreneur (MGE) (2021)), Liberia (FACE-GREENLIFE (2022)), and Sierra Leone (GREENLIFE (2020)).

2 Cote d'Ivoire committed to bring 5 million hectares; Liberia 1 million hectares; and, Guinea 2 million hectares into restoration by 2030 under the Bonn Challenge.

Acknowledgements

The Forest Landscape Restoration Opportunities Assessment for Mano River Union is a result of collaborative effort between the Mano River Union (MRU) Secretariat, the International Union for Conservation of Nature (IUCN), and the Global Environment Facility (GEF).

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Acronyms

ANR	assisted natural regeneration
CSO	civil society organization
FLR	Forest Landscape Restoration
GEF	Global Environment Facility
GIS	Geographic Information System
GRCLG	Gola Rainforest Conservation Company Ltd
HA	hectare
IUCN	International Union for Conservation of Nature
LULC	land use land cover
MGE	*Maison Guinéenne de l'Entrepreneur* (Guinean Entrepreneur's House)
MRU	Mano River Union
NbS	Nature-based Solutions
NGO	non-governmental organization
NTFPs	non-timber forest products
ROAM	Restoration Opportunities Assessment Methodology
SMCA	spatial multi-criteria analysis

Man inspects saplings in community tree nursery © Faouzi Maamouri

1 Introduction to FLR

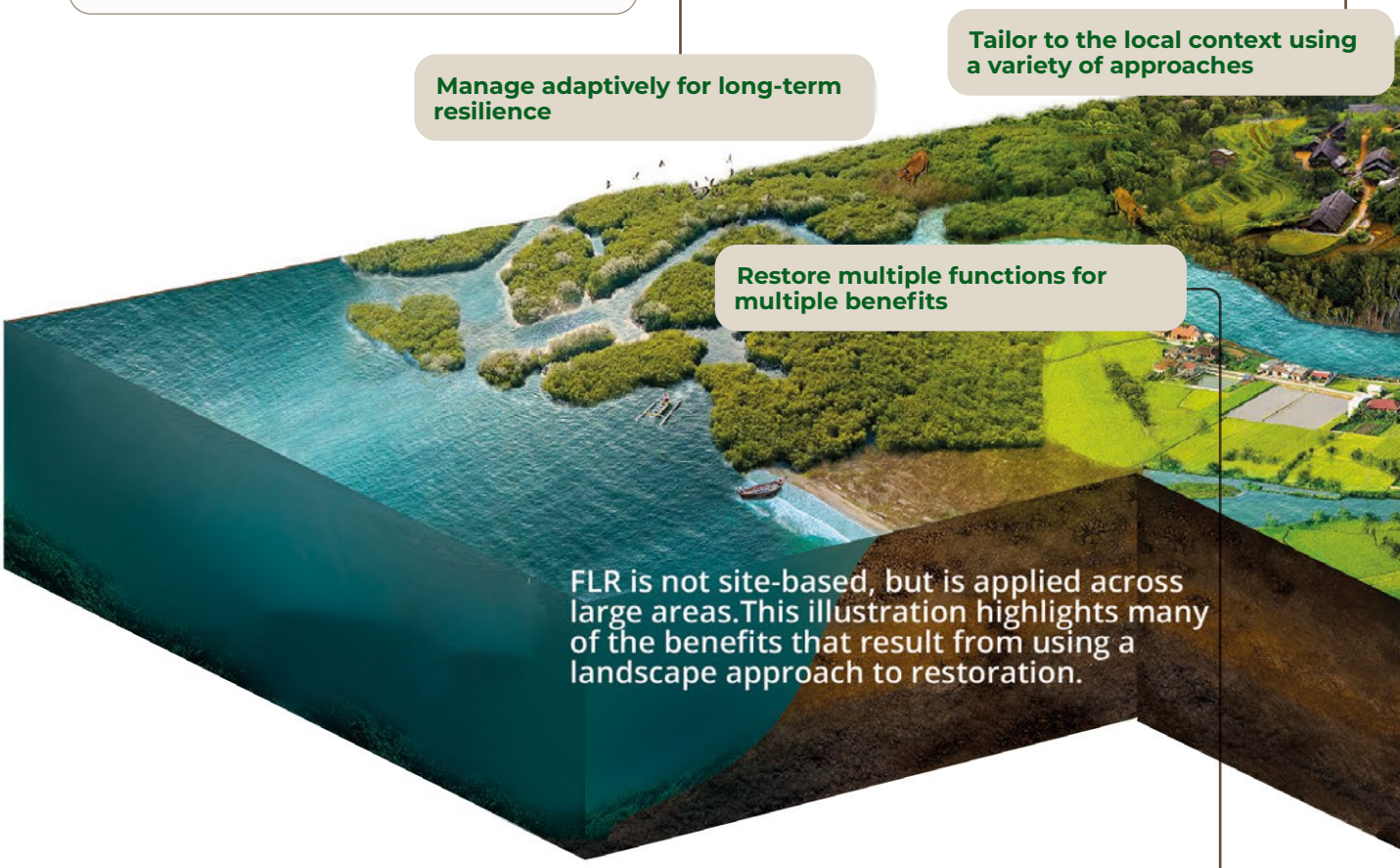
Forest landscape restoration (FLR) is the long-term process of regaining ecosystem functionality and enhancing human well-being across deforested and degraded landscapes. It is about 'forests' because it involves increasing the number and health of trees on landscapes as a restorative measure. It is about 'landscapes' because it involves entire watersheds, jurisdictions and biomes where many land uses interact. It is about 'restoration' because it involves bringing back the biological productivity of an area in order to achieve multiple benefits for people and the planet.

Therefore, FLR focuses on more than just planting trees – it is restoring a whole landscape 'forward' to meet present and future needs and to offer multiple benefits and land uses across landscapes and over time. As the first *fit-for-purpose* Nature-based Solution (NbS), FLR can address diverse challenges related to food and water security, climate mitigation and adaptation, disaster risk reduction, economic and social development. FLR can be used to help MRU countries meet their nationally determined contributions to the Paris Agreement, post-2020 targets under the UN Convention on Biological Diversity to halt and reverse biodiversity loss to achieve a nature-positive world by 2030, and Land Degradation Neutrality targets.

1.1 FLR principles

Manage adaptively for long-term resilience: FLR seeks to enhance the resilience of the landscape and its stakeholders over the medium and long-term. Restoration approaches should enhance species and genetic diversity and be adjusted over time to reflect changes in climate and other environmental conditions, knowledge, capacities, stakeholder needs and societal values. As restoration progresses, information from monitoring activities, research and stakeholder guidance should be integrated into management plans.

Tailor to the local context using a variety of approaches: FLR uses a variety of approaches that are adapted to the local social, cultural, economic and ecological values, needs and landscape history. It draws on the latest science, best practices and traditional and indigenous knowledge, and applies that information in the context of local capacities and existing or new governance structures.

