High Conservation Value Public Summary

Wonegizi Proposed Protected Area

Assessment Details

Location: Zorzor District, Lofa County, LIBERIA

Assessment area: 70,126 ha

Planned use for assessment area: Multi-Use Reserve

Certification scheme: REDD+

Lead assessor: Benjamin Barca
Gola Rainforest National Park
164 Dama Rd.
Kenema, Eastern Sierra Leone

June 2018

Table of Contents

I. Introduction & Background

This assessment took place between March and June 2018, beginning with a desk review of data already available for the assessment site. Next, a gap analysis was conducted, and methodologies were developed. This was followed by field work to fill the identified gaps in order the to finalize the HCV assessment. This assessment followed the Liberian national HCV toolkit, developed by Fauna & Flora International and Proforest in 2013, as a reference document to identify HCVs at a national level. This national toolkit follows the interpretations in the HCVRN guidance, and any deviations from these are noted clearly in this assessment.

The organisation commissioning this assessment is Fauna & Flora International (FFI) Liberia, lead by Colin Pringle, Senior REDD+ Programme Manager. Contact: +447725594204, colin.pringle@fauna-flora.org, The David Attenborough Building, Pembroke Street, Cambridge, UK, CB2 3QZ. Fauna & Flora International was founded in 1903 and was the world's first international wildlife conservation organization. Its mission is "*to conserve threatened species and ecosystems worldwide, choosing solutions that are sustainable, based on sound science, and which take into account human needs*"[1]. It is currently working on over 140 projects in over 40 countries worldwide. FFI has started working on REDD+ (Reducing emissions from deforestation and forest degradation) projects in Liberia and Myanmar to create a financial value for the carbon stored in their forests to use towards conservation activities. The REDD+ project in Liberia will provide gazettement of vital conservation habitats and sustainable forest management while integrating community incentives.

Table 1: HCV assessment team.

Name	Organisation*	Role	Expertise
Benjamin Barca	Gola Rainforest CLG	Lead assessor	Logistics, report writing, quality control
Claire Vincent	Independent	Assessor	HCV 1 – 4 team leader
HCV 5&6 person	FFI Liberia	Assessor	HCV 5 & 6 team leader
Patrick Garteh	FTI	Field team	Botanist
Keifala Lahai	Gola Rainforest CLG	Field team	Herpetologist
Emmanuel M. Loqueh	SCNL	Field team	Ornithologist
Menladi Mama Lormie	FDA	Field team	Mammologist
Patrick Yealue	FDA	Field team	Field technician
Allen O. Guleh Sr.	FDA	Field team	Field technician
Gabriel T. Kerkulah	FDA	Field team	Field technician
Mooh E. Lamah	FDA	Field team	Field technician
*FDA: Forestry Development Authority, FTI: Forestry Training Institute, Gola Rainforest CLG: Gola Rainforest Company Limited by Guarantee, SCNL: Society for the Conservation of Nature of Liberia			

[1] www.fauna-flora.org

Site description

The HCV assessment site is the Wonegizi Proposed Protected Area (PPA) located in Zorzor district, Lofa County, Liberia, and it's leakage belt. The PPA covers a total area of 37,979 ha and the leakage belt is 32,147 ha. The land cover of the PPA is comprised predominantly of mature forest, although 7% of the area is covered by farmland (Table 2). The Wonegizi PPA has been under some level of government protection since the 1970s (excluding during the civil war). The forest is comprised of seasonal moist evergreen and semi-deciduous forests, the annual precipitation is 2500mm and the mean annual temperature is 24.9 C°. The northern section of the Wonegizi PPA is dominated by rolling forested hills that reach 670m elevation that descend to the south to an alluvial plane cut in half by the Lawa river. Three villages, Barwen, Kargbota, and I-Maa, are situated within Wonegizi PPA along the banks of the Lawa River. As you move south, there is a large tract of lowland evergreen moist forest that extends to the Wonegizi mountain range. It contains the third highest peak in Liberia at 1029m elevation, within the Wonegizi range, and the terrain contains rocky outcrops and upland grasslands in some areas. The leakage belt surrounds the Wonegizi PPA on three sides and encompasses several villages as well as a dirt road that connects the district capital, Zorzor, to the county capital, Voinjama. The leakage belt contains some remnant primary forest, but the majority has been converted to farmland. Together the leakage belt and Wonegizi PPA form the Project Zone of 70,126 ha which lies on the international border with Guinea and its forest is contiguous with the Massif du Ziama Biosphere reserve to the East and Wologizi to the West. It forms an important forest corridor between the Wologizi and Wonegizi mountains which together formed the North Lorma National Forest until they were separated under the National Forest Reform Laws of 2006.

Table 2: Land cover classifications and cumulative size within the Wonegizi PPA and the leakage belt, respectively.

Type	Wonegizi PPA Size (ha)	Leakage Belt Size (ha)	
Core forest	25,873.7	13,161.7	
Farmland	2,741.2	10,405.6	
Multi-use forest	9,246.4	8,579.2	
Waterbody	117.6	0.66	
TOTAL	**37,978.9**	**32,147.2**	**70,126.1**

Zorzor District is made up of six tribes, two of which, the Lorma and Mandingo tribes, form the Ziama Clan which is predominantly found in 20 communities around Wonegizi PPA and extends into Guinea. The Lorma tribe is dominant in the area, and some still retain their Lorma religions and belief in forest spirits. The communities have a close affinity to the forest and have been its guardians for many years. As Lofa is one of the main agricultural production sites in the country, the forest is under pressure in this area due to an increased demand for farmland. Increased deforestation is endangering the livelihoods of the forest dependent people, threatening the remaining biodiversity, and reducing the ecosystem services provided by the forests.

Liberia is signatory to all the major global environmental accords including the Convention on Biological Diversity (CBD), United Nations Framework Convention on Climate Change (UNFCCC), Ramsar Convention (Liberia has 5 sites), Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and United Nations Convention to Combat Desertification (UNCCD). In Liberia there are

currently five designated protected areas, and nine currently in the development stages, accounting for a total of 30% of the country's forested area (Figure 1). Wonegizi has been a proposed protected area since 2006. In 2015, FFI conducted a gap analysis to identify what steps remained to be taken in order for it to achieve full designation as a protected area. The two main gaps identified were the boundary demarcation and community outreach and consultations, both responsibilities of the Forestry Development Authority (FDA). Under the Global Environmental Facility (GEF) funded EXPAN Project (Expansion of Protected Areas Network), and with on-going support from FFI, the boundary has now been tentatively demarcated and FFI plans to designate Wonegizi as a REDD+ forest, which would make it the first of its kind in Liberia.

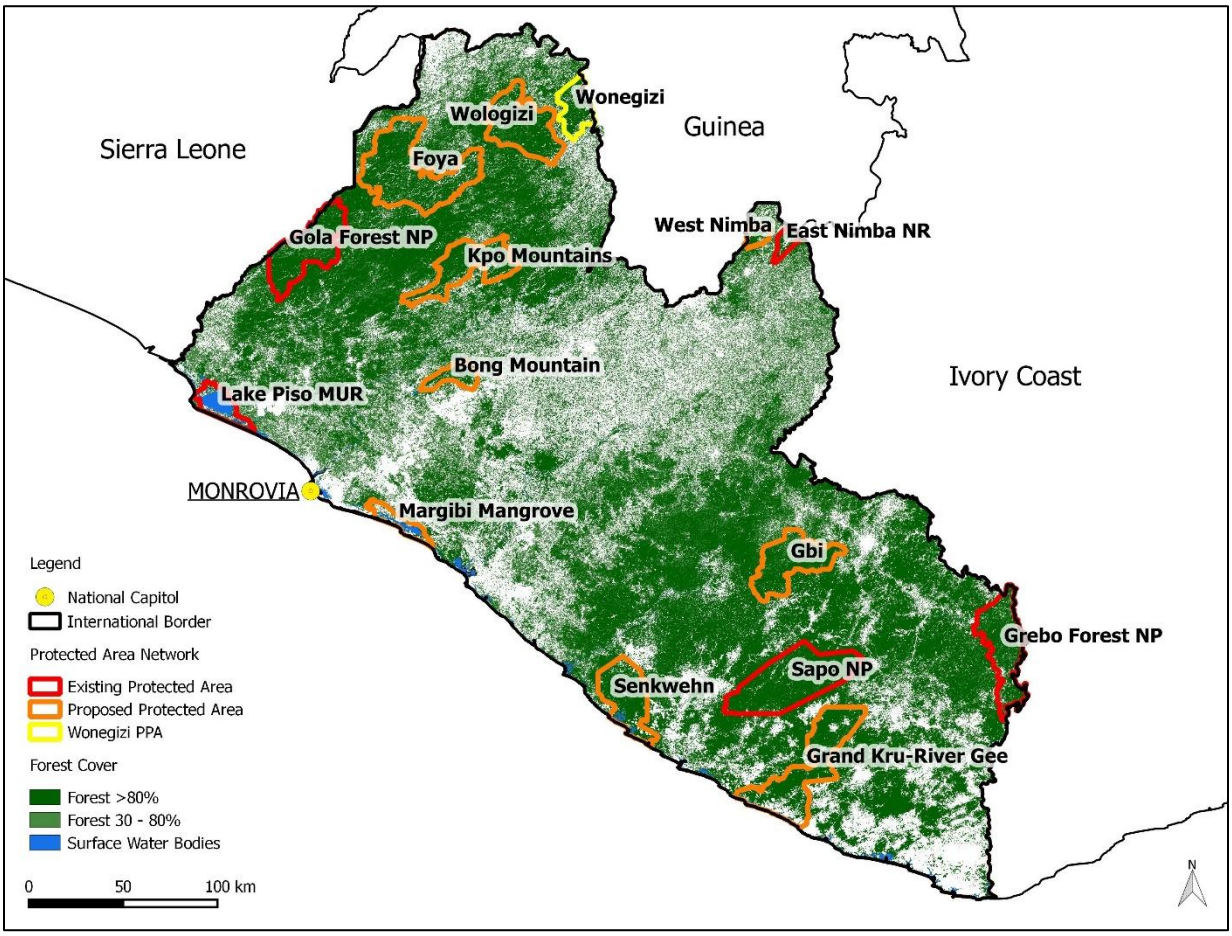

Figure 1: The Liberian protected area network showing the existing and proposed protected areas which cover 30% of the national forest estate. Forested area of the country is shown in green, white refers to all other land cover types.

II. Methods

Secondary Data Collection:

There was extensive existing data and reports from the study site available from previous studies conducted by FFI and many of these were consulted to gather secondary data for this assessment. For a full list of the reports consulted see Appendix A. Data from these surveys was used towards HCV 1, especially past records of mammals, birds, and plant data. All records of HCV species present in the Project Zone were recorded as well as the way such data was gathered (i.e. camera trapping, transect surveys). Gaps in this data were identified and further used to plan the fieldwork needed to gather primary data. Two main gaps were identified in the species data. The first was the absence of any records of amphibians from previous surveys, and the second was the plant data not being spatially distributed throughout the Project Zone.

