CEPF MOON: Mainstreaming Opportunities for Operationalizing Business contributions to Nature in Mano River Union countries: Côte D'Ivoiré, Guinea, Liberia

Aim:

Create a threat and opportunity map with data on KBAs, companies and projects, and key opportunities to work with companies to create PPPs or other mainstreaming opportunities such as landscape restoration.

Methods

Relevant data including mining concessions and plantation locations have been collected and documented in a source table so data is easily accessible.

Landcover

In order to identify areas of threats in the landscape a landcover dataset was created by modifying Global Forest Watch data (Hansen et al., 2013) to demonstrate areas of primary (80-100% tree cover) or secondary forest (30-79% tree cover) in lowland (<550m) and upland (>550m) areas. This modified landcover dataset was compared against existing landcover datasets created with ground truth data such as the IGNFI Guinea 2019 dataset (IGNFI, CIRAD 2020) and the FFI ZWW 2019 dataset (Fauna & Flora International, 2020). Confusion matrices demonstrated a 72.5% (+/- 2.5%) overall accuracy for the modified landcover; it was clear from visual comparison that GFW overestimated areas of tree cover in comparison to the IGNFI and ZWW datasets.

Despite this, the modified global forest watch dataset provides the best option for the CEPF MOON project due to its larger coverage across all three Mano River Union countries. Using different data sets for each of the different defined areas of interest would result in further errors in comparing datasets produced from different methodologies and resolutions. The uniform coverage provided by GFW data is, therefore, more suitable for this high-level project. Once opportunities have been identified it is recommended that finer scale landcover analysis is completed with ground truth data. Additionally, the GFW dataset provides yearly coverage from 2000 to 2020 enabling the identification of temporal trends in tree cover through hot spot analysis, which would otherwise not be possible with static and low temporal resolution datasets.

Hot Spot Analysis

GFW tree cover loss data from 2000- 2020 was used in a hot spot analysis for the three areas of interest across Guinea, Liberia and Côte D'Ivoiré. Emerging hot spot analysis identifies trends by considering statistically significant relationships across spatial and temporal dimensions (Harris et al., 2017). The ArcGIS Pro 2.8 tool utilises two statistical tests (the Getis-Ord Gi* and the Mann-Kendall trend) to evaluate these spatial-temporal trends and classify them into one of 17 bins: eight hot spots, one non-significant, and eight cold spots. For example, an area that has a statistically high level of forest loss consistently across the specified time period within the same space would be classed as a consecutive

hotspot. Types of potential hot spot results are listed in Table 1. The forest loss events were aggregated into 1-km by 1-year space-time cube. A default neighbouring distance to search for statistically similar events was applied to each area of interest.

Table 1: Emerging hot spot analysis statistically significant relationship definitions

Hot Spot Pattern	Definition
New	A location that is a statistically significant hot spot for the final time step and has never been a statistically significant hot spot before.
Consecutive	A location with a single uninterrupted run of statistically significant hot spot bins in the final time-step intervals. The location has never been a statistically significant hot spot prior to the final hot spot run and less than ninety percent of all bins are statistically significant hot spots.
Intensifying	A location that has been a statistically significant hot spot for ninety percent of the time-step intervals, including the final time step. In addition, the intensity of clustering of high counts in each time step is increasing overall and that increase is statistically significant.
Persistent	A location that has been a statistically significant hot spot for ninety percent of the time-step intervals with no discernible trend indicating an increase or decrease in the intensity of clustering over time.
Diminishing	A location that has been a statistically significant hot spot for ninety percent of the time-step intervals, including the final time step. In addition, the intensity of clustering in each time step is decreasing overall and that decrease is statistically significant.
Sporadic	A location that is an on-again then off-again hot spot. Less than ninety percent of the time-step intervals have been statistically significant hot spots and none of the time-step intervals have been statistically significant cold spots.
Oscillating	A statistically significant hot spot for the final time-step interval that has a history of also being a statistically significant cold spot during a prior time step. Less than ninety percent of the time-step intervals have been statistically significant hot spots.
Historical	The most recent time period is not hot, but at least ninety percent of the time-step intervals have been statistically significant hot spots.

Connectivity Analysis

Structural connectivity analysis will identify threats to forest habitat connectivity within the areas of interest. Morphological Spatial Pattern Analysis (MSPA) (Soille and Vogt, 2009) has been conducted using a binary version of 2020 forest cover for the three regions, this provides a simplistic view of structural connectivity identifying core areas and bridges of forest habitat. Connectivity modelling with the Linkage Mapper toolbox (McRae and Kavanagh, 2011) additionally allowed for a more in-depth analysis of landscape connectivity by identifying the least cost pathways of movement across a resistance surface of the study areas. A resistance surface was created in which areas of non-forest and roads with a 1km buffer represent areas of high resistance to movement and primary forest provided the least resistance to movement. Core areas larger than 200km^2 identified in the MSPA analysis were used as locations to model connectivity to and from in Linkage Mapper. A core area size of 200km^2 was chosen to reflect the home range size of thelargest species in the landscape the forest elephant (Beirne *et al*., 2021).