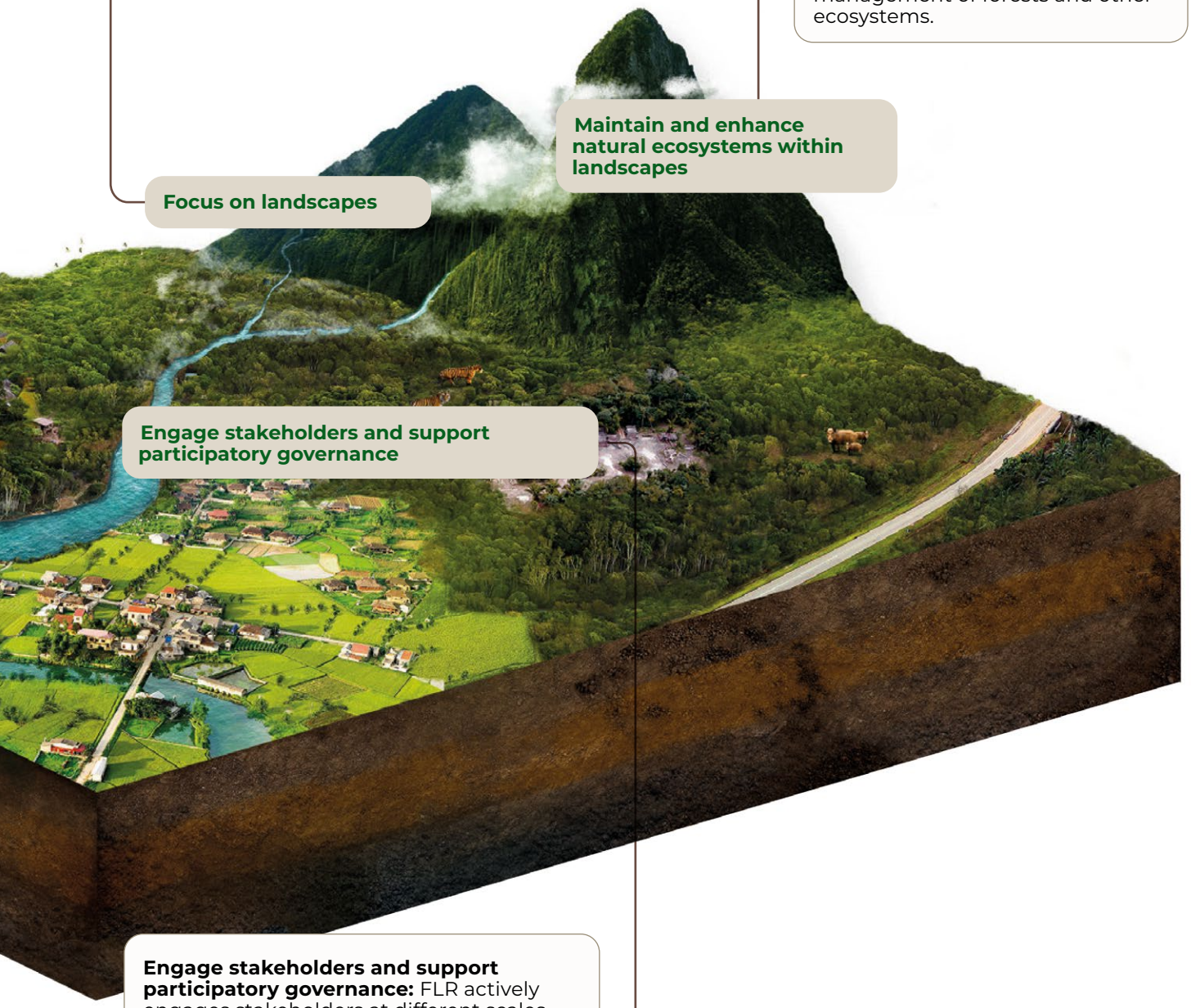


Restore multiple functions for multiple benefits: FLR interventions aim to restore multiple ecological, social and economic functions across a landscape and generate a range of ecosystem goods and services that benefit multiple stakeholder groups.

Figure 1. Principles of FLR
(Source: IUCN)

Focus on landscapes: FLR takes place within and across entire landscapes, not individual sites, representing mosaics of interacting land uses and management practices under various tenure and governance systems. It is at this scale that ecological, social and economic priorities can be balanced.

Maintain and enhance natural ecosystems within landscapes: FLR does not lead to the conversion or destruction of natural forests or other ecosystems. It enhances the conservation, recovery and sustainable management of forests and other ecosystems.



Engage stakeholders and support participatory governance: FLR actively engages stakeholders at different scales, including vulnerable groups, in planning and decision-making regarding land-use, restoration goals and strategies, implementation methods, benefit sharing, monitoring and review processes.

1.2 Types of FLR interventions

To recover ecological functions across the MRU transboundary landscape that guarantee the sustained flow of key benefits and services over time, FLR interventions should complement and not displace existing and legal land uses in the MRU transboundary landscapes. These FLR interventions can be classified into three main land use types: forest lands, agricultural lands and protective or buffer lands (Table 1):

- **Forest lands** are those intended to be managed as either protected or productive forests. When the forest cover has been removed, restoration can be done by planting trees or allowing natural regeneration; when the forest cover has been degraded, they can be restored through silviculture and sustainable management.
- **Agricultural lands** are those managed to produce food and other goods. In lands managed for crop and livestock production, agroforestry, silvopastures and other agroecological approaches can be used to improve productivity and reverse or prevent degradation. In lands managed for intermittent production, improved fallow methods can help protect and recover the land.
- **Protective or buffer lands** are areas that play a critical role in the protection against risk of severe events. They include steep slopes and areas bordering water bodies, which when adequately managed are important to protect infrastructure and ecosystem services. Interventions here include erosion control and riparian buffers.

Table 1. Types of FLR interventions

Land Use	Land sub-type	General category of FLR option	Description
Forest land Land where forest is, or is planned to become the dominant land use **→ Suitable for wide-scale restoration**	If the land is without trees, there are two options:	1. Planted forests and woodlots 	Planting of trees on formerly forested land. Native species or exotics and for various purposes, fuelwood, timber, building, poles, fruit production, etc.
		2. Natural regeneration 	Natural regeneration of formerly forested land. Often the site is highly degraded and no longer able to fulfil its past function – e.g. agriculture. If the site is heavily degraded and no longer has seed sources, some planting will probably be required.
	If the land is degraded forests:	3. Silviculture 	Enhancement of existing forests and woodlands of diminished quality and stocking, e.g., by reducing fire and grazing and by liberation thinning, enrichment planting, etc.
Agricultural land Land which is being managed to produce food **→ Suitable for mosaic restoration**	If the land is under permanent management:	4. Agroforestry 	Establishment and management of trees on active agricultural land (under shifting agriculture), either through planting or regeneration, to improve crop productivity, provide dry season fodder, increase soil fertility, enhance water retention, etc.
	If it is under intermittent management:	5. Improved fallow 	Establishment and management of trees on fallow agricultural land to improve productivity, e.g. through fire control, extending the fallow period, etc., with the knowledge and intention that eventually this land will revert back to active agriculture.
Protective land and buffers Land that is vulnerable to, or critical in safeguarding against, catastrophic events **→ Suitable for watershed protection and erosion control**	If protective land or buffer:	6. Watershed protection and erosion control 	Establishment and enhancement of forests on very steep sloping land, along water courses, in areas that naturally flood and around critical water bodies.