No scoping study was conducted for three reasons. Firstly, because the existing quality and amount of information available was so robust. Secondly, FFI has been working in Liberia since 1997 therefore enough background information could be gathered directly from their staff. Thirdly, the assessment team was comprised of local stakeholders who have been working in the region and have a thorough knowledge of the landscape and the context of the project.

Primary Data Collection:

A rapid assessment was conducted within the Wonegizi PPA to ground-truth the information gathered from satellite imagery, fill in the gaps identified (amphibians and trees), and confirm the presence of rare, threatened and endangered species of mammals and birds. The team leader conducted a training for all field staff on the 18th of May in Vetesu, Zorzor District. The field staff were trained in best practices, survey methodologies, opportunistic HCV data collection, and amphibian identification.

For the amphibian survey, a total of 22 plots of 25m x 25m were surveyed. Each survey comprised of four research technicians who began the survey in a different corner of the plot and moved systematically around the area for 30 minutes. The team carefully scanned the forest floor by carefully turning the leaf litter, carefully lifting big branches on the floor and stones with cavities underneath. When disturbed in this way, amphibians normally jump and then can be detected (and followed) by the observer. Almost all amphibians seen were captured and kept in separate Ziplock bags with some humid leaves. After the end of the 30 minutes, the herpetologist identified and measured all the captured specimen. Once identified, all the specimens were released. Any amphibians that were not caught, but could be identified, as well as those that can be identified by call, were also recorded. General habitat data was collected for each plot, including canopy cover, leaf litter cover and depth, and presence of water features.

The botanical survey focused on trees and a total of 22 plots of 25 x 25m were surveyed. Within this square all tree species with a Diameter at Breast Height (DBH) of more than 30cm were identified to species level by the botanist. If identification to species level was not possible, then these were identified to genus level. General habitat data, as for the amphibian plots, was again collected for each plot.

Other data was taken opportunistically as the team moved through the forest. Incidental data of HCV mammals and birds was taken when any sign, sound, or animal sighting was identified by any member of the team and confirmed by the mammologist or the ornithologist. If a microhabitat or natural feature of relevance was encountered it was marked in the GPS as a waypoint and labelled appropriately (e.g. swamp, rocky outcrop, spring, etc.).

Any threats encountered were again marked in the GPS after being identified opportunistically during the field survey. These included most human signs encountered in the forest, especially when these appeared to pose a threat to HCV species (e.g. cartridges, snares, mining sites). New land cleared for farming was also identified and marked in the GPS and the responsible community noted.

Fire data was taken from Global Forest Watch Fires online database who obtain their data from NASA[2]. Fire incidence rate was used from data collected between January and May 2018. Land cover data was obtained from the FDA who had National land cover data created by JV Metria/GeoVille[3]. They used Landsat-8 data from December 2011 – January 2015 and RapidEye images from December 2011 – January 2013. The classification into land cover categories was assessed through Landsat-8 spectral data and confirmed through RapidEye imagery. Slope was calculated from the International Centre for Tropical Agriculture (CIAT) topography elevation data[4] using the Fleming and Hoffer[5] method in the raster package[6] in R v3.4.3[7]. All other spatial data analysis was done with qGIS 2.18[8].

Table 3: Timeline for all activities undertaken for the Wonegizi PPA HCV pre-assessment, assessment, and report writing.

Process Steps	Activities	Dates
Pre-assessment	Gathering and reviewing previous reports from FFI and partners.	March & April 2018
	Gap analysis to identify gaps in existing data	April 20th-30th 2018
	Planning for field survey	May 1st-13th 2018
Assessment	Conducting field survey for HCV 1-4	May 19th-27th 2018
	Conducting field survey for HCV 5-6	?
	Stakeholder consultations	?
Report writing	First draft (excluding HCV 5&6)	June 30th 2018
	First draft (complete)	?
	Final report	?

[2] NASA "FIRMS Active Fires" accessed through Global Forest Watch on June 15th 2018. fires.globalforestwatch.org
[3] Metria AB, Sweden; GeoVille GmbH, Austria. 2015. For Liberia Forestry Development Authority (FDA) under the REDD+ Readiness Preparation Activities Grant.
[4] Jarvis A., H.I. Reuter, A. Nelson, E. Guevara, 2008, Hole-filled seamless SRTM data V4, International Centre for Tropical Agriculture (CIAT), available from http://srtm.csi.cgiar.org.
[5] Fleming, M.D. and Hoffer, R.M., 1979. Machine processing of landsat MSS data and DMA topographic data for forest cover type mapping. LARS Technical Report 062879. Laboratory for Applications of Remote Sensing, Purdue University, West Lafayette, Indiana.
[6] Robert J. Hijmans (2016). raster: Geographic Data Analysis and Modeling. R package version 2.5-8.
[7] R Core Team (2017). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria.
[8] QGIS Development Team, 2016. QGIS Geographic Information System. Open Source Geospatial Foundation.

III. Results

Biogeographic context – Upper Guinea Forests

The Guinean Moist Forest is an Endangered global ecoregion which covers an area of 42,700,000 ha across West Africa[9] (Figure 2). The soils in this area are nutrient poor as they lay upon nutrient poor Precambrian rocks. These rocks have been uplifted in the mountainous areas of the hotspot, including the Mount Nimba region of northern Liberia. The southern regions of the hotspot contain volcanoes which create volcanic rocks in some areas such as in Cameroon. The ecoregion is comprised of three terrestrial sub-regions: the Guinean montane forests, the Eastern Guinean forests, and the Western Guinean lowland forests in which Wonegizi PPA is found.

The lowland forest belongs to the Tropical and Subtropical Moist Broadleaf Forests group and is classified as Globally Outstanding by WWF due to its high species richness[10]. Due to the high species richness and endemism, most of this ecoregion is also designated within the Guinean Forests of West Africa Biodiversity Hotspot[11], which includes 98.5% of Liberia (Figure 3). The Guinean Forests Hotspot provides a variety of ecosystem services that range from local and regional to global importance. They include provisioning services such as drinking water, food, medicine, and building materials for local residents. Regulating services such as carbon storage are important globally, and sediment retention, flood regulation and water catchment protection are more important in a regional context. Supporting services are also present, with the forest providing habitat for high levels of biodiversity and endemic species.

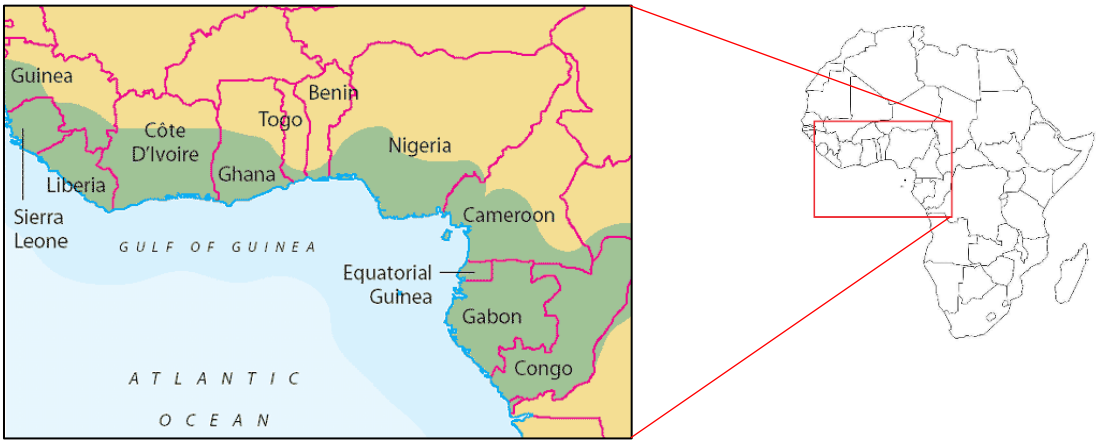

Figure 2: Map of West Africa showing the extent of the Guinean Forest (shaded green). The Upper Guinean Forest extent ranges from Guinea to Ghana. Source: Conservation International at www.unep.org

[9] Olson, D. M., & Dinerstein, E. (2002). The Global 200: Priority ecoregions for global conservation. *Annals of the Missouri Botanical garden*, 199-224.
[10] Burgess N, D'amico Hales J, Underwood E, Dinerstein E, Olsen D, Itoua I, Schipper J, Rickketts T & Newman K. (2004). Terrestrial eco-regions of Africa and Madagascar: A conservation assessment. World Wildlife Fund (United States). 23.
[11] Mittermeier, R.A., Robles-Gil, P., Hoffmann, M., Pilgrim, J.D., Brooks, T.B., Mittermeier, C.G., Lamoreux, J.L. and Fonseca, G.A.B. (2004) Hotspots Revisited: Earth's Biologically Richest and Most Endangered Ecoregions. CEMEX, Mexico City, Mexico.

Figure 3: The Guinean Forests of West Africa Biodiversity Hotspot (outlined in red) and the conservation corridors (shaded yellow) identified by the Critical Ecosystem Partnership Fund. Source: IUCN, 2015.

This forest ecoregion can be further divided based on its flora and fauna, and Wonegizi PPA falls within a key part of the remaining Upper Guinean Forest. The Upper Guinean Forest is typified by tropical and subtropical broadleaf forests comprised of moist evergreen in the south transitioning to dry semi-evergreen in the north. Liberia has the highest forest cover in West Africa and retains the largest portion (around 40%) of the Upper Guinean Rainforest, containing two of its three remaining intact rainforest blocks.

Liberia falls within the West African coastal watershed which covers a total of 101,000,000 ha. This watershed is faced with two main risks. First, recent forest loss has reduced the forests ability to regulate flow and to purify water across the watershed. Second, the high frequency of fires in the area can result in increased runoff, erosion, and forest loss, all negatively impacting the water quality. The main mountain ranges in Liberia are the Wologizi, which includes Liberia's highest peak (Mt. Wutuvi 1424m), the Wonegizi, and Nimba mountains.

Social context

The Guinean Forests of West Africa also host a human population of 282.4 million people across Liberia, Côte d'Ivoire, Ghana, Togo, Benin and Nigeria, who rely on the forest resources for their livelihoods[12]. This ecoregion faces many threats including logging, fires, clearing for agriculture, and mining activities[12]. The hotspot is undergoing increasing pressure from human encroachment due largely to the clearing of forest for farmland, consequently only an estimated 15% of the original forest cover is now remaining[13]. Some studies suggest as much as 80% of the original forest area is now an agriculture-forest mosaic[14], and that much of the remaining forest is used by local residents for timber and livelihoods.