Results

Land cover mapping

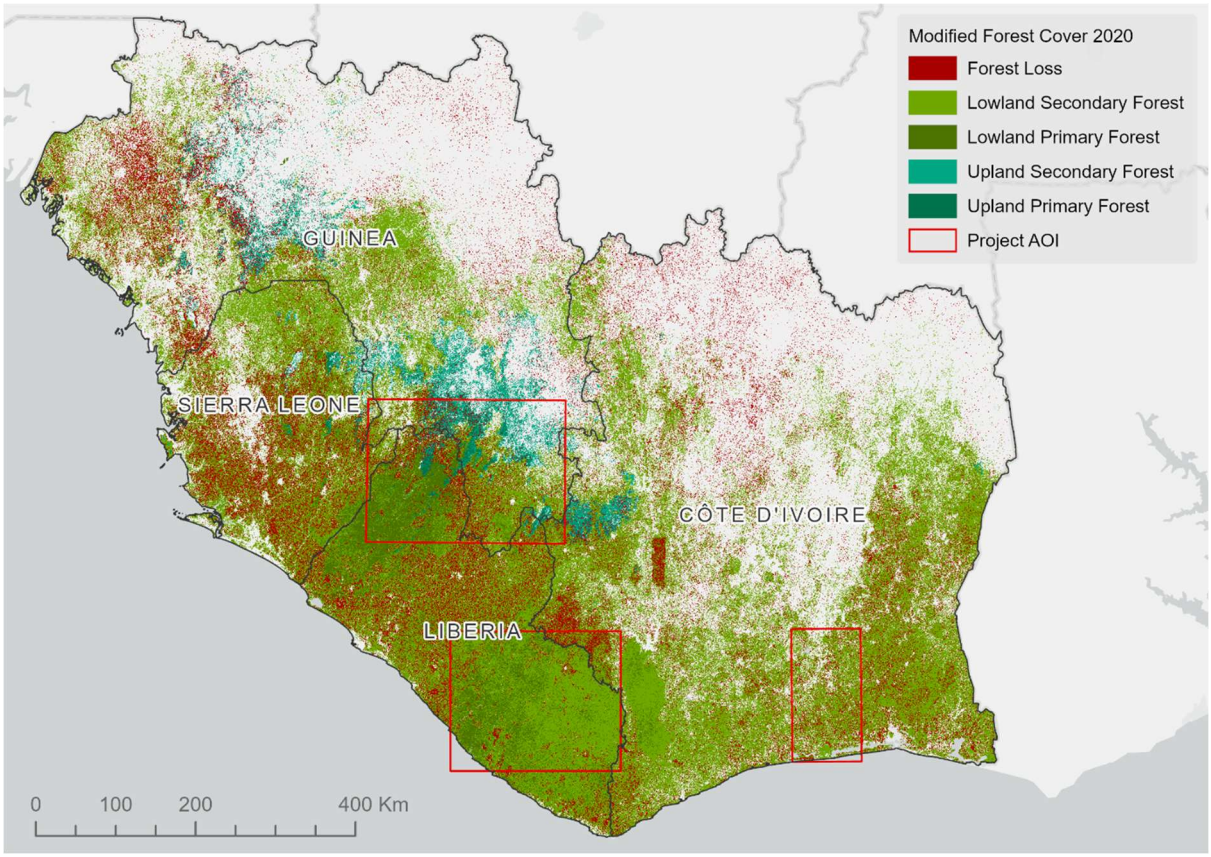

Figure 1: Modified Global Forest Watch land cover dataset across the Mano River Union countries and project areas of interest

The modified Global Forest Watch landcover layer suggests predominately lowland secondary and primary forest, with clusters of deforestation in the southern Liberia AOI. There remains some lowland secondary forest interspersed with deforestation in the Côte D'Ivoiré AOI. Northern Liberia/ southern Guinea AOI has the most varied landscape with a mixture of all land classes, here deforestation appears to be concentrated around the border.

Proximity to Concessions, Protected Areas and Roads

Proximity to concessions is shown on a scale of light to dark, with darker greys indicating closer areas. It is suggested there may be greater opportunities for business engagement within 10km of concessions due to the proximity to business operations providing a direct opportunity to help positively influence the landscape they work in. The locations of roads further indicate where areas may be vulnerable to future/current threats of deforestation and biodiversity loss by greater access to the forest and fragmentation of biodiversity hot spots. Additionally, viewing protected areas and community forests in the context of distance to concessions and roads indicates where partnerships may have a greater impact as a result of linking to highly biodiverse protected areas, important buffer zones, communities and businesses.