(Source: Modified after IUCN and WRI, 2014)

2 FLR interventions in MRU

2.1 Overview of FLR interventions in MRU

FLR in the four MRU countries should be viewed as a long-term process. As a forward-looking and dynamic approach, effectively implemented FLR actions can strengthen the resilience of the transboundary landscapes in MRU and create future options to adapt as emerging societal needs or new challenges arise. Existing governance structures can be strengthened through the adoption of an FLR approach as it uses a multi-year vision of the ecosystem functions and the benefits to biodiversity and human well-being generated through the implementation of FLR interventions.

The majority of FLR opportunity areas identified in the 5km buffer zone of the MRU transboundary landscapes are found on or adjacent to agricultural or pastoral lands. However, FLR focuses on restoring landscapes rather than individual plots or sites, so it is critical that the mosaic of interdependent land uses is recognised and the landscape functions upon which people and nature depend. An example would be the protected forests in the protected and conserved areas; and the agroforestry, managed plantations, and riparian buffers in the 5km buffer and broader landscape.

As part of the ROAM processes completed in Guinea, Sierra Leone, and Liberia, three activity reports[3], prepared with local knowledge, provide the necessary information linking the landscape level analysis to field conditions such that the eventual FLR interventions can be effectively planned and implemented. It is expected the information contained in the three activity reports, when aligned with and considered alongside the landscape level geospatial analysis, will be harmonised to guide formulation and eventual implementation of FLR interventions.

While the multi-criteria spatial analyses described in the MRU transboundary ROAM report identifies and measured FLR opportunities at the MRU landscape level, this analysis should be verified by national expertise and linked to site level conditions to ensure effective implementation plans are to be produced. Similarly, the national activity reports from Guinea, Sierra Leone, and Liberia, contain a diverse set of recommendations for scaling and accelerating FLR action, including manuals for agroforestry, proposals for site level preparation, and choice and selection of commodity types.

2.2 Priority FLR interventions in MRU

The restoration of degraded and deforested transboundary landscapes in MRU can include a range of methods from passive (natural regeneration) to active (reforestation). These approaches include natural

3 For further detailed information, see activity reports 1.4 developed by national consultants under the supervision of national committees in Guinea (Maison Guinéenne de l'Entrepreneur (MGE) (2021)), Sierra Leone (GREENLIFE (2020)), and Liberia (FACE-GREENLIFE (2022)).

regeneration, assisted natural regeneration and reforestation. The appropriate method will depend on the local site conditions (e.g., soil nutrients, moisture) of the transboundary site, the flow of goods and services on the landscape and the specific site-level objectives of the stakeholders within the landscape.

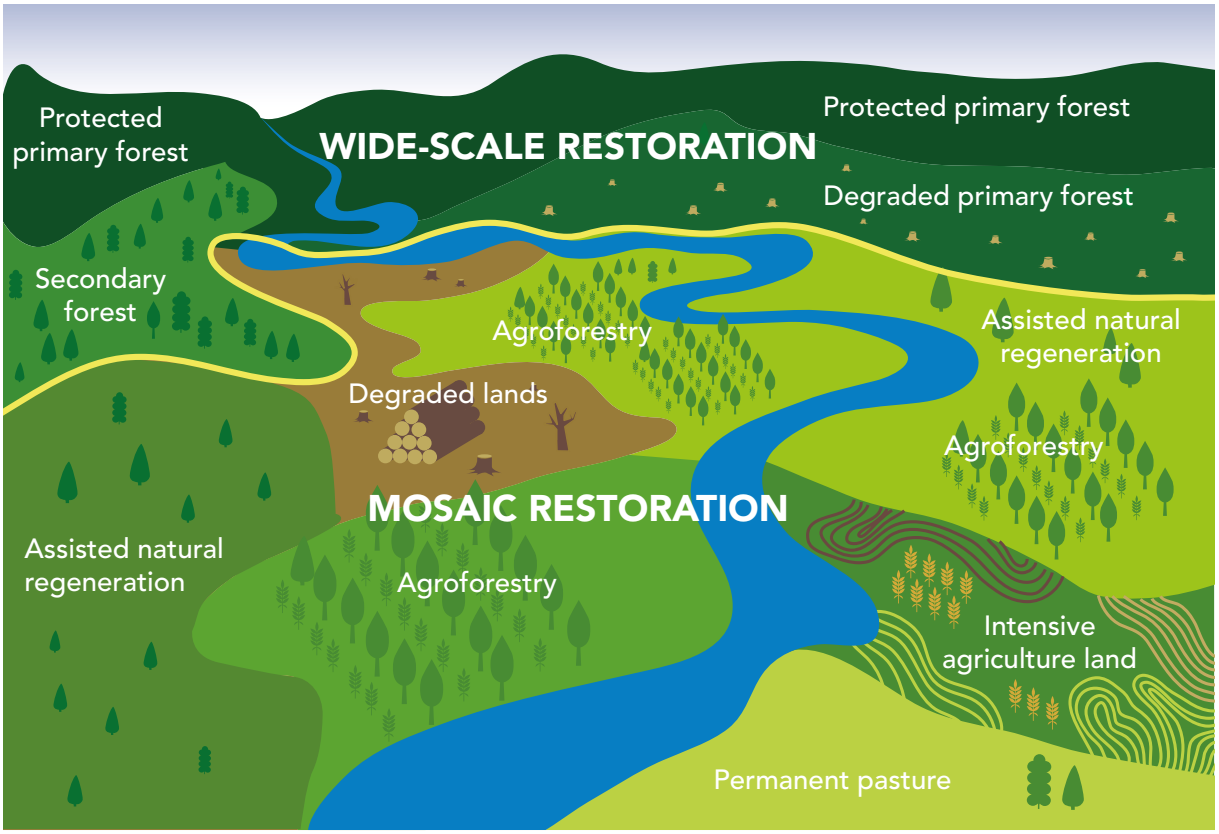


Figure 2. Schematic representation of FLR interventions in MRU
(Source: Modified after IUCN and WRI, 2014)

The recommendations for restoration interventions included in the national activity reports from Guinea, Liberia and Sierra Leone are summarized in Table 2 below, and generally share five typologies. It is important to recapitulate that in order for these proposed interventions to adhere to FLR, ecological, social and economic conditions will need to be understood at specific site-level within the four transboundary landscapes, and the FLR principles (as outlined in section 1.1) should be followed.

Table 2. FLR interventions proposed in the national activity reports

1	Assisted natural regeneration of degraded natural forest
2	Agroforestry systems (cash crops cultivated alongside indigenous trees grown for shade or timber)
3	'Sedentarization' of smallholder agriculture (with indigenous as well as fast-growing species) and agricultural crops
4	Woodlots for fuel wood
5	Commodity plantations

(Source: compiled by report authors)

Proposed intervention 1 (assisted natural regeneration) and intervention 2 (agroforestry systems) are the most likely to achieve restoration of the transboundary landscapes whilst adhering to the FLR principles. However, to achieve this, necessary resources and appropriate technical support should be provided to local stakeholders in terms of seed collection, propagation and planting, silvicultural expertise, and know-how regarding agroforest crop cultivation and marketing.

Proposed intervention 3 could vary greatly in terms of concrete actions, ranging from being predominantly agricultural to mainly agroforestry systems. Therefore, technical models would need to be developed that respond to the specific site-level ecological, social and economic conditions within the four transboundary landscapes.