[12] Olson, D. M., & Dinerstein, E. (2002). The Global 200: Priority ecoregions for global conservation. *Annals of the Missouri Botanical garden,* 199-224.
[13] Mittermeier, R.A., Robles-Gil, P., Hoffmann, M., Pilgrim, J.D., Brooks, T.B., Mittermeier, C.G., Lamoreux, J.L. and Fonseca, G.A.B. (2004) Hotspots Revisited: Earth's Biologically Richest and Most Endangered Ecoregions. CEMEX, Mexico City, Mexico.
[14] Norris, K., Asase, A., Collen, B., Gockowksi, J., Mason, J., Phalan, B. and Wade, A. (2010). Biodiversity in a forest-agriculture mosaic – The changing face of West African rainforests. *Biological Conservation* 143: 2341-2350.

Very little of the remaining forest is pristine and there is evidence of past human use followed by re-growth in many of these forested areas[15].

Liberia has the lowest human presence within the Guinean Forests Hotspot, with large expanses of the country still uninhabited, but it did have the highest population growth rate in the world in 2007. In 2013, the population of Liberia was 4.3 million (49.3% urban[16]) with a density of 42 people per km^2. There are 31 extant languages spoken in Liberia and 17 indigenous ethnic groups, and residents are predominantly Christian (86%), but Islam is still dominant in some inland areas. Wonegizi PPA is inhabited by the Ziama Clan, made up of the Lorma and Mandingo tribes.

Liberia is ranked as a Low-Income Group by the World Bank and 83.8% of the population lives below the poverty line, the greatest proportion within the hotspot (2012 data)[17]. The main economic driver in Liberia is mining[18], in addition to agriculture where 60% of the countries labour force works. Oil Palm production is common in Liberia producing 43.5 thousand tonnes in 2013 and making up 1.8% of the total oil palm production in Africa[19]. In Liberia, more than 57,000 hectares of forest have been converted to monoculture rubber plantations, accounting for 260 million USD in export income[20].

Regional biodiversity

The Guinean Moist Forests Ecoregion is of global importance as it contains 936 species of fauna and flora that are globally threatened, as well as a high concentration of endemic species (Table 44; Figure 4). The Guinean Forests contain over 25% of African mammalian diversity. Two of the rarest antelopes in the world reside in this ecoregion: the Jentink's Duiker (EN) and the Zebra Duiker (VU). The subspecies West African Chimpanzee (CR), the Pygmy Hippopotamus (EN) and the Liberian Mongoose (VU) are also globally threatened species found only in this ecoregion. The hotspot is of high priority for primate conservation because of their diversity and endemism, with a total of 30 species of primates including six endemics, many of which are susceptible to the high levels of threat they are facing in the region[21].

The Wonegizi PPA also forms part of the Southern Upper Guinea freshwater ecoregion which includes the watershed of both the Lofa and St. Paul rivers[22]. This freshwater ecoregion is classified as Bio-regionally Outstanding[23] because of the high levels of biodiversity and endemism. There is high diversity of freshwater fish including many endemic killifish and cichlids (ca. 30 endemic fish), as well as crab (ca. 3

[15] Lindsell, J. A., & Klop, E. (2013). Spatial and temporal variation of carbon stocks in a lowland tropical forest in West Africa. *Forest Ecology and Management*, 289, 10-17.
[16] United Nations Department of Economic and Social Affairs, Population Division (2014) World Urbanization Prospects: The 2014 Revision, CD-ROM Edition. United Nations Economic and Social Affairs, New York, USA.
[17] World Bank (2013) The World Bank – World Development Indicators: Table 1.1 Size of the Economy. Available from: http://databank.worldbank.org/data/download/WDI-2013-ebook.pdf.
[18] World Bank (2015) The World Bank – World Development Indicators.
[19] FAOSTAT (2015) Online Statistical Service. Available from: http://faostat.fao.org/.
[20] VERITE (2011) Rubber production in Liberia: An exploratory assessment of living and working conditions, with special attention to forced labour. VERITE, Amherst, USA.
[21] Critical Ecosystem Partnership Fund. Available at: https://www.cepf.net/our-work/biodiversity-hotspots/guinean-forests-west-africa
[22] Ashley Brown and Michele Thieme, (2013) Conservation Science Program, WWF-US, Washington, DC. Available at: http://www.feow.org/ecoregions/details/southern_upper_guinea
[23] Thieme, M.L., Abell, R., Stiassny, M.L.J.S., Lehner, B., Skelton, P., Teugels, G., Dinerstein, E., Toham, A.K., Burgess, N. and Olson, D. (2005) Freshwater Ecoregions of Africa and Madagascar, a Conservation Assessment. World Wildlife Fund (WWF), United States.

endemics), and amphibian species (ca. 11 endemics) in this area. The transition between lowland forest and mountain peaks and plateaus are the areas in the ecoregion that have the highest species richness.

Table 4: Species diversity and endemism in the Guinean Forests Hotspot.

Taxonomic Group	Number of Species Identified in Hotspot	Number of Endemic Species	Percentage Endemic
Mammals	416	65	16%
Birds	917	48	5%
Reptiles	107	20	19%
Amphibians	269	118	44%
Plants	> 9,000	?	est. 20% [24]
Freshwater Fish	1281	ca. 448	35% [25]

Wonegizi was recognised as an Important Bird Area (IBA) by Birdlife International in 2001, and it forms part of the Upper Guinea Forest Endemic Bird Area (EBA). It meets three of the four IBA criteria containing globally threatened species (criteria A1), range restricted species (criteria A2), and biome-restricted species (criteria A3). In addition, it is designated as a Key Biodiversity Area (KBA)[26].

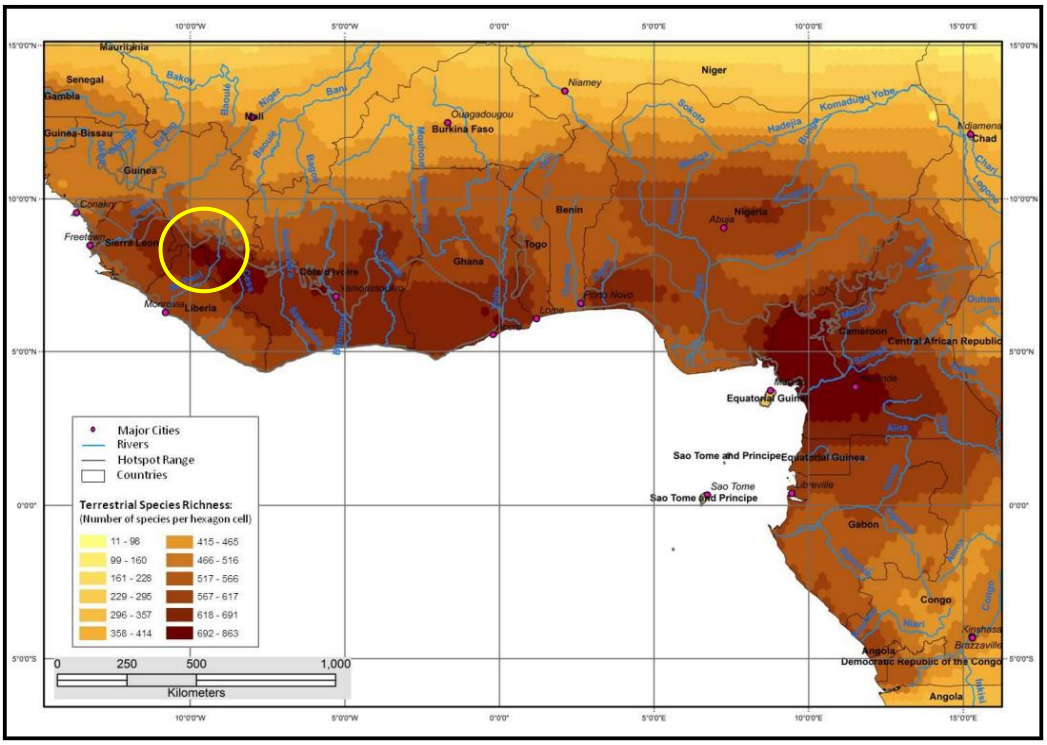

Figure 4: Terrestrial species richness within the Guinean Forests Hotspot with darker areas indicating higher richness. Project Zone is located within the yellow circle. Source: IUCN Red List version 2013 in IUCN Ecosystem Profile: Guinean Forests of West Africa Biodiversity Hotspot.

[24] Mittermeier, R.A., Robles-Gil, P., Hoffmann, M., Pilgrim, J.D., Brooks, T.B., Mittermeier, C.G., Lamoreux, J.L. and Fonseca, G.A.B. (2004) Hotspots Revisited: Earth's Biologically Richest and Most Endangered Ecoregions. CEMEX, Mexico City, Mexico.
[25] Paugy, D., Lévêque, C. and Teugels, G.G. (2003) Poissons d'eaux douces et saumâtres de l'Afrique de l'Ouest [The Fresh and Brackish Water Fishes of West Africa]. Tomes 1 and 2. IRD Editions, France.
[26] Kouame OML, Jengre N, Kobele M, Knox D, Ahon DB, Gbondo J, Gamys J, Egnankou W, Siaffa D, Okoni-Williams A and Saliou M. (2012). Key Biodiversity Areas identification in the Upper Guinea forest biodiversity hotspot. Journal of Threatened Taxa 4(8): 2745-2752.

Table 5: Summary table for HCV results from the Wonegizi PPA including the Liberian interpretation from the national toolkit.

HCV	DEFINITION	LIBERIAN INTERPRETATION	PRESENT	POTENTIAL	ABSENT
1	**Species diversity:** Concentrations of biological diversity including endemic species, and rare, threatened or endangered (RTE) species that are significant at global, regional or national levels.	**1.1** Protected Areas			
		1.2 Concentrations of RTE species			
		1.3 Concentrations of endemic species			
		1.4 Critical temporal concentration of species			
2	**Landscape-level ecosystems and mosaics:** Large landscape-level ecosystems and ecosystem mosaics that are significant at global, regional or national levels, and that contain viable populations of the great majority of the naturally occurring species in natural patterns of distribution and abundance.	**2.1** Landscape-level ecosystems and mosaics			
3	**Ecosystems and habitats:** Rare, threatened, or endangered ecosystems, habitats or refugia.	**3.1** Ecosystems and habitats			
4	**Ecosystem services:** Basic ecosystem services in critical situations including protection of water catchments and control of erosion of vulnerable soils and slopes.	**4.1** Water catchments			
		4.2 Erosion control			
		4.3 Fire prevention			
5	**Community needs:** Sites and resources fundamental for satisfying the basic necessities of local communities or indigenous peoples (for example for livelihoods, health, nutrition, water), identified through engagement with these communities or indigenous peoples.	**5.1** Basic needs of local communities			
6	**Cultural values:** Sites, resources, habitats and landscapes of global or national cultural, archaeological or historical significance, and/or of critical cultural, ecological, economic or religious/sacred importance for the traditional cultures of local communities or indigenous peoples, identified through engagement with these local communities or indigenous peoples.	**6.1** Cultural values			

HCV 1: Concentrations of biodiversity values

HCV 1 focuses on the fauna and flora within the project zone, paying special attention to rare, threatened, endangered, and endemic species. Following the Liberian toolkit, this HCV has four sub-categories.