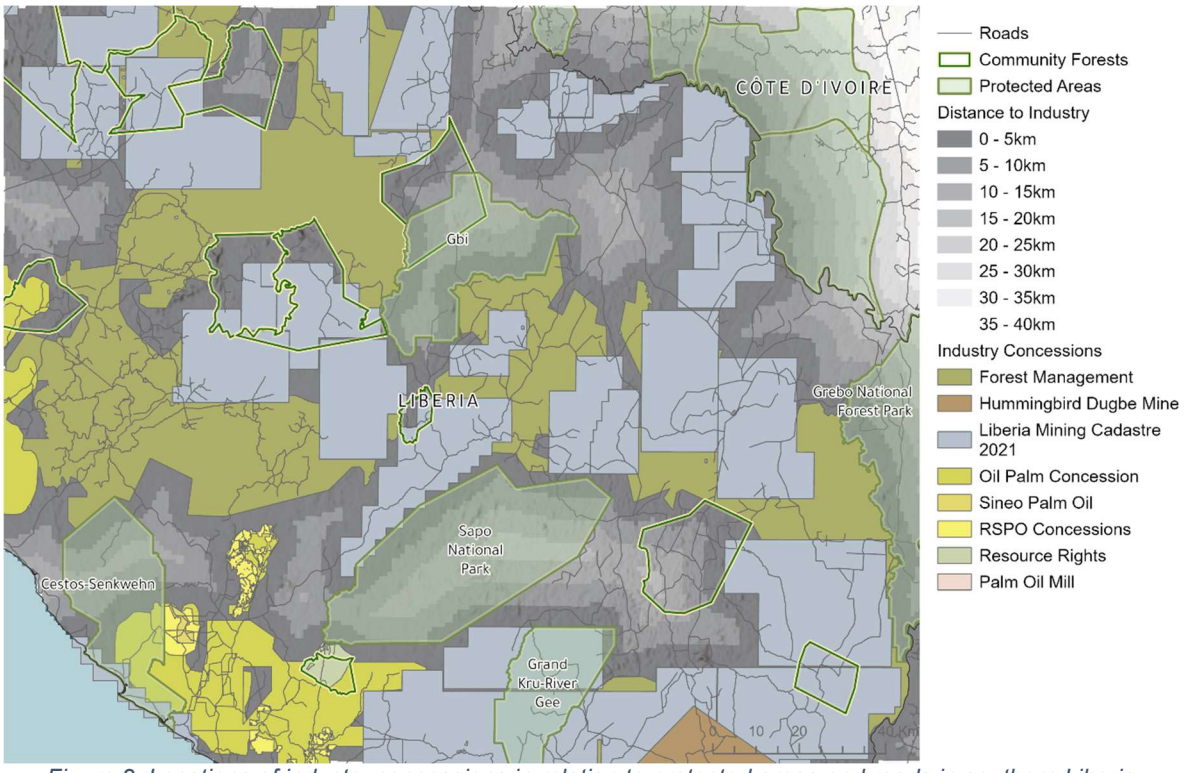

Figure 2: Locations of industry concessions in relation to protected areas and roads in southern Liberia

Points of interest in the southern Liberia AOI:

- The area south of the Gbi protected area is surrounded by mining and forest management concessions
- North of Sapo National Park there is a gap of 5km between the PA and concessions
- Community forest east of Sapo National Park, close to concessions in the northeast and high density of roads indicating it may be vulnerable to exploitation
- Similar community forests in the north of AOI overlapping mining concessions – a key opportunity for businesses to work with local communities to ensure their natural resources are protected and biodiversity supported.

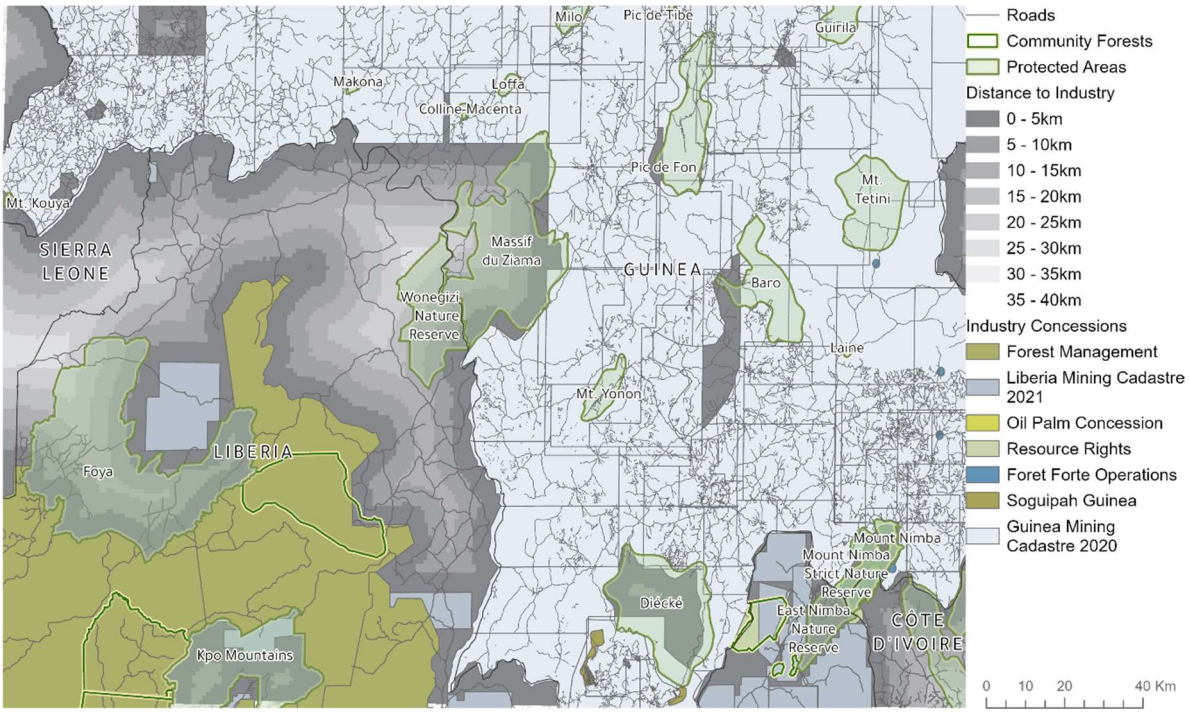

Figure 3: Location of industry concessions at the southern Guinea/Liberia border in relation to protected areas, community forests and roads.