Proposed intervention 4 (woodlots for fuel) and intervention 5 (pure commodity plantations), in isolation could not be considered FLR. Planting exotic species in highly degraded areas can help rehabilitate some site characteristics, although they cannot effectively restore the site's biodiversity and ecological function, which are important considerations for FLR interventions.

The above restoration interventions proposed in the national activity reports (1.4) from Guinea, Liberia and Sierra Leone are linked to the FLR opportunities identified in the multi-criteria spatial analysis described in the MRU transboundary ROAM report. The next section provides further details and guidance on each priority FLR intervention, and these should be used in combination with the more detailed national activity reports to inform FLR implementation in the target sites and orient diverse landscape stakeholders as to the myriad of possible FLR interventions that will help address the drivers of degradation and deforestation to ensure resilient and thriving MRU transboundary landscapes and communities.

A traditional food crop system with groundnuts in Ziama, Guinée. © Dominique Endamana

FLR natural regeneration in Ziama, Guinea. © D

2.2.1 Assisted natural regeneration

Assisted natural regeneration (ANR) – a blend of active planting and passive restoration – can be used to accelerate restoration of natural forest in the transboundary MRU landscapes. This is a low-cost, low-tech and high-impact strategy for restoring forests, sequestering carbon, and conserving biodiversity, and is achieved, principally, by removing existing barriers to forest succession by reducing disturbance and competition to enhance the growth and survival of naturally dispersing trees. The specific activities will vary based on the degree of degradation at each FLR priority site, as well as the availability of seed sources.

Examples of ANR activities include i) identifying and removing disturbances (e.g., grazing, fires); ii) reducing above- and below-ground competition (e.g., weeding); iii) facilitating desired species (e.g., fertilising or thinning); and, iv) introduction of desired seeds or seedlings (e.g., including live fences for seed-dispersers or enrichment planting).

In particularly degraded areas, enrichment planting can be used to facilitate desired species and supplementing natural regrowth. To enhance species composition, species that are unable to regenerate on their own may need to be planted as seeds or seedlings in the understory of the forest. Species for enrichment can be selected for different goals, including economic and ecologic values. However, species must be selected to match the conditions of the existing forest (e.g., shade-tolerant species for a closed canopy). The spacing and placement of planting should be considered to avoid competing with the naturally occurring regeneration.

Native species reforestation or planting mixed native trees and shrubs can catalyse forest recovery in heavily degraded sites. The right model depends on the site conditions, the potential for seed arrival and the project characteristics and objectives, examples include direct seeding and non-native plantations.

ominique Endamana

NRA by a traditional land owner practioner in Noborotono village, Guinea. © Dominique Endamana

2.2.2 Agroforestry systems

Whilst the MRU transboundary ROAM process focused on the 5km buffer zone of the transboundary protected areas, there is an opportunity through FLR to improve and maintain lands that are actively managed for food production, whilst releasing more marginal lands for protection and ensuring connectivity for species within the broader transboundary landscape. Diverse techniques can be used to this end, for example the integration of agricultural crops with trees or shrubs on the same land (agroforestry), or improved soil management to preserve agricultural productivity over time.

Agroforestry involves the selection of species that can complement the growth of crops. Some examples include:

- Linear systems are lines of trees or shrubs that can be easily integrated into or around existing agriculture as living fences, windbreaks and alley cropping strips.
- Home gardens are traditional agro-forest gardens grown around the homestead. They are characterised by high species diversity (including both native and exotic species) and multiple layers of vegetation (3–5 vertical strata) planted for diverse uses (food, medicine, fibre, etc.).
- Shade crops are where agricultural subsistence or cash crops are grown beneath the shade of trees.
- Taungya System are when staple food crops are cultivated on the same land as seedlings of valuable hardwood timber species during the initial years.
- Successional agroforestry is a system designed to mimic the stages of forest succession but using annual crops or short-lived tree crops instead of early successional pioneer trees. The different crops (annual crops, short-lived tree crops, longer-lived forest species) are harvested at different stages, while also facilitating the dispersal of additional late successional forest species.

Community agroforestry with cacao in Ziama, Guinea. © Dominique Endamana

Community agroforestry with cacao in Ziama, Guinea. © Dominique Endamana

In all three MRU country activity reports, there is evidence of strong preferences for and familiarity with specific agroforestry crops and varieties according to the national local markets. In alphabetical order, in Liberia: banana, cocoa, coconut, cashew, coffee, fuel wood, kola nut, oil palm, rubber are preferred, whilst communities in Guinea prefer a coffee (*Robusta, Excelsa*), raffia palm, small kola, wild pepper and Kany (*Xylopia aethiopica*).

The *Sierra Leone* report describes a decision-tree approach for agroforestry systems that sets out a logical pathway to be followed in individual tree selection, planting, spacing and substitution within the canopy that are guided by individual farmer preferences, whether for a cash crop (i.e. income) food, medicine, fruit or for construction materials (timber). The agroforestry training manual developed by Gola Rainforest Conservation Company (GRCLG) of Sierra Leone makes specific recommendations on planning layouts in diverse agroforestry restoration interventions. In addition to guidance on selection of healthy indigenous timber and fruit 'mother trees' from which to gather seeds and propagate seedlings, the manual includes recommendations on the spatial configuration of agroforestry plots including the design and layout of alley cropping and selection of single vs. mixed species combinations in agroforestry systems.

Whilst the *Liberia* report proposes, amongst others, timber certification for indigenous timber species (suggested density up to 18 trees / ha) grown within the pure commodity tree crop plantations (cacao, coffee, etc.). With a lower density of indigenous timber species this could be integrated into a productive, resilient, and biodiverse agroforestry system.

2.2.3 Improved productive land management

The proposed 'sedentarization' of smallholder agriculture could be understood as a type of conservation agriculture, which uses indigenous and in some cases fast-growing exotic tree species combined with agricultural crops. Trees can be integrated into or around existing agriculture, either using living fences, windbreaks or alley cropping strips. These can be planted for diverse uses including food, medicine, fibre, and timber. Similarly, agricultural subsistence and cash crops can be grown beneath the shade of trees, and seedlings of valuable hardwood timber species can be planted amongst staple food crops.

Community agroforestry with cacao in Ziama, Guinea.
© Dominique Endamana

By adopting agricultural practices (e.g., reduce tillage, use cover crops, protect riparian areas) that maximise biodiversity and stimulate biological interactions in high species diversity systems, that may include both native and exotic species, long-term soil fertility can be conserved, soil resilience increased, and livelihoods within the transboundary MRU landscapes supported. In this way, degraded agricultural landscapes in the MRU transboundary landscapes can be gradually transformed to support both biodiversity and ecosystem services and food security and livelihoods by scaling-up improved farming systems.

2.2.4 Woodlots for fuelwood and mixed plantations

When integrated into a broader landscape level restoration strategy, fast-growing exotic species can help initiate the restoration process in highly degraded areas, helping for example to achieve rapid canopy closure, which in turn create favourable conditions that reduce competition and facilitate other species growth.

When combined with native forest species that are regenerating under the canopy, the exotic trees can be gradually harvested to offset the costs of restoration and, where appropriate, could provide alternative livelihood income for local communities.

Community nursery in Noborotono village, Guinea.
© Dominique Endamana

3 FLR opportunities and priority interventions

3.1 Harmonisation of FLR opportunities with the FLR interventions

This section presents the results of the harmonisation and alignment of FLR opportunities identified from the ROAM SMCA with the five opportunities identified in the national activity reports.