1.1: Protected areas

HCV	LIBERIAN DEFINITION	FINDING
1	**1.1** Areas that have been legally gazetted as protected areas and meet IUCN's protected area categories I-V.	ABSENT

To commit to protecting at least 30% of existing forests and to define new categories of protection, Liberia approved the Act Establishing Protected Forest Areas Network (PA Act) in 2003. The Wonegizi PPA was formerly part of North Lorma National Forest, created in 1959 by the Government of Liberia, together with Wologizi PPA, but they split under the PA Act. It is now designated to become a Multi-Use Reserve (Table 6) which is classified as an IUCN Category VI protected area. This category of protected area is defined as an area that includes the sustainable use of forest resources. The Wonegizi PPA shares a border with the Massif du Ziama Biosphere Reserve in Guinea and is 2 km from Wologizi. However, neither of these neighbouring protected areas fall within the IUCN categories I-V. Following the Liberian toolkit, to be considered HCV 1.1 the area must form part of an IUCN Category I-V protected area, and therefore this HCV is absent in the Project Zone.

Table 6: Definitions of Liberian protected area categories as defined in the National Interpretation of HCVs for Liberia.

Protected Area Categories	Definition	Rules
National Forests	An area that is legally set aside for sustainable regulated commercial forest product extraction, hunting and the preservation of essential environmental functions performed by the forest.	Permitted acts include Class A mineral rights, access to licensed and managed commercial forest product extraction unless local restrictions are imposed by the FDA.
Multiple Sustainable Use Reserves	An area set aside by regulation for a fixed period to allow sustainable use of forest products including subsistence and potentially licensed and community forestry schemes.	Acts prohibited include farming and commercial timber extraction.

1.2: Concentrations of rare, threatened or endangered species

HCV	LIBERIAN DEFINITION	FINDING
1	**1.2** Areas holding significant concentrations of rare, threatened or endangered (RTE) plant or animal species.	PRESENT

Following the Liberian toolkit, an HCV 1.2 may be considered present if (i) viable populations of species listed as endangered (EN) or critically endangered (CR) on the IUCN RedList, listed in Appendix I or II of CITES, or are fully protected under national law, or (ii) there is any breeding pair of species considered exceptional conservation significance, or (iii) any species found that is CR on the IUCN RedList. For Wonegizi PPA, these three criteria have been met, with numerous RTE species found during field surveys (Figure 5a), as well as the CR West African Chimpanzee subspecies (*Pan troglodytes verus*) photographed by camera traps in 2013. Details about the presence of each species of conservation significance in the project zone is explained below. The full list of HCV species is found in Appendix B.

Mammals

Liberia has an estimated 150 mammal species, and of these 12 are VU, EN, or CR and 28 are fully protected by national law. In Wonegizi PPA, 20 HCV mammal species were identified during camera trapping and transects in 2013 and the field assessment in 2018.

The presence of numerous ungulates was confirmed during the field assessment. One sign of African Forest Buffalo (LC; *Syncerus caffer nanus*), two of Bongo (NT; *Tragelaphus eurycerus*), 17 of Red River Hog (LC; *Potamochoerus porcus*), and one sign and one call of Water Chevrotain (LC; *Hyemoschus aquaticus*) were recorded during the survey, all of which are fully protected by Liberian law. Footprints of the CITES Appendix II listed Ogilby's Duiker (LC; *Cephalophus ogilbyi*) and Yellow-backed Duiker (NT; *Cephalophus silvicultor*) were also identified. One footprint of Jentink's Duiker (EN; *Cephalophus jentinki*) was observed, a species listed in CITES Appendix I and fully protected by Liberian law. In addition, one camera trap photo of a Zebra Duiker (VU; *Cephalophus zebra*), listed on CITES Appendix II, was taken in July 2013.

Five groups of Sooty Mangabey (NT; *Cercocebus atys*) and one group of seven individual Diana Monkeys (VU; *Cercopithecus diana*) were heard during transects in 2013, they are listed on Appendix II and Appendix I of CITES respectively. Diana monkeys live exclusively in mature forest, either primary or old secondary forests[27], and therefore may be considered an indicator species of forest age and quality. Therefore, the presence of this primate group may also indicate that the area qualifies as HCV 3. The West African Chimpanzee (CR; *Pan troglodytes verus*), which is listed on CITES Appendix I, was recorded by camera traps in 2013 at two locations and is believed to have a viable population within the Wonegizi forest. No signs of any primates were identified during the field assessment, except for the Demidoff's Dwarf Galago (LC; *Galagoides demidoff*) which is listed on CITES Appendix II. Two of these nocturnal primates were seen together, and a third was heard at another location. The rapid assessment could not

[27] Oates, J.F., Gippoliti, S. & Groves, C.P. 2016. *Cercopithecus diana*. The IUCN Red List of Threatened Species 2016.

confirm the presence of other primates, however the local guides said that the chimpanzees and monkeys do still occur in the forest. Further surveys would be needed to estimate population size. Hunting pressure is very high, therefore there is the possibility that remaining populations are restricted and elusive.

Camera traps also recorded images of Liberian Mongoose (VU; *Liberiictis kuhni*), a fully protected species under Liberian law, at six sites. This biome restricted species, endemic to Liberia and Ivory Coast, is highly elusive and was first recorded in Liberia in Sapo National Park in 2012[28]. The records from Wonegizi in 2013 are the first of this species in North-Western Liberia[29]. The presence of the Liberian Mongoose was confirmed during the field assessment in three locations through their fresh tracks. The West African Linsang (VU; *Poiana leightoni*) was also recorded across ten camera trap sites in 2013 and these were the first records of the species in Western Liberia[14]. However, the presence of the West African Linsang was not confirmed during the field assessment. The assessors also found evidence of a Leopard (VU; *Panthera pardus*) by the characteristic scratch marks left on a root. Leopards are fully protected in Liberia and are listed in CITES Appendix I. In addition, camera trap photos of three species of pangolin, all listed on CITES Appendix II and protected by Liberian law, were taken in 2013.

In 2013, a Pygmy Hippopotamus (EN; *Choeropsis liberiensis*) was recorded at one location by camera traps, indicating that this species is present within the Project Zone. Pygmy Hippopotamus are listed on Appendix II of CITES and are fully protected by Liberian law. During the most recent field assessment, presence of Pygmy Hippopotamus was confirmed with prints recorded by the banks of two small streams near larger and more permanent streams. However, occurrence may be in very low densities and there is the possibility of individuals living outside of the Wonegizi PPA in lower elevation areas.

A Forest Elephant (VU; *Loxodonta africana cyclotis*) track was recorded during surveys in 2013 and subsequent camera traps surveys recorded videos of Forest Elephants at three locations in the same year. The presence of Forest Elephants was confirmed in the Northern half of the Project Zone during the field assessment. Signs were recorded including four separate tracks, three locations with dung, and three trails or tree damage created by individuals passing within the last three months. The Forest Elephant is listed on Appendix I of CITES and is fully protected by Liberian law, and it is likely they are using the Project Zone as a migratory route (see HCV 1.3).

Birds

A total of 114 bird species were encountered and identified during transects, point counts and mist netting within the 2013 Wonegizi Biodiversity survey. During the field assessment, another 12 species were identified bringing the total to 126 species. Of these, 21 HCV species were observed in the Project Zone.

The Vulnerable White-necked Picathartes (*Picathartes gymnocephalus*) is listed on CITES Appendix I and is considered a flagship conservation species of the Upper Guinean forests. Given the rocky environment that characterises the Wonegizi forest it has potential to be an important site for this species

[28] Vogt T, Forster B, Quawah JN, Ransom C, Hodgkinson C and Collen B. (2012). First records of Liberian Mongoose *Liberiictis kuhni* in Sapo National Park, southeast Liberia. *Small Carnivore Conservation*, 47: 35–37.

[29] Empowering local stakeholders for REDD+ implementation in Liberia: biodiversity survey report of Wakolor and Wonegizi. FFI Liberia. By Dr. S.T. Osinubi, J.D. Onoja, Dr. M.N. Molokwu and Dr N. Ndam.

and in 2013 a total of 7 colonies were found during surveys with a total of 38 nests recorded, most of which with breeding pairs. Some of the Picathartes colonies were found very near Vetesu village.

All hornbill, parrot, and turaco species are fully protected under Liberian national regulation and thus fall under the category of HCV 1.2. The Yellow-casqued Hornbill (*Bycanistes cylindricus*) is a species that requires primary forest but also makes use of edge habitats such as fallow and farmed areas and is Vulnerable on the IUCN Red List. It was encountered across all transects in 2013 and during the field assessment was encountered on four occasions. Other hornbill species encountered on transects in 2013 and confirmed during the field assessment were the Black-casqued Hornbill (LC; *Ceratogymna atrata*), the West African Pied Hornbill (LC; *Lophoceros semifasciatus*), the Dwarf Hornbill (LC; *L. camurus*), the White-crested Hornbill (LC; *Horizocerus albocristatus*) and the Western Little Hornbill (LC; *H. hartlaubi*). The Brown-cheeked Hornbill (VU; *Bycanistes cylindricus*) had not been recorded in 2013 but was seen on three occasions during the recent field assessment.

The Timneh Parrot (*Psittacus timneh*) was encountered in 2001 and one incidental sighting of 3 individuals in 2013, the species has recently been declared Endangered on the IUCN Red List mainly due to habitat destruction and the capture of live individuals for the pet trade. No individuals were recorded during this field assessment. Further surveys will be needed to identify whether the species is still present in the area. Two species of turaco were also encountered during both 2013 and 2018 surveys: the Yellow-billed Turaco (LC; *Tauraco macrorhynchus*) and the Great Blue Turaco (LC; *Corythaeola cristata*) both listed on CITES Appendix II. The Green Turaco (LC; *Tauraco persa*) was heard on one occasion in 2013, and two Violet Turacos (LC; *Musophaga violacea*) were seen on one occasion during the latest field assessment.

In addition to the above, all birds of prey are fully protected by Liberian law. In 2013, nine bird of prey species were recorded including Shelley's Eagle-owl (NT; *Bubo shelleyi*) and the Crowned Eagle (NT; *Stephanoaetus coronatus*). During the field assessment, only two species were recorded, the Akun Eagle-owl (LC; *Bubo leucostictus)* and the Palm-nut Vulture (LC; *Gypohierax angolensis*).