Points of interest in the northern Liberia/Southern Guinea AOI:

- Eastern Ziama and eastern Wonegizi are both within 5km of concessions in Guinea. This may represent a strong opportunity for concession owners to engage in support of biodiversity conservation in the PA and within the PA buffer zones.
- Diécké is surrounded by concessions and roads and should therefore be seen as vulnerable to impacts business operations in the region and an opportunity to engage business in the area to protect the PA and surrounding communities.
- Baro, Mt.Tetini and Pic de Fon among others all overlap concession within Guinea and could also be seen as opportunity locations

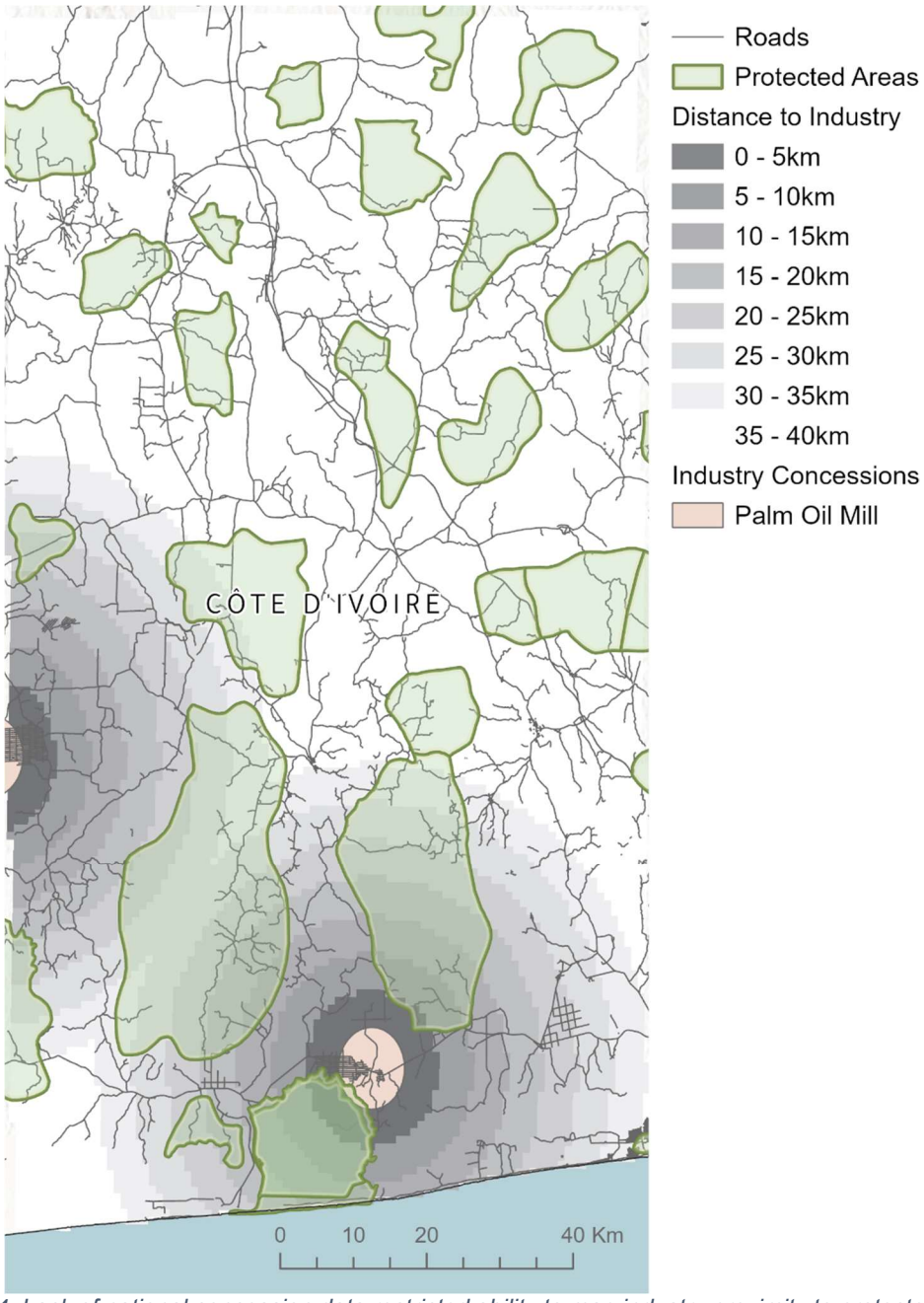

Figure 4: Lack of national concession data restricted ability to map industry proximity to protected areas

Points of interest in the Côte D'Ivoiré AOI:

- Highlights the importance of having a good dataset currently gives very little information about the spread of industry throughout the area. Ideally, areas assessed for opportunities would have access to national concession data.