The activity reports prepared by national MRU ROAM teams result from local knowledge and site visits to the field and prioritise five common FLR interventions presented in Table 2. While the multi-criteria spatial analysis in this report uses the best available spatial data and implements the ROAM to identify FLR interventions, it is important to highlight that available global scale data sets (i.e. erosivity) were used and the criteria (i.e. defining sloping land at > 5 degrees) were used to identify the extent, type, and precise location of FLR interventions.

The examples in this section take the results of the SMCA analysis and matches these with the FLR intervention categories from the national reports to produce FLR opportunities that anticipate further engagement with local community stakeholders to determine site-level suitability of the proposed interventions. In most cases, the analysis involved combining the SMCA factors – due to their characteristics (i.e. rainfall erosivity, soil erodibility) are not possible to locate precisely at site-level – into single classes before then allocating an FLR intervention. This is essentially a simplifying mechanism, which recognises that the data alone is insufficient to recommend a specific intervention for a site-specific area (for example, between agroforestry and Assisted Natural Regeneration (ANR)) without additional site information, including crucial inputs and validation from the local stakeholders.

3.2 Diecke – Nimba

Figure 3 shows the ROAM SMCA analysis of FLR opportunities in the Diecke - Nimba 5 km buffer zone (see Fig. 28)[4], simplified and harmonised to align with the five FLR interventions that have been commonly identified in the national activity reports. In Table 3, the nine FLR cases from the SMCA are combined into the five intervention categories (Table 2).

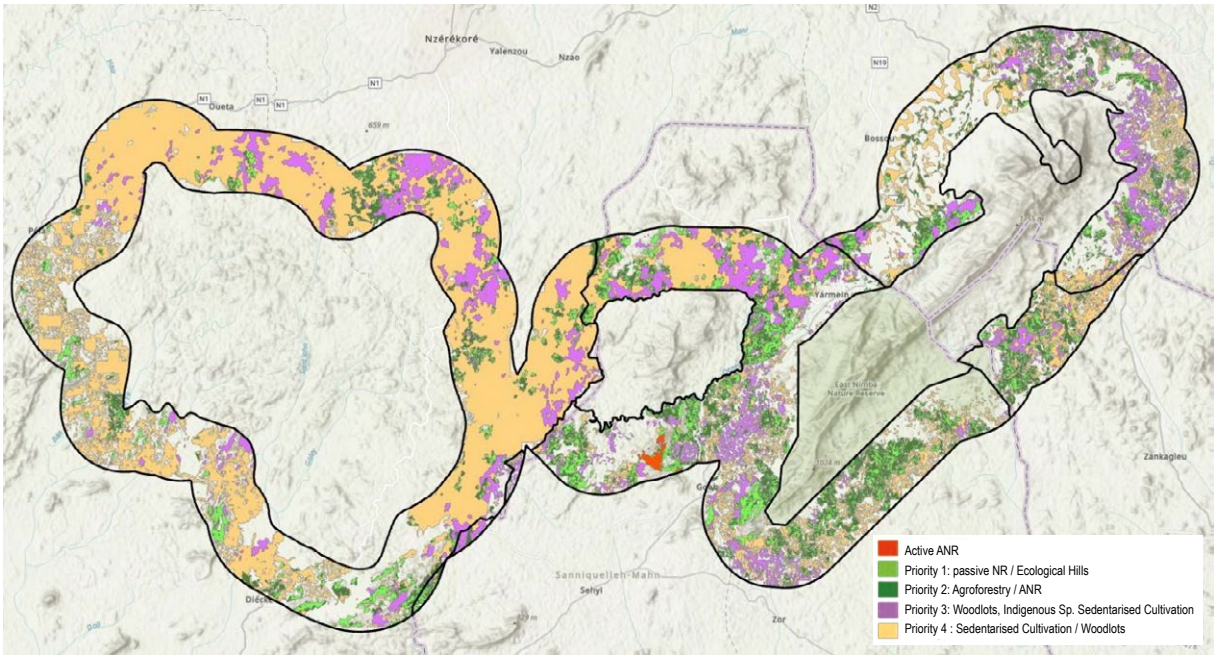


Figure 3. FLR opportunities in the Diecke – Nimba 5 km buffer
(Source: compiled by N. Jewell using land cover data extracted from ESA Sentinel 2 10m resolution imagery': https://scihub.copernicus.eu/dhus/)

Priority 1 areas contemplate 14,331 hectares of degraded forest land, located on steep topography are allocated for passive forest regeneration. In practice, this means 'setting aside' or excluding the land from agriculture, agroforestry, woodlots, or any other use. This is equivalent to areas identified in the Guinea national activity report as 'ecological hills'. Priority 1 land is defined as degraded forest on steep land, less attractive for non-forest uses, and once restored (by being set aside for x years) has the potential to become a community forest in which timber certification could be considered to add value and accrue additional benefits to local stakeholders.

Priority 1b) is for ANR on relatively small areas (241 hectares) of mining waste.

The Priority 2 action identifies 9,156 hectares of degraded forest land whether with additional constraints (i.e. high soil erodibility) or not, in which Agroforestry and ANR can effectively take place.

Priority 3 identifies 15,263 hectares of fallow land that has recently been cultivated. Such land can be used for the establishment of woodlots, pure commodity plantations, or permanent smallholder agriculture, in order of descending priority. Fallow land may include remaining remnant native and other tree species that may be propagated and included in the mix of woodlot species, with

4 IUCN (2022) *Forest Landscape Restoration Opportunities Assessment in the Mano River Union*.

the possibility of certification as indicated in the national reports.

Priority 4 identifies 54,128 hectares of actively cultivated land, in which the indirect FLR opportunity is by establishing permanent smallholder cultivation and avoiding further loss of primary or degraded forest by shifting cultivation.

Table 3 Diecke – Nimba SMCA harmonised with national activity reports

Priority	Land attributes	Hectares
1	Passive natural regeneration / *'Ecological Hills'*	14,331
1b	ANR of mine debris	241
2	Agroforestry / Assisted Natural Regeneration (ANR)	9,156
3	Woodlots, w / Indigenous Sp. Sedentarized Cultivation, plantations	15,263
4	Sedentarized Cultivation / woodlots / pure commodity plantations	54,129
	Total (ha)	**93,119**

(Source: compiled by report authors)

3.3 Gola – Liberia

In the case of Gola (Liberia), the 14 FLR transitions identified in the ROAM SMCA (Figure 4) have been combined into two FLR actions. Notably, ANR, or Agroforestry or ANR as one category. Prior to making any more specific recommendation as to which is FLR intervention is most appropriate, a multistakeholder participatory process at the landscape level is recommended to refine the selection.