Amphibians

No previous surveys in the area had accounted for amphibians, therefore during the field assessment, specific amphibian surveys were carried out to fill this important gap. A total of 18 species were identified in the field including *Conraua alleni* (VU). Amphibians are good indicators of habitat quality. For example, the presence of *Amietophrynus maculatus* can indicate that a habitat has been disturbed or converted[30]. Alternatively, *Conraua alleni*¸ is a species that is sensitive to human disturbances[31]. In the Project Zone we recorded *C. alleni* in two locations and had no records of *A. maculatus*, indicating a high forest quality with little human disturbance to their habitat.

Two HCV 1.2 species were identified during the field assessment. One adult male *Phrynobatrachus annulatus* (EN) was seen in mature forest at 600m asl. One adult female *Sclerophrys superciliaris chevalieri* (NT) was seen at 664m asl, which is listed on CITES Appendix I and is culturally significant as some local tribes believe that it has magic.

[30] IUCN SSC Amphibian Specialist Group. 2016. *Sclerophrys maculate*. The IUCN Red List of Threatened Species 2016: e. T84519931A3018482.

[31] Rodel M-O, Schiotz A. 2004. *Conraua alleni*. The IUCN Red List of Threatened Species 2004: e.T58250A11757606.

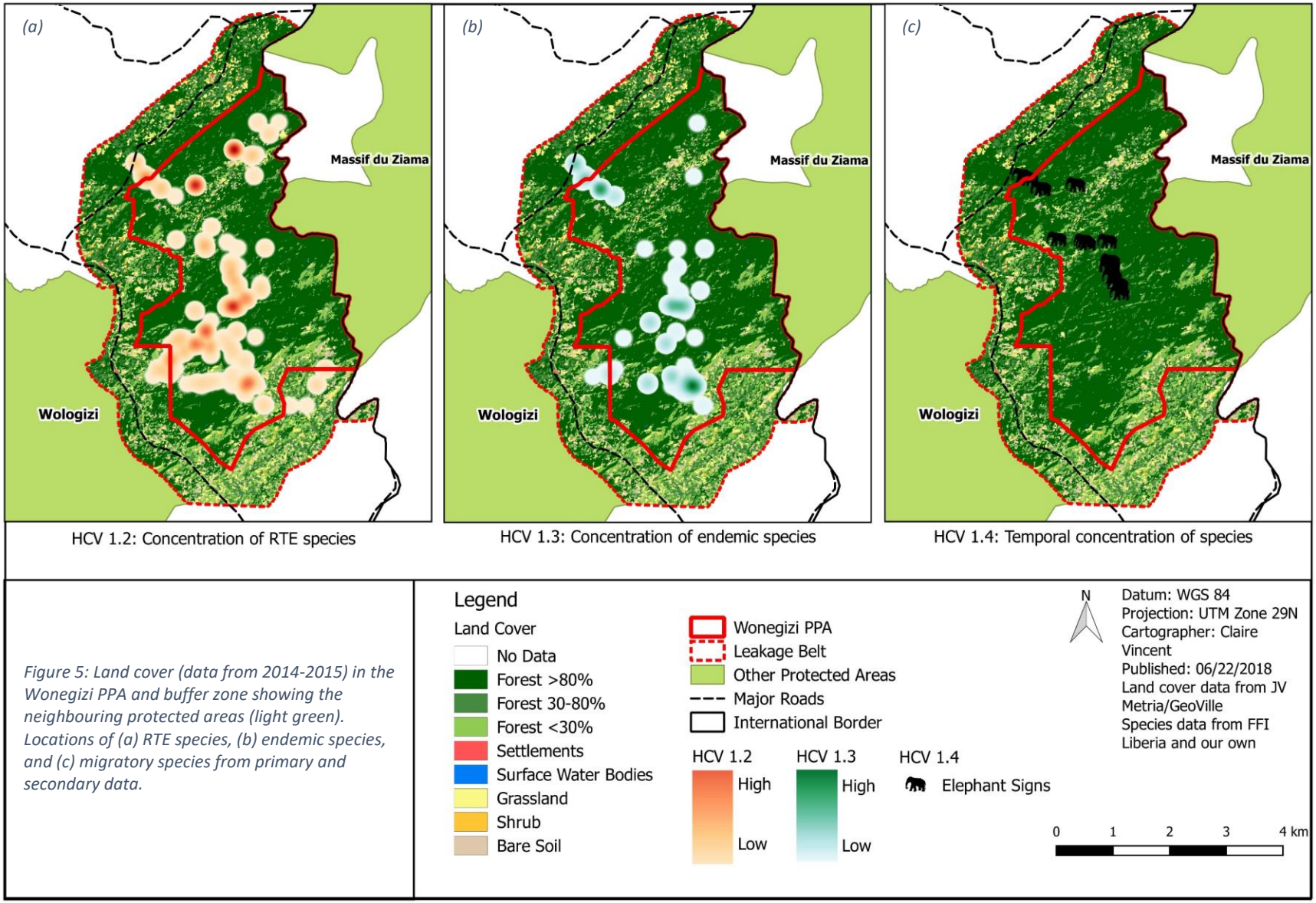

Figure 5: Land cover (data from 2014-2015) in the Wonegizi PPA and buffer zone showing the neighbouring protected areas (light green). Locations of (a) RTE species, (b) endemic species, and (c) migratory species from primary and secondary data.

Botany

A total of 374 plant species have been recorded in Wonegizi during two surveys by Jongkind in 2010 and 2013. The field assessment focused on high-value timber species that the national toolkit identifies as HCV species. The field assessment recorded 69 species of which 28 were not recorded by Jongkind. The endemic *Neolemonniera clitandrifolia* (EN) was found during surveys in 2010, but was not recorded in either 2013 nor 2018. Six high-value timber species were confirmed during the field assessment. These included *Heriteria utilis* (VU), *Tetraberlinia tubmaniana* (VU), *Lophira alata* (VU), *Entandrophragma angolensis* (VU), *Piptadeniastrum africanum* (not assessed) and *Triplochiton scleroxylon* (LC). *Lovoa trichiodes* (not assessed) was recorded in both 2010 and 2013 surveys but was not confirmed in the field assessment.

1.3: Concentrations of endemic species

HCV	LIBERIAN DEFINITION	FINDING
1	**1.3** Areas holding significant concentrations of endemic plant or animal species.	PRESENT

Only one species, the vulnerable African Pine (*Tetraberlinia tubmaniana*), was recorded that is endemic only to Liberia. Notwithstanding this, many species endemic to the Upper Guinea Forests were recorded from a variety of taxonomic groups (Figure 5b). As Liberia has the most intact forest remaining in the Upper Guinea forest, it plays a critical role in supporting these species.

Of the 402 plants identified during the 2010, 2013, and 2018 botany surveys, 68 species (17%) are Upper Guinea endemics. During the field assessment, two Upper Guinea endemic species were recorded *Brachystegia leonensis* and *Dialium aubrevillei* which had not been identified in earlier surveys. This rate of endemism is high compared to other countries within the same ecoregion, but not for Liberian forests. Sapo and Cestos-Senkwehn both had a greater percentage of endemic plants, however certain endemic species recorded were unique to Wonegizi and absent in these other forests. This highlights the importance of preserving the remaining intact forests of Liberia, as they harbour a high concentration and variety of Upper Guinea endemic botanical species some of which are at higher risk due to their high value as timber species.

The Project Zone appears to have significant concentrations of two endemic small carnivore species that have not been recorded in high numbers elsewhere in Liberia. These are the Liberian Mongoose and the West African Linsang (both endemic to Ivory Coast and Liberia). Both these highly elusive species were recorded on multiple occasions across multiple sites indicating they may both have viable and healthy populations in need of protection. The presence of the Pygmy Hippopotamus was confirmed during the field assessment, and this species is an Upper Guinea endemic. This endangered nocturnal mammal is found in Ivory Coast, Guinea, Sierra Leone, and Liberia. It relies on streams and rivers, and our records found their tracks on the edge of small streams near more permanent water courses.

Figure 6: Photographs taken in the Project Zone of HCV 1.2 and 1.3 species. (a) West African Chimpanzee mother and baby taken by camera traps in 2013. (b) Adult female Sclerophrys superciliaris chevalieri *taken during the recent field assessment in 2018. (c) Pygmy Hippopotamus taken by camera traps in 2015. (d) Trail created by Forest Elephants near the northern boundary of the PPA taken in 2018.*

The bird data from the IBA assessment carried out in 2001 identified 5 bird species endemic to the Upper Guinea Forest. Three of these species have since been recorded again in the Project Zone. Surveys undertaken in 2013 found a total of 7 colonies of White-necked Picathartes (VU; *Picathartes gymnocephalus*), including many breeding pairs, indicating that the Project Zone contains a significant concentration of this species. In addition, the most recent field assessment confirmed the presence of two more endemic bird species; the Green-tailed Bristlebill (NT; *Bleda eximius*) and the Yellow-bearded Greenbul (VU; *Criniger olivaceus*). Both of these species are of global conservation concern as outlined in the national toolkit.

Of the four species of amphibians strictly endemic to Liberia none were encountered during the surveys carried out in 2018. However, many of the species recorded were Upper Guinea endemics. These included the Banded Banana Frog (LC; *Afrixalus fulvovittatus*), Allen's Slippery Frog (VU; *Conraua alleni*), Big-eyed Forest Treefrog (LC; *Leptopelis macrotis*), Sierra Leone Water Frog (NT; *Odontobatrachus natator*), Ringed River Frog (EN; *Phrynobatrachus annulatus*), *Phrynobatrachus fraterculus* (LC), Liberian River Frog (NT, *Phrynobatrachus liberiensis*), *Phrynobatrachus phyllophilus* (NT), *Phrynobatrachus tokba* (LC), Western Long-fingered Frog (not assessed; *Cardioglossa occidentalis*), and African Giant Toad (NT; *Sclerophrys superciliaris chevalieri*). Of the species mentioned above, *P. phyllophilus* and *P. fraterculus* had the most significant encounter rates including numerous juveniles, indicating that the Project Zone supports a viable population of these two endemic species.

1.4: Critical temporal concentrations of species

HCV	LIBERIAN DEFINITION	FINDING
1	**1.4** Seasonal or temporal concentration of species.	PRESENT

The IBA assessment from 2001 did not identify any migratory bird species present in the area. The field assessment did not take place in a season when migratory birds would be present, so we were unable to confirm or deny the absence of migratory birds in the Project Zone. However, personal observations from the Liberian ornithologist indicated that certain species, like the European Pied Flycatcher (*Ficedula hypoleuca)* are likely to migrate to this forest to overwinter.

A recent study by Lindsay *et al*[32] found that 76% of African Elephants are found in transboundary ranges. This report stresses the fact that conservation issues need to address these transboundary areas at a regional level rather than working only at a national level. They identified 45 populations of African Elephants across the continent whose populations are transboundary. Among these was the Ziama-Wonegizi population which they estimated at 114 individuals. Although their presence has been documented, the population size of Forest Elephants in Wonegizi is still unknown. The population in the Massif de Ziama across the border in Guinea has reduced drastically since 2004 from around 200 individuals to a mere 15 recorded through a survey conducted in 2017 by FFI Guinea[33]. This highlights the importance of the Wonegizi forest as a seasonal habitat and perhaps even a refuge for this transboundary population. The presence of Forest Elephants in Wonegizi was confirmed during the field assessment with the identification of fresh tracks and dung around the Northern half of the Project Zone (Figure 5c). Through conversations with local hunters and community officers they confirmed the annual presence of Elephants in this area and gave anecdotal evidence that the Elephants come from Ziama Massif, and that they cross the national road to access the Wologizi forest.