Deforestation Hot Spots

The results of the deforestation hot spot analysis indicate significant spatial and temporal trends in deforestation providing a useful oversight into which areas may be currently under threat and where areas switch between deforestation ad stable activity. These areas may be key when considering what represents a good opportunity. New hot spots suggest deforestation is not yet an ingrained income within local communities, and so there may be

socio-ecological benefits to be gained from conservation agreements steering communities away from deforestation. Areas oscillating between deforestation and stable activity, particularly those near roads and protected areas could also represent good opportunities to encourage partnerships between business and local communities to remove deforestation as a source of income or social practice.

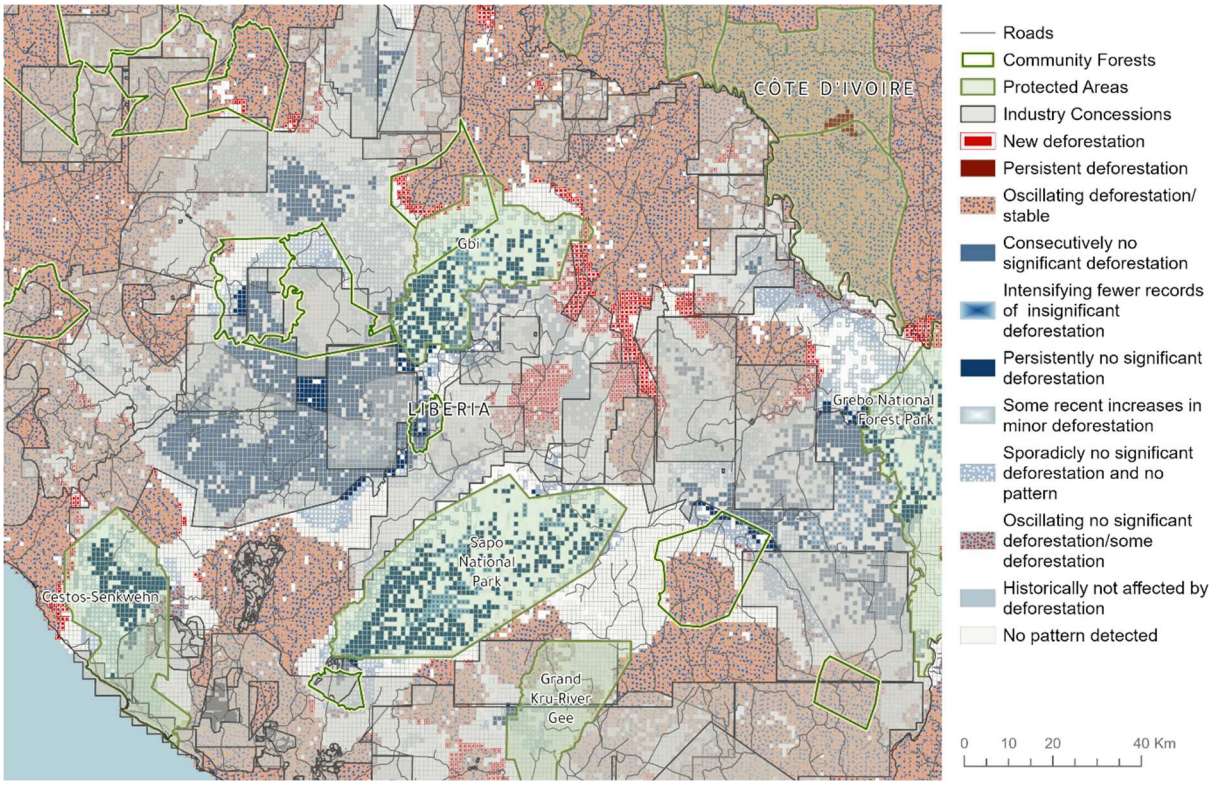

Figure 5: Deforestation spatial-temporal trends between 2001-2020 in southern Liberia

Patches of new deforestation trends can be seen south-east of Gbi protected area, whilst oscillating trends of stability and deforestation cover the majority of the area of interest. Roads running through cold spots should be considered at a ground level to determine if this represents a new route into untouched forest and therefore high risk or a previously deforested area. For example, roads around and within Cestos-Senkwehn protected area could increase access to the protected area and therefore risk of deforestation.