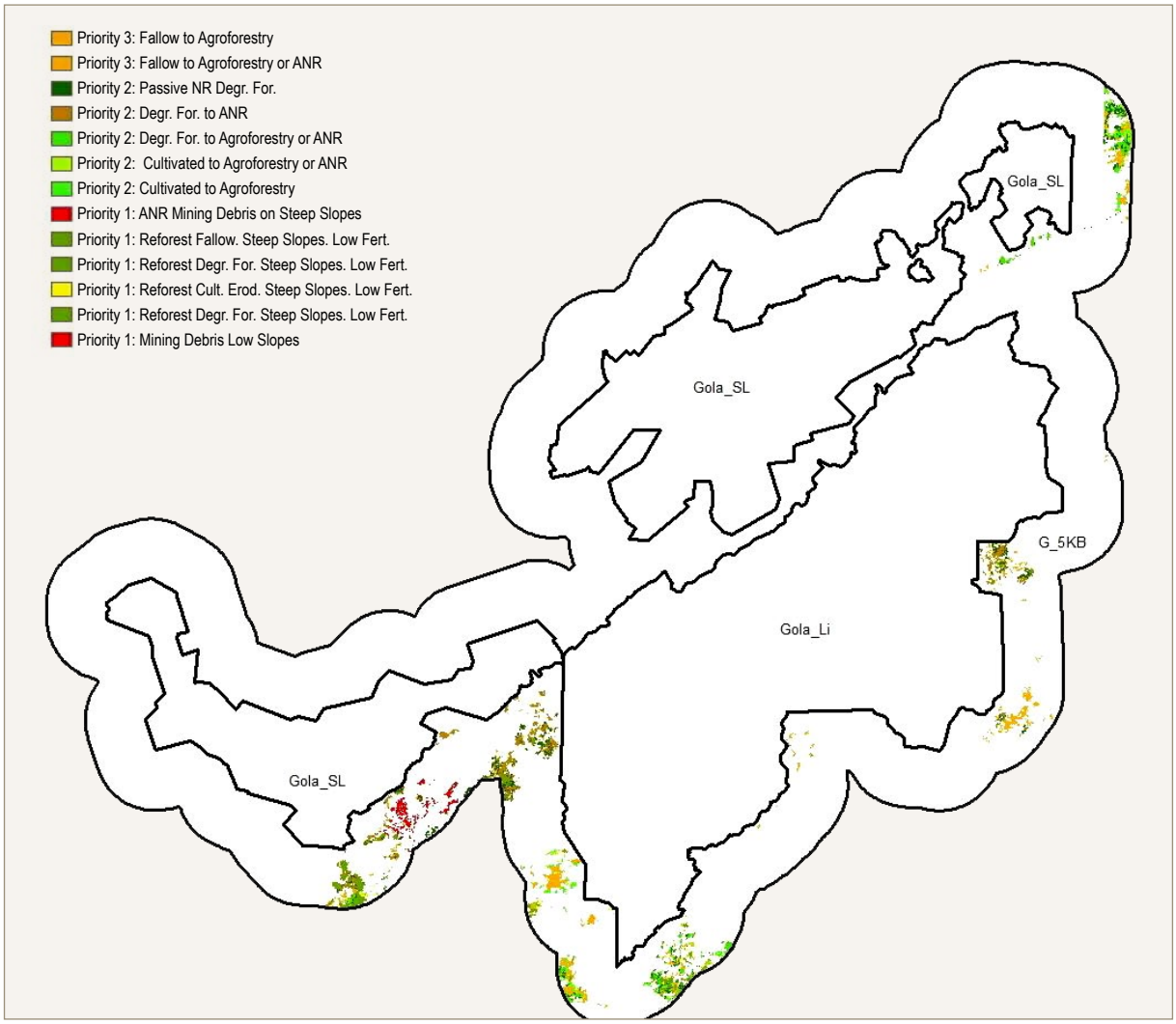


Figure 4. FLR opportunities in the Gola – Liberia 5 km buffer
(Source: compiled by N. Jewell using land cover data extracted from ESA Sentinel 2 10m resolution imagery[1]: https://scihub.copernicus.eu/dhus/)

Table 4. Gola – Liberia SMCA harmonised with national activity reports

Priority	Land attributes	FLR intervention	Hectares
1	Forest Rehabilitation – mining debris	ANR	377
	Fallow / cult on steep slopes	ANR or Agroforestry	362
	Degraded forest on steep slopes	Passive NR	623
2	Cultivated land	Agroforestry or ANR	623
	Degraded forest	Agroforestry or ANR	2,601
3	Fallow	Agroforestry or ANR	609
4	Fallow	Agroforestry or ANR	1,010
		Total (ha)	**6,205**

(Source: compiled by report authors)

3.4 Gola – Sierra Leone

In Gola (Sierra Leone) the eleven FLR cases identified in the ROAM SMCA (Figure 5) are combined into four FLR actions. Assisted Natural Regeneration is proposed for Degraded Forest on Steep slopes; Agroforestry or Assisted Natural Regeneration for degraded Forest on lower slopes; Agroforestry for cultivated and fallow land on steep slopes for agroforestry; Agroforestry or Assisted Natural Regeneration on low slopes. Fallow land is proposed for agroforestry or sedentary permanent agriculture; and cultivated land proposed for sedentary permanent agriculture. Priority 3 areas proposes agroforestry or sedentary permanent agriculture as one single category, with no specific recommendation regarding which is most appropriate, first requiring a multistakeholder participatory process at the landscape level. Sedentary permanent agriculture includes options for non-FLR land uses such as woodlots or pure commodity plantations.