[32] Lindsay, K., Chase, M., Landen, K., & Nowak, K. (2017). The shared nature of Africa's elephants. *Biological Conservation*, 215: 260-267.

[33] Sloane. L. (2017). Forest elephants decline drastically. FFI News. Available at: https://www.fauna-flora.org/news/forest-elephants-decline-drastically

The field assessment identified 18 species of frogs and toads within the project zone. The assessment took place at the beginning of the rainy season which coincided with the amphibian breeding season. Amphibians are known to migrate to wetland refugia during drier seasons (i.e. swamps, big streams) to avoid desiccation[34]. Given the large number of amphibians found throughout the project zone and the few permanent water sources, there is the potential for these amphibians to migrate to these permanent water sources during the dry season. These permanent water bodies will be covered by HCV 3 and 4.1, therefore recommendations towards those HCV will cover the potential amphibian seasonal dependence on these areas.

HCV 2: Landscape-level ecosystems and mosaics

HCV	LIBERIAN DEFINITION	FINDING
2	**2.1** A contiguous block of unfragmented large landscape level forest, where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance.	PRESENT

For an area to be considered HCV 2 under the Liberian toolkit, the area must be at least 50,000 ha in size and consist of a contiguous block of unfragmented natural forest. What used to be the North Lorma National Forest, covering roughly an area of 100,000 ha was later separated into the Wonegizi and Wologizi PPAs. The two PPAs are split by the main road to Voinjama which cuts through the forest blocks. The Wonegizi PPA leakage belt, which is included in the Project Zone, bridges the gap between the two forests. Recent road improvements and access will most likely lead to an increase in deforestation in the area adjacent to the road. As fragmentation between the two blocks increases we may no longer consider this to be contiguous habitat but rather two separate forest blocks.

The Wonegizi PPA on its own covers 37,979 ha, not enough to adhere to the HCV 2 criteria. However, it forms a contiguous block of natural forest across the international border into Guinea where the Ziama Massif Biosphere Reserve is located (Figure 7). Ziama Massif has an area of 91,360 ha of which 89,000 ha is forested[35], therefore, together with the forested area within Wonegizi PPA, the landscape far exceeds the 50,000 ha threshold. Between these transboundary reserves, they form one of the largest remaining forest complexes in the Upper Guinea Forest. Therefore, even though Wonegizi PPA does not meet the threshold size on its own, it is part of a larger landscape that provides connectivity functions, and consequently meets the HCV 2 criteria.

As was discussed under HCV 1, there are viable populations of naturally occurring and endemic species in the Wonegizi forest. These species comprise almost all expected and naturally occurring species in this landscape, living in natural patterns of distributions. Therefore, this contiguous block of forest serves as a refuge for many of these species, and if this habitat were not protected adequately many such species would likely be at higher risk.

[34] Sinsch, U. (1990). Migration and orientation in anuran amphibians. *Ethology Ecology & Evolution*, 2(1), 65-79.
[35] Hansen, M. C., et al. (2013). "High-Resolution Global Maps of 21st-Century Forest Cover Change." Science 342 (15 November): 850–53. Data available from: earthenginepartners.appspot.com/science-2013-global-forest

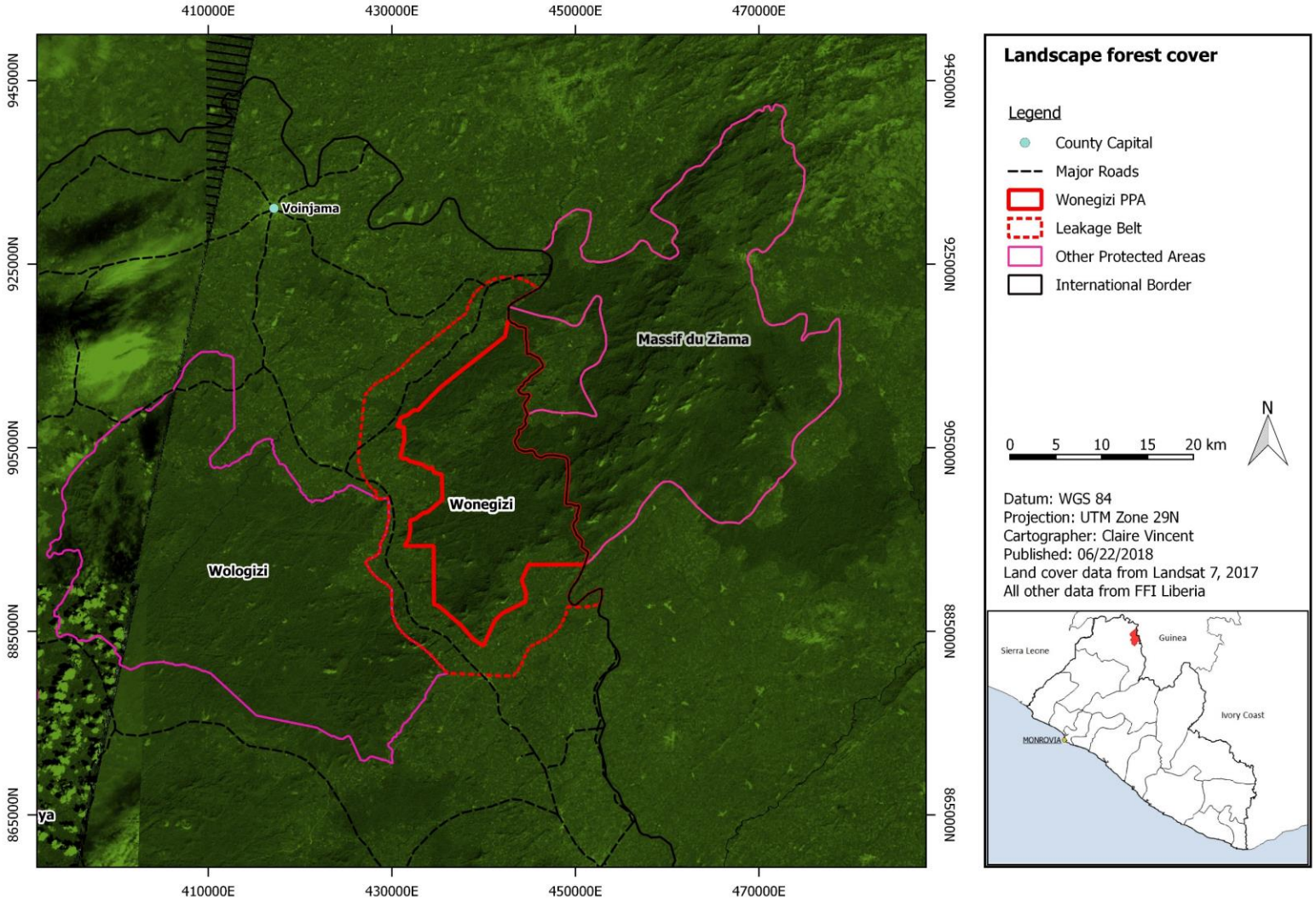

Figure 7: Landsat 7 data from 2017 showing the forest cover at the landscape level (darker green areas show intact forest). The Project Zone is outlined in red and the neighbouring protected areas are outlined in pink.

HCV 3: Ecosystems and habitats

HCV	LIBERIAN DEFINITION	FINDING
3	**3.1** Ecosystems that are naturally rare or are threatened by present or future processes.	PRESENT

The Wonegezi PPA covers a large portion of the remaining Upper Guinean Forest which is of national, regional, and international significance. This area is also internationally designated as a Key Biodiversity Area (KBA), and an Important Bird Area (IBA), forming part of the Upper Guinea Forest Endemic Bird Area (EBA); one of only 8 in the world[36].

The Project Zone encompasses the Wonegizi mountain range, one of the few important montane habitats remaining in the Upper Guinean Forests. Montane landscapes (above 600m asl) in the Upper Guinea Forest are very rare (0.4% of the region is montane forest) and represent a band of high biodiversity because they may contain species restricted to higher altitude conditions and which are more likely to be endemic (Figure 8). In addition, these montane forests have acted as a glacial refuge for some lowland Rubiaceae timber species which can now only be found in their surroundings[37]. The transition area between lowland and montane forests is also a naturally rare ecosystem and has the highest levels of species richness in the Guinean Moist Forests ecoregion[38]. This transition area can be found in the Project Zone and the Wonegizi mountain range is known to contain one of the last remaining transition forests in Liberia[39].

Both lowland and montane forests are naturally rare, but they are also rare due to anthropogenic actions. Population growth in the region is creating an increased demand for timber and farmland, threatening the continued existence of this habitat. The amount of tree cover loss in Lofa County between 2001-2016 was 141,037 ha, or 14% of the land area of the county[40]. The deforestation rate has increased since the end of the civil war and with chainsaws becoming more readily available in remote areas. These current and future threats to this ecosystem reinforce its designation as HCV 3.

The presence of some species of leaf litter frogs indicate high forest quality and are found only in forested areas that have not been fragmented[41]. During the field assessment, two such species were identified *Phrynobatrachus fraterculus* and *P. annulatus*, indicating that the locations in which they were found represent intact areas of high quality forest habitat.

---

[36] BirdLife International (2013) Endemic Bird Area Factsheets. Available from: http://www.birdlife.org/datazone/

[37] Robbrecht E. (1996). Geography of African Rubiaceae with reference to glacial rain forest refuges. In *The biodiversity of African plants*.564-581. Springer, Dordrecht.

[38] Darwall, W., Polidoro, B., Smith, K., and Somda, J. (2015). Ecosystem Profile Guinean Forests of West Africa Biodiversity Hotspot.

[39] East, R. (1990). Status of antelope communities and identification of regional conservation priorities. Antelopes: Global Survey and Regional Action Plans, 13, 144.

[40] Hansen, M. C., P. V. Potapov, R. Moore, M. Hancher, S. A. Turubanova, A. Tyukavina, D. Thau, S. V. Stehman, S. J. Goetz, T. R. Loveland, A. Kommareddy, A. Egorov, L. Chini, C. O. Justice, and J. R. G. Townshend. 2013. "High-Resolution Global Maps of 21st-Century Forest Cover Change." Science 342 (15 November): 850–53. Accessed through Global Forest Watch on [15/03/18]. www.globalforestwatch.org

[41] Hillers, A., Veith, M., & Rödel, M-O. (2008). Effects of forest fragmentation and habitat degradation on West African leaf-litter frogs. Conservation Biology, 22(3), 762-772.