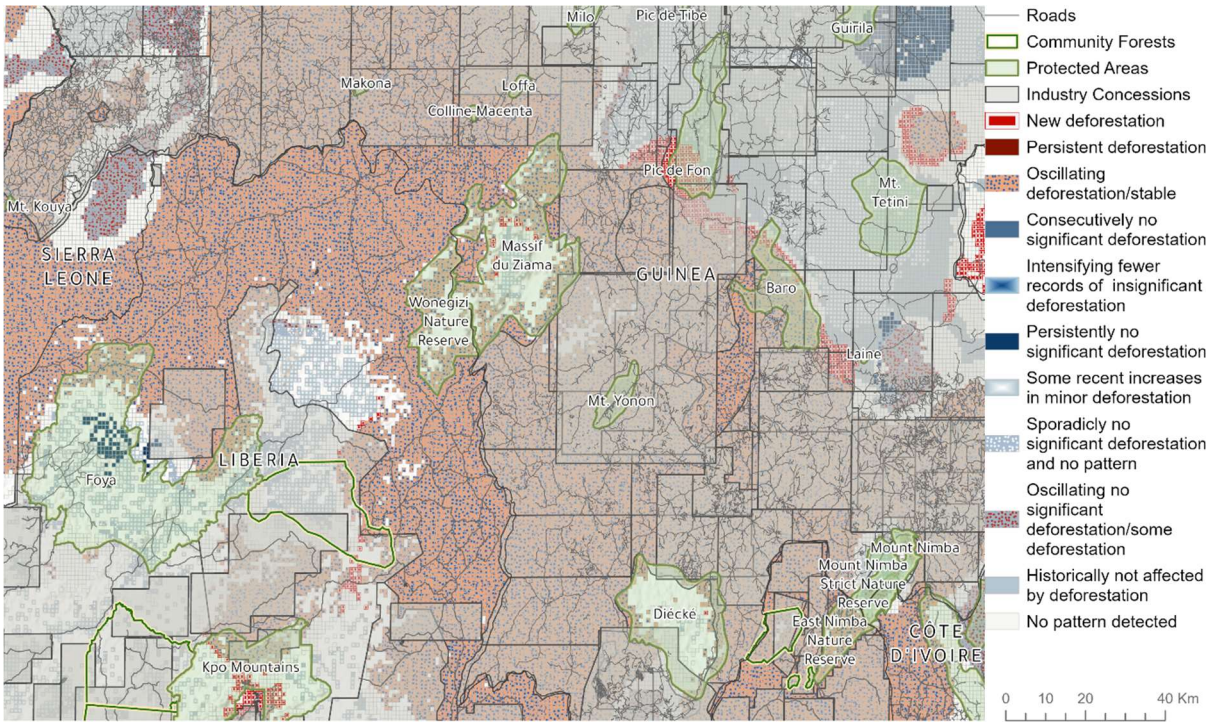

Figure 6: Deforestation spatial-temporal trends between 2001-2020 in northern Liberia and Southern Guinea

The concessions overlapping the emerging deforestation patches south of Pic de Fon and Baro protected areas, could be areas of opportunity to engage concession owners to react to the increasing threat of deforestation for biodiversity in the area. The oscillating trends between deforestation and stability around the edges of Wonegizi, Ziama and Diécké further indicate these as important areas to encourage business engagement and avoid consistent deforestation in these high biodiversity areas. A high density of roads north of Nimba reserves and oscillating deforestation trends also indicate high-risk areas for biodiversity loss and provide a good opportunity to engage overlapping concessions to be actively involved in local conservation efforts.