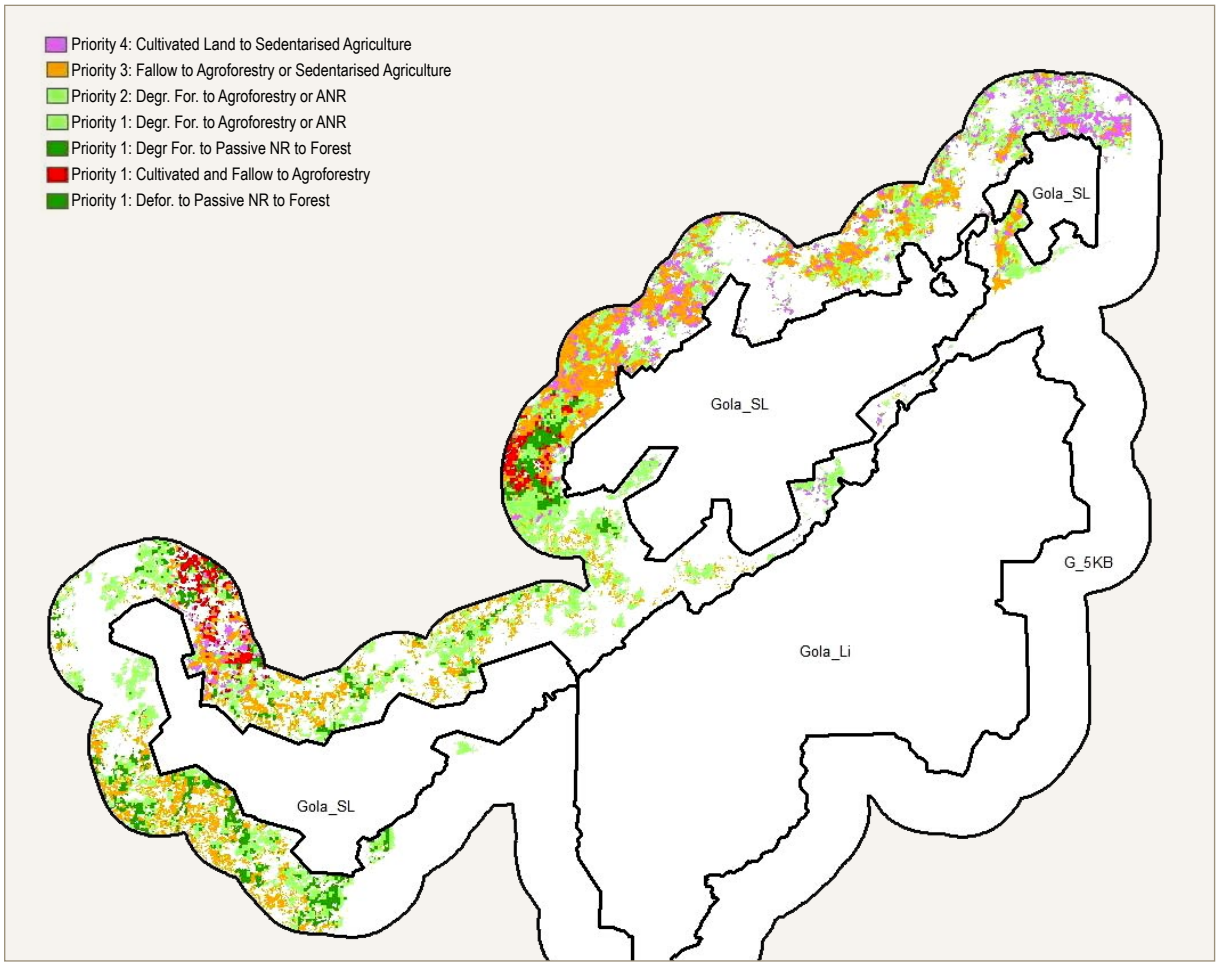


Figure 5. FLR opportunities in the Gola – Sierra Leone 5 km buffer
(Source: compiled by N. Jewell using land cover data extracted from ESA Sentinel 2 10m resolution imagery': https://scihub.copernicus.eu/dhus/)

Table 5. Gola – Sierra Leone SMCA harmonised with national activity reports

Priority	Land attributes	FLR intervention	Hectares
1	Degraded forest on steep slopes – 'Ecological Hills''	Passive NR	5,071
	Degraded forest	Agroforestry or ANR	10,558
	Cultivated and fallow land – steep slopes	Agroforestry	1,832
2	Degraded forest / low slopes	Agroforestry or ANR	10,349
3	Fallow	Agroforest/Sedentary agriculture	15,302
4	Cultivated land	Sedentary Agriculture	6,039
		Total (ha)	**49,150**

(Source: compiled by report authors)

3.5 Wonegizi – Ziama

Figure 6 and Table 6 show a revised and simplified map and area estimates of FLR opportunities in Wonegizi – Ziama in which Sedentary Cultivation, Woodlots or pure commodity plantations are proposed on currently cultivated land, Agroforestry or ANR on land that is currently degraded forest or fallow, and passive natural regeneration for degraded forest occurring on steep land. The simplified map and statistics can be compared with the ROAM SMCA analysis[5], a more prescriptive result which includes distance factor to proposed land appropriate for tree crops and agroforestry.

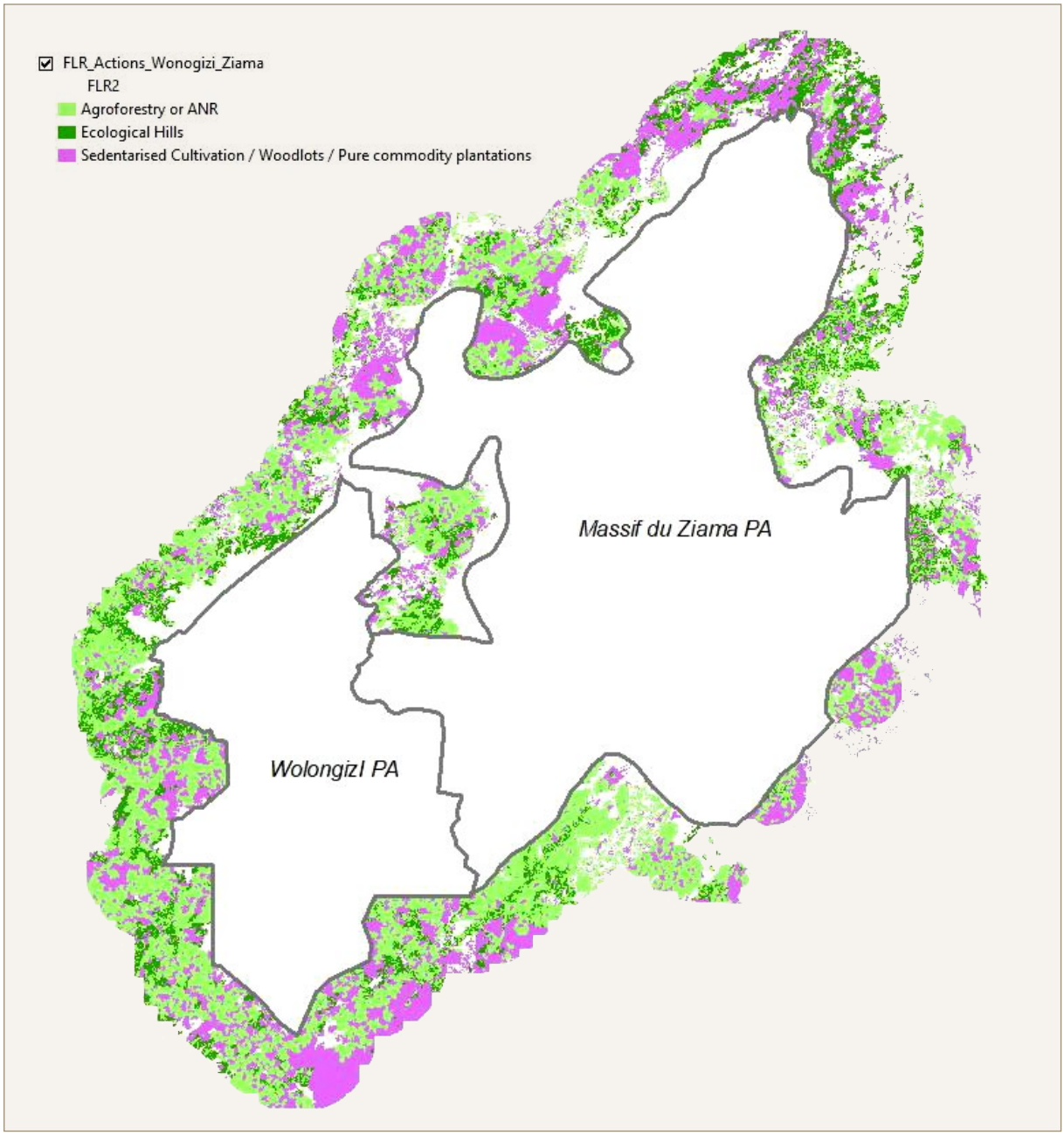


Figure 6. FLR opportunities in the Wonegizi – Ziama 5 km buffer
(Source: compiled by N. Jewell using land cover data extracted from ESA Sentinel 2 10m resolution imagery': https://scihub.copernicus.eu/dhus/)

5 IUCN (2022) *Forest Landscape Restoration Opportunities Assessment in the Mano River Union.*

Table 6. Wonegizi – Ziama SMCA harmonised with national activity reports

Priority	Land attributes	FLR intervention	Hectares
1	Degraded forest or fallow	Agroforestry or ANR	38,258
2	Degraded forest on steep land	Passive NR on 'Ecological Hills'	11,779
3	Cultivated land	Sedentary cultivation / woodlots / pure commodity plantations	26,645
		Total (ha)	**76,682**

(Source: compiled by report authors)

4 Conclusions

Whilst the proposed FLR interventions can increase biological, social and economic values of the priority areas within the 5 km buffer zones, there are additional actions that should be considered at the broader MRU transboundary landscape level. These actions can help improve water quality, reduce erosion and surface runoff and increase overall connectivity, and include conserving riparian corridors, protecting steep slopes and protective buffers around remaining high conservation value forest areas.