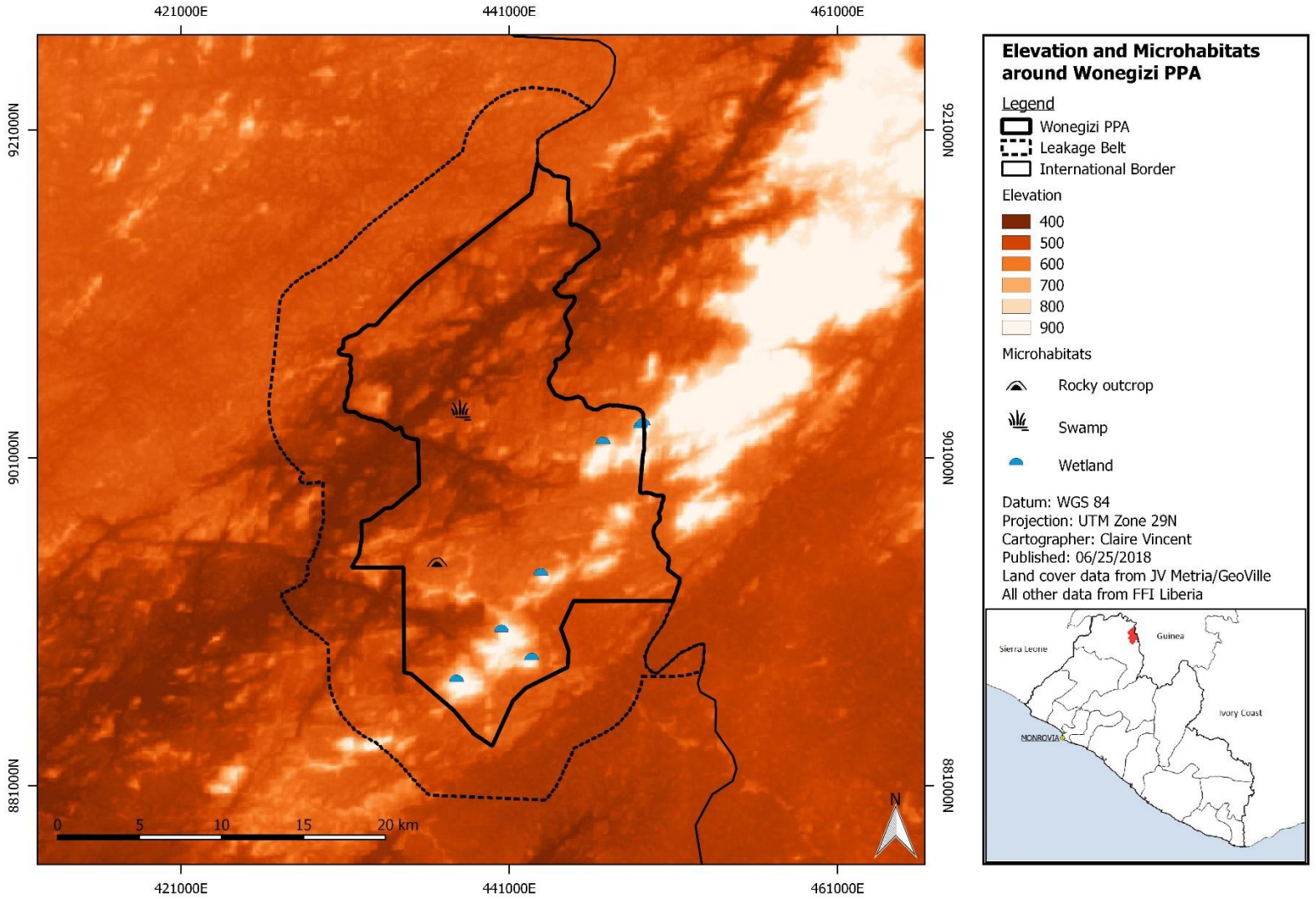

Figure 8: Elevation of the Project Zone indicating areas of montane forest (above 600m) that are classified as HCV 3 habitats. Microhabitats are indicated as points on the map and were identified in the field (swamp, rocky outcrop) or through satellite imagery (wetlands).

There are also some localized microhabitats within the project zone. A rocky outcrop was found that forms a vast savannah. This provides habitat for different species than would be found in the lowland forests, exemplified by the track of a rock python that was found during the biodiversity field survey. During the field assessment, one swamp (roughly 50 x 200m in size) was identified from which abundant frog calls were heard, indicating that it acts as a breeding site for amphibians.

Six wetlands were identified from satellite imagery and we attempted to access two of them during the field assessment. However, they were surrounded on all sides by steep cliffs making them inaccessible by the field team. When the local hunters and guides were consulted on these areas they said that they had never entered this area of the forest and that they had no knowledge on how to access the wetland. This indicates the potential for a pristine wetland and wildlife habitat that may be undisturbed by human presence, for those species that can surpass the cliffs (e.g. primates, birds, amphibians).

HCV 4: Ecosystem services

HCV 4 focuses on critical ecosystem services, specifically regulating and supporting services. Following the Liberian toolkit, this HCV has three sub-categories.

4.1: Areas critical to water catchments

HCV	LIBERIAN DEFINITION	FINDING
4	**4.1** Areas that are critical for the protection of water catchments.	PRESENT

Wonegizi PPA forms part of the West African Watershed, and its regional importance is highlighted above in the Biogeographic Context section. At a national scale, the Wonegizi PPA provides part of the watershed for two major Liberian rivers: the Lofa and the St. Paul. The Lawa River flows into the Lofa, and the Via River flows into the St. Paul (Figure 9). The majority of the Lofa river's watershed is within the Wonegizi PPA, north of the Wonegizi mountain range, and thus this area is crucial for all who depend on the river downstream. South of the Wonegizi mountain range, the water flows into the St. Paul river. The St. Paul river reaches the sea at the capital Monrovia, and also leads to the largest mangrove habitat in the country.

At a local scale, the forest protects the watershed that forms streams and rivers that the local communities use for domestic use and fishing. From community consultations, five examples of communities relying on the water for basic services were identified (Figure 9). First, people from the Medina community use the Lawa River for washing, drinking, and fishing, providing a direct ecosystem service to them because of its close proximity. Second, people from Nekebozu village use the creek for drinking water, and it is traditionally protected by the people who do not allow any cutting of trees near the water. Third, the Vetesu community uses the Nyaza River for fishing and they have also protected the area locally. Fourth, those from Konia village depend on the Benee River and they have local bylaws

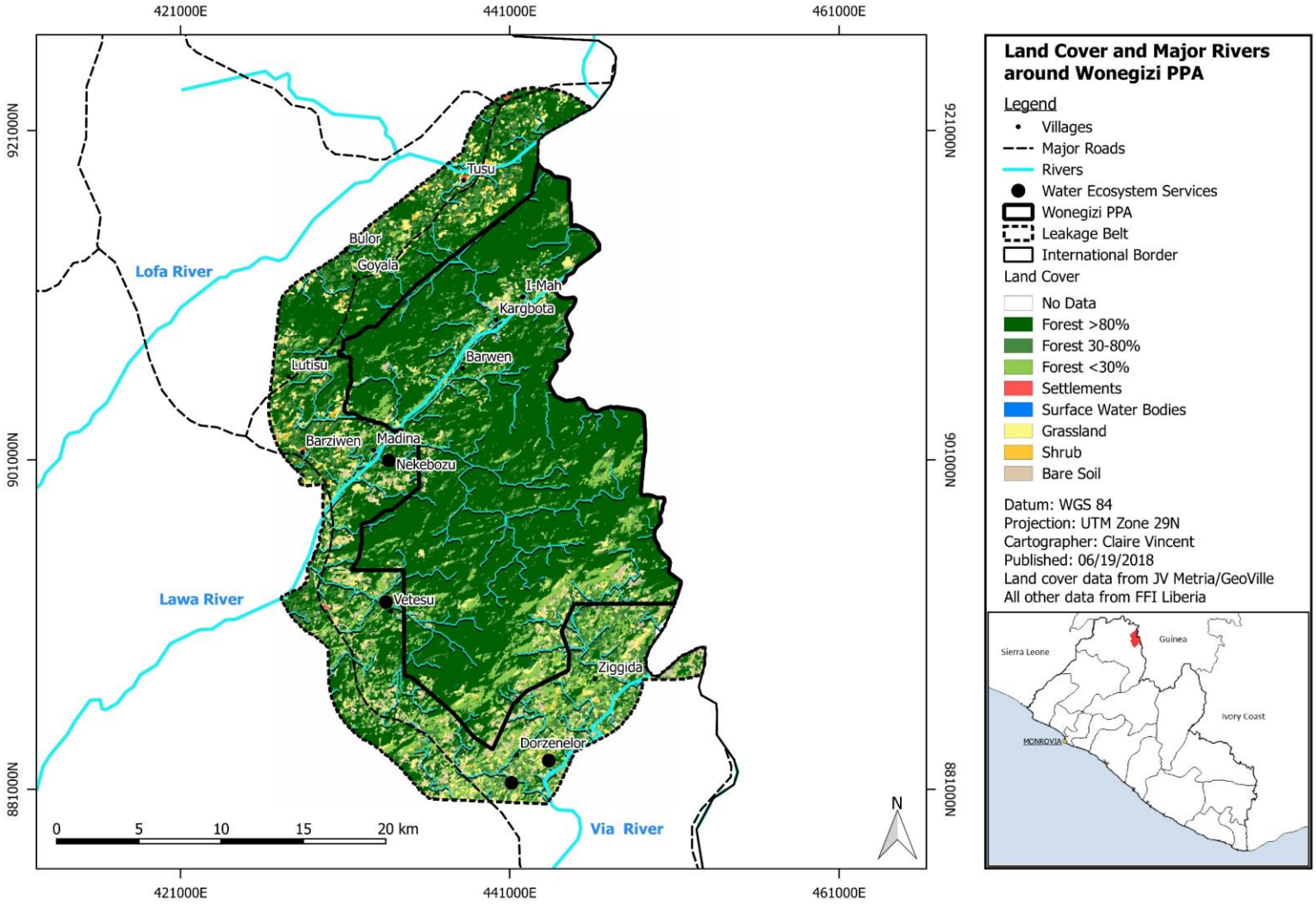

Figure 9: Land cover (data from 2014-2015) in the Wonegizi PPA and buffer zone showing large streams and forest-edge communities. Blue stars show locations indicated by community members that provide an ecosystem service either as freshwater source or fishing sites (HCV 4.1). Dark green areas indicate forest that has over 80% density meaning that these areas can act as a fire block (HCV 4.3).

against cutting any trees at the river's edge. Fifth, the people of the Borni Hills use the Kpavah creek as their main source of drinking water, and they have preserved the trees around the source. These five examples show the importance of these water resources on the local communities, and their knowledge regarding the role that forests have in protecting their waterways.