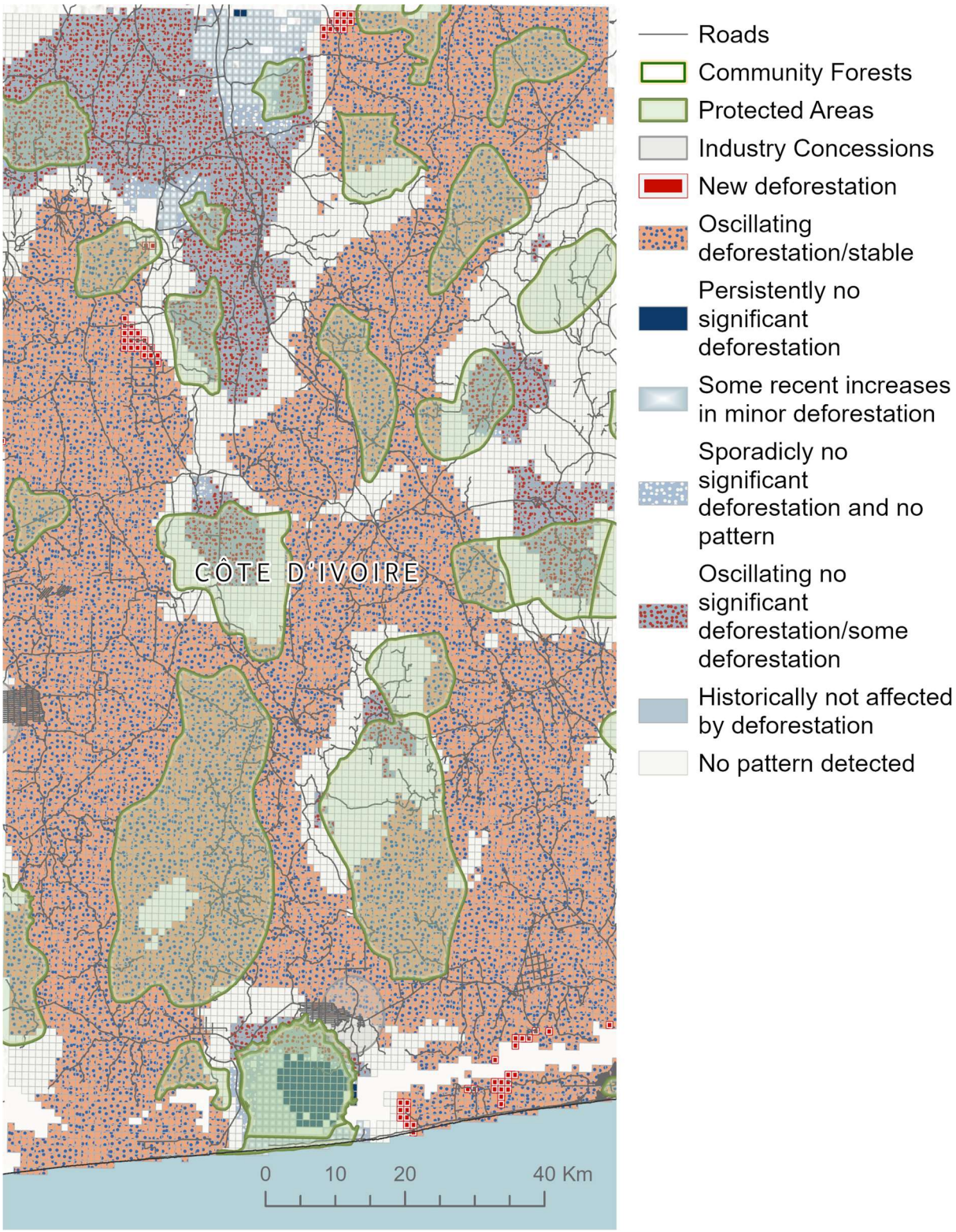

Figure 7: Deforestation spatial-temporal trends between 2001-2020 in Côte D'Ivoiré

Oscillating deforestation between protected areas suggests a good opportunity to reduce deforestation risk and increase connectivity between protected areas.

Connectivity

The connectivity results indicate regions that may be disconnected and therefore identify where connectivity needs restoring/generating between forest patches. Landscape connectivity is necessary to support healthy functioning ecosystems so indicates where business engagement could help facilitate this. However, it is important to note these high scale efforts may not demonstrate the details of finer-scale where roads and rivers may present in reality provide a barrier to movement for some species.

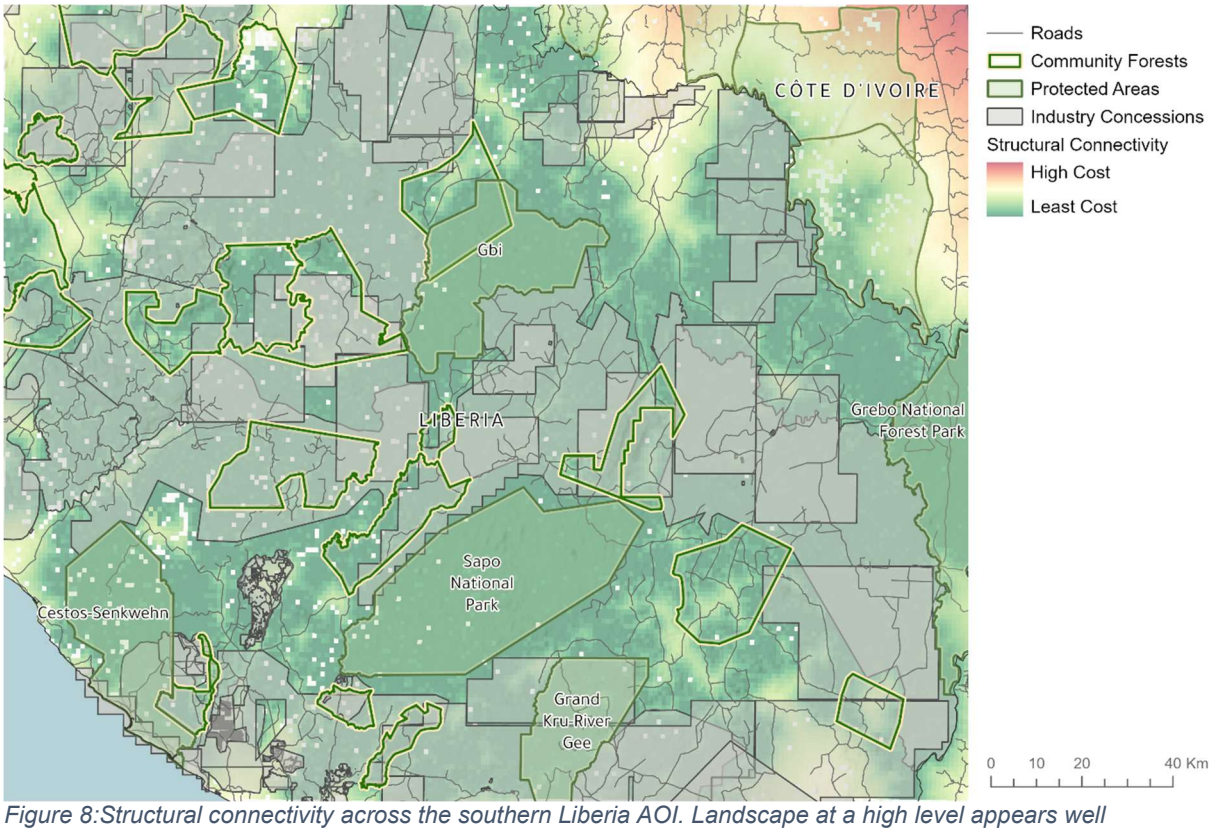

Figure 8:Structural connectivity across the southern Liberia AOI. Landscape at a high level appears well connected although efforts could be used to increase connectivity between Sapo National Park and Grebo National Park and connect community forests in the north or the AOI with protected areas.