One such important action to increase connectivity is to consolidate, connect or integrate the significant number of small and larger blocks of degraded or closed (i.e. high conservation value) forest that exist in the 5 km buffer zones (see Fig. 10)[6]. These forest remnants are important sources of seeds and seedlings for natural regeneration, ANR, and for establishing community native tree nurseries, which will be vital in establishing community agroforestry enterprises, for example. Establishing such buffer zones can expand the area used by some species and protect sensitive areas from damaging edge effects at the protected area boundary.

Given the level of fragmentation in the 5 km buffer zone, the integration of connective landscape elements such as live fences into proposed community agroforestry enterprises can improve local livelihood options

Nursery development for restoration near Gola National Park, Liberia. © Nathaniel Mulbah

6 IUCN (2022) *Forest Landscape Restoration Opportunities Assessment in the Mano River Union*.

and increase biodiversity connectivity that expands the habitat of species that may be unable to thrive in the current agricultural matrix, playing a critical role in their survival. Similarly, riparian corridors can provide benefits related to water (e.g., hydrological regulation, filtration), biodiversity (e.g., wildlife habitat and movement, aquatic habitats), agriculture (e.g., pollination, runoff control), climate change mitigation (e.g., carbon sequestration, riverbank stabilisation) and livelihoods (e.g., fishing, spiritual values).

In steeper dryer areas with marginal agricultural value in the 5 km buffer, ANR represents the most cost-effective alternative over the long-term to achieve FLR at scale. However, it can take significantly longer and, given the social, biological and economic context of the MRU transboundary landscapes, active restoration approaches will be important. The proposed agroforestry is therefore a particularly suitable FLR intervention to ensure livelihood options for local stakeholders, increase biodiversity connectivity, and the resilience of the protected areas in the transboundary landscapes.

Local traditional knowledge is critical for successful FLR implementation. Informed decisions regarding selection of individual trees (quality of fruit and timber, selective planning and thinning) will ensure the most effective and productive use of the tree canopy is made and each tree responds to specific biological, social and economic needs. For example, agroforestry land-use plans would need to form the basis for village-level discussions and agreements, and be prepared in a participatory and consultative manner, including details such as the siting, presence of biodiversity, development and use of village tree nurseries, species selections, responsibilities for implementation and other local factors.

Where customary land use rights exist at the village level, setting up site level agroforestry land use plans with clear agreements on timber harvesting, rules and responsibilities for access and collection of non-timber forest products (NTFPs),[7] areas for agroforestry among others, would seem to be a priority task for the communities, for which guidelines, rules, and technical procedures (including standards in the best use of drone and mapping technologies) should be well laid out.

It will be important to understand local knowledge from the perspective of the diverse communities within the target landscapes, and to determine how it could be best used 'at scale' for FLR over extensive buffer areas, where widespread forest losses and conversion to agriculture continues. The role of local knowledge in managing the agroforestry sites and the use of indigenous silvicultural methods is critical, combined with standard and widely-used silvicultural methods, with appropriate instruction and capacity building on local traditional knowledge and vice versa.

The establishment of village tree nurseries has been highlighted in all activity reports, especially ensuring the use of a wide variety of species, including cash crop species, and native and non-native tree species for agroforestry systems. A recommendation is to create a network of village nurseries throughout the FLR landscape (i.e. within the 5 km buffer) to build capacity in propagating agroforestry species as well as indigenous tree saplings and seedlings, which is a vital element in the FLR effort. Village

7 NTFPs include fruits, nuts, vegetables, fish, game, and medicinal plants, among other products or services other than timber that is produced in forests.

nurseries are the functional means whereby smallholder farmers, local stakeholders in the communities can most effectively be supported and learn the adoption of new agroforestry and silvicultural techniques.

The need for quality site design and layout has been evidenced in the national activity reports, with the Liberian report highlighting that 'fine-scale spatial analyses would be required during deployment' of agroforestry interventions as part of restoration, 'to be matched by updated mapping of the management plans of the protected/proposed protected areas'. These observations stress the importance of detailed spatial information to be recorded at the site level as implementation progresses, whether hand drawn on paper or, assuming adequate investment and support in training, being recorded digitally. These would effectively be site level land-use plans showing the location of each agroforestry location and details of the design, extent in the local context.

There would seem to be a clear opportunity for the use of drone technology to provide a very detailed photographic record of each individual FLR site, being positionally accurate (via GPS technology) and providing both a simple intuitive base map that local smallholders can easily understand and make use of as a practical guide. The set of digital data could also be saved and compiled for later use as GIS data layer by project staff guiding the intervention over the larger FLR area including many village and community level sites. This would represent important baseline spatial data to facilitate monitoring of progress and for reporting purposes alike.

Availability of low cost, consumer grade drones allows capture of real time local high-resolution aerial photography for each FLR site, showing in great detail the nature of the land and forest surface and identify precisely remaining indigenous tree species to be conserved, especially the valuable 'mother tree' sources of seeds and seedlings.

Community nursery in Noborotono village, Guinea. © Dominique Endamana

Community tree nursery. © Faouzi Maamouri

Digital drone imagery can easily and intuitively be understood by non-specialists and most importantly can readily be used (by a GIS technician) to produce detailed base maps to be related, for example, to satellite imagery covering a much wider area, such as the Sentinel data used to create the land use land cover (LULC) data in this report. As the drone imagery can also generate a local elevation model the high level of detail provides the most accurate level of local (site level) planning possible, especially for example where slope steepness is used a decisive factor to specify areas for ANR.

The data can be compiled to serve as a quick, effective and intuitive local base map for use both at the initial FLR design and planning stage as well as a necessary record during implementation and for later monitoring and evaluation assessments to ensure high quality and high integrity FLR and measure progress of the interventions against project objectives.

Restoration actions are already happening in many places across the MRU landscapes, with principle FLR actions including agroforestry systems with various levels of intercropping of cash crops with native tree species; assisted natural regeneration, where farmers conserve and propagate trees on their croplands instead of clearing; and, ensuring local levels of forest protection and safeguards are effective enough to prevent land clearance for natural forests in the MRU transboundary landscapes and beyond to thrive. The focus now should be on scaling up and accelerating implementation of these FLR actions – embedding gender responsive restoration in MRU development strategies, building the capacity of government agencies and local communities for implementation of stakeholder-driven, demand-responsive FLR interventions, putting in place robust monitoring systems, and unlocking existing and leveraging additional funds.

Community nursery in Noborotono village, Guinea. © Dominique Endamana

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