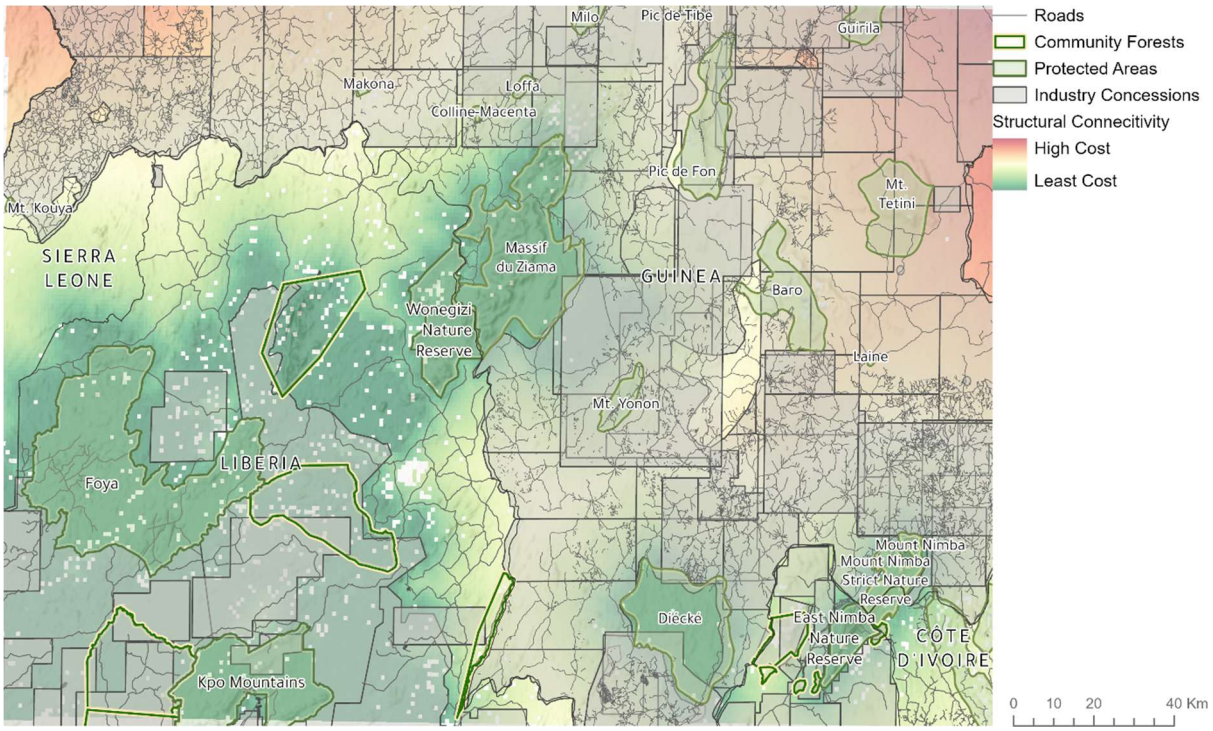

Figure 9: Structural connectivity across the northern Liberia/southern Guinea AOI. Connectivity could be enhanced surrounding Mt.Yonon and Diécké protected areas.

Discussion

The high-level assessment has indicated certain areas within the project AOIs that may represent opportunities for business engagement in conservation. Areas with relatively lower connectivity, new or oscillating areas of deforestation, and those within 10km of protected areas and high road densities present key areas of opportunity. The lack of concession data available for Côte D'Ivoiré has restricted our ability to map potential opportunities in this region. As a result of the caveats associated with the data used in this assessment, most notably the global scale forest cover, and the influences of scale on the different types of analyses carried out: it is recommended that these opportunities are seen as high-level guidance only. National level assessments are possible but feasibility is restricted by resources available as demonstrated here. A national assessment would require an up to date, fine-scale (<50m resolution) landcover map alongside other high-resolution national datasets. It would also require multiple in-person workshops to gain local insights into restoration and opportunity needs and interests. Such data was unavailable across the entire study region of this high-level analysis across the three Mano-River countries.
These results should be used to inform where further more detailed analysis and project scoping should be carried out on the ground.

Future more detailed assessments should similarly follow the ROAM assessment guidelines (IUCN and WRI, 2014) with a focus on stakeholder engagement with agreements made on what local restorations and opportunities can and should look like at a local level. With engagement from local actors' decisions can be made to prioritise certain opportunities such as support for community management of resources and minimisation of corporate impacts on highly biodiverse areas. Prioritisation can occur by scoring variables such as deforestation, protected area status, proximity to industry concessions and combing in an additive way using GIS software to produce a local scale prioritised opportunity map. This level of prioritisation of opportunities cannot be made at such a high level as this project due to the necessity of involvement of people on the ground and local to the area to whom these

decisions would affect. The restoration opportunity assessment in the East Nimba Nature Reserve serves as a good example of how these finer scaled assessments can be carried out with emphasis on stakeholder engagement (Forest Development Authority, 2020).

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