4.2: Areas critical for erosion control

HCV	LIBERIAN DEFINITION	FINDING
4	**4.2** Areas that play a critical role in preventing erosion, especially in areas where the consequences could potentially be severe in terms of loss of productive land or ecosystems, cause damage to property or loss of human life.	PRESENT

The main identifier for HCV 4.2 is steep or mountainous areas, or areas with high rainfall where there is a high risk of erosion leading to catastrophic events. This is especially crucial in areas where there are human settlements near such high-risk areas. The Wonegizi PPA contains areas with steep slopes and heavy rain falls are frequent, especially during the rainy season from May to October with an annual rainfall of 2500mm. The risk to property and loss of life is small as the human settlements are well away from the steep hills and tend to be located in the lowlands near rivers and streams. The risk of erosion could however indirectly affect the communities surrounding these hills. The communities utilise the forest areas for NTFP collection and for freshwater sources which could be affected by erosion. In addition, farmland is located farther away from the villages, and some do occur in higher risk areas. If these farmlands were affected by landslides or erosion, the communities' livelihoods would as a result also be affected.

Following the national toolkit, areas can also be considered HCV 4.2 if they are playing a critical role in preventing erosion that may cause the loss of ecosystems. There are such critical ecosystems that were identified under HCV 3 and that occur in areas characterised by steep slopes (Figure 10). Therefore, such HCV ecosystems would be at risk from any potential erosion and landslides reinforcing the need to protect these steep-sloped areas.

4.3: Areas critical for fire prevention

HCV	LIBERIAN DEFINITION	FINDING
4	**4.3** Areas that serve as a barrier to the spread of destructive wildfires that can pose a threat to human life, property, economic activity, threatened ecosystems, species or important ecological processes.	PRESENT

A recent report from research in Ghana indicated that large areas of dense forest (over 80% density) can be influential in reducing the number of fires[42]. The report also found that high-density forest contributes to water retention and increases precipitation, as well as stabilising microclimates, which are all factors that lead to a reduced fire risk. As Ghana forms part of the Upper Guinea Forests and has similar climate to Liberia, we applied the same density threshold in the Project Zone for fire prevention.

[42] World Bank Group. In Press. (2018). Forest Smart Mining. WORLD BANK.

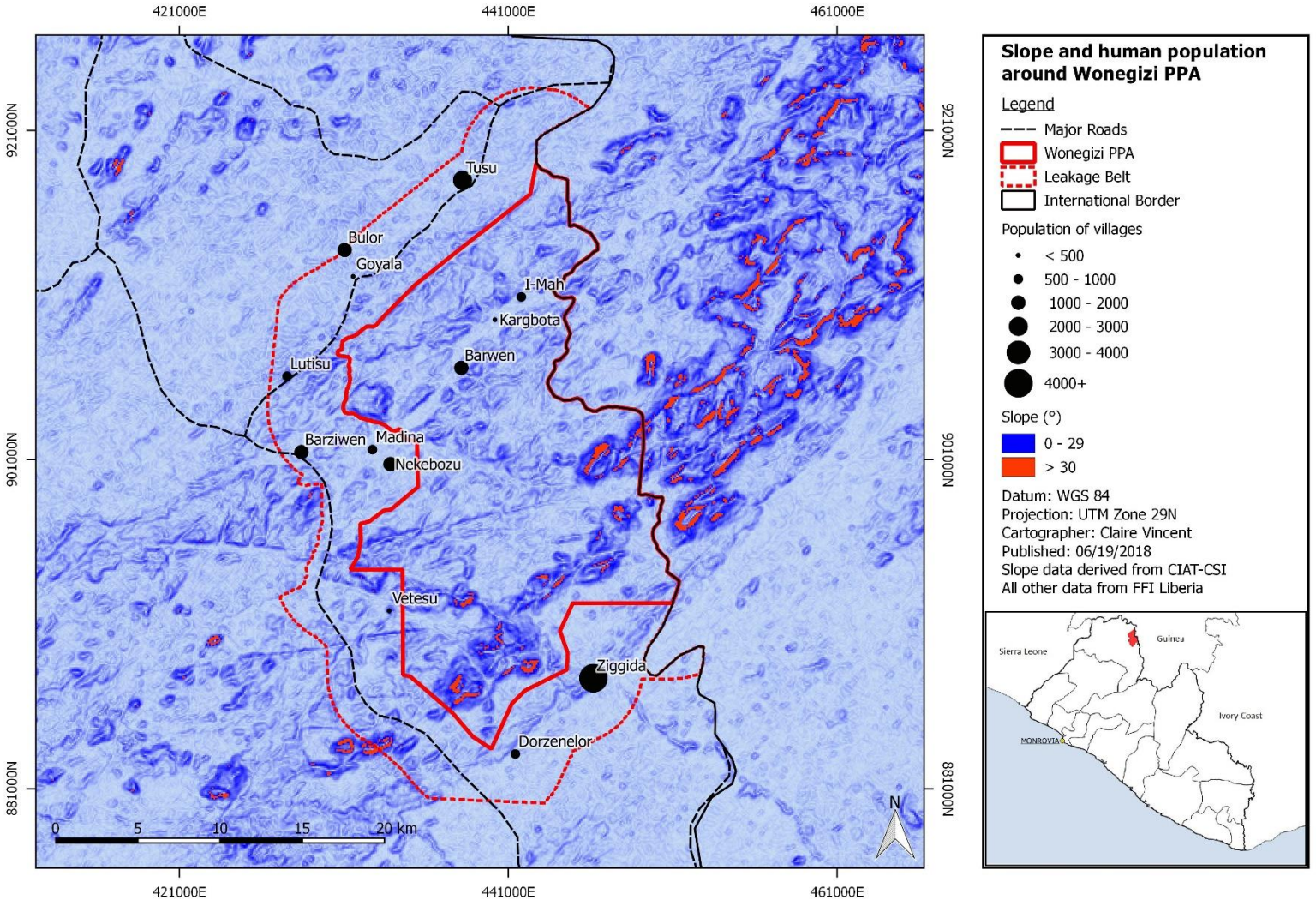

Figure 10: Slope (in degrees) of the terrain around the Wonegizi PPA, where the darker blue areas indicates steeper slope, and red shows slope greater than 30°. Forest-edge communities are shown with points relative to their population size, where larger points indicate higher populations.

Data collected from Global Forest Watch[43] shows that Lofa county is the most fire prone area in Liberia during the dry season, especially in grasslands and degraded areas. More than twice as many fires occurred in Lofa county than in any other, with over 1500 already started this year (Figure 11). Since the level of threat from fire in this region is high, it is of great importance to keep such natural fire barriers intact, especially when these are close to communities. Three quarters of the area of the Wonegizi PPA has over 80% forest density (Figure 9). Large patches of this dense forest are designated HCV 4.3 as they act as a fire break and decrease the risk of fires starting and spreading through the region. Other barriers could include wetlands and water-bodies, but these are covered under HCV 3 and 4.1.

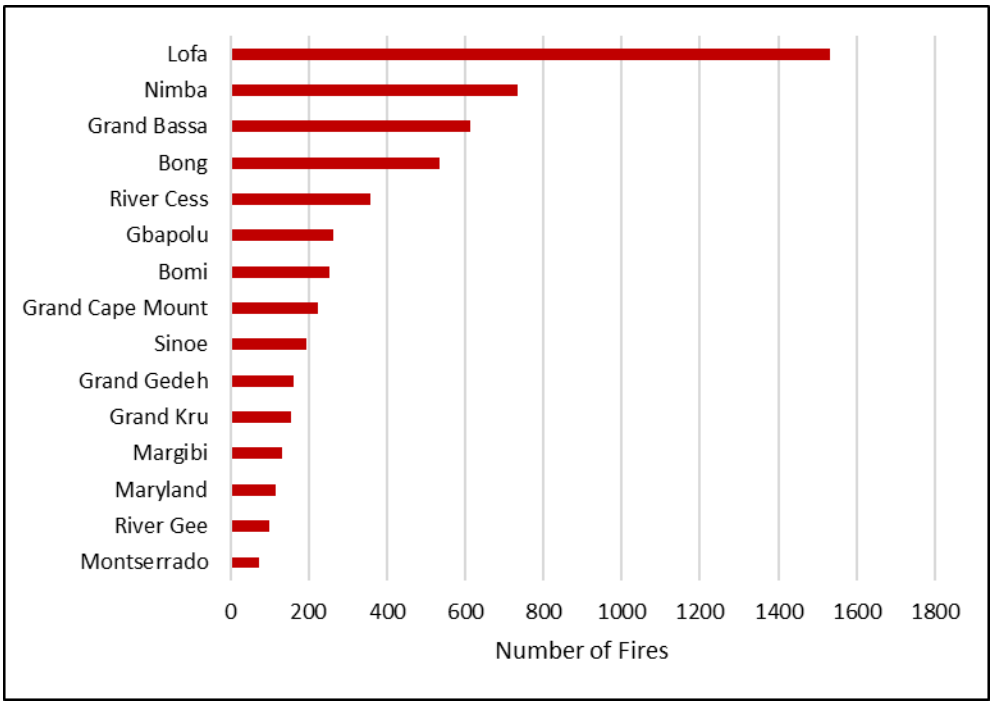

Figure 11: The number of fires recorded between January and May 2018 for each county in Liberia [43].

HCV 5: Basic needs of local communities

HCV	LIBERIAN DEFINITION	FINDING
5	**5.1** Sites and resources fundamental for the basic necessities of local communities or indigenous peoples (for livelihoods, health, nutrition, water, etc.), identified through engagement with these communities or indigenous peoples.	

[43] NASA "FIRMS Active Fires" accessed through Global Forest Watch on June 15th 2018. www.globalforestwatch.org

HCV 6: Cultural values

HCV	LIBERIAN DEFINITION	FINDING
6	**6.1** areas that are critical to the traditional cultural identity of local communities and includes areas of cultural, ecological, economic, religious or archaeological significance, identified in cooperation with such local communities.	

Stakeholder consultations

IV. Management & Monitoring

Threat assessment

Threats were assessed for the Project Zone through observational evidence in the field, informal interviews with community members, and through a literature review of potential threats for this zone. The threats are presented in Table 3 and each explained in more detail below. The following section outlines management and monitoring strategies to mitigate each threat.

Table 3: Threat table. Area, intensity, and permanence are from a scale of low (1) to high (3), and urgency is a sum of these values for each threat (from 3-9). Each threat is explained in more detail in the text.

	Threat to HCV	HCV threatened	Area	Intensity	Permanence	Urgency
a	Habitat loss through agricultural expansion	1, 2, 3, 4	2	2	3	7
b	Habitat loss in riparian areas	1, 3, 4	1	2	3	6
c	Selective logging	1, 4	1	1	2	4
d	Hunting	1	3	3	3	9
e	Roads (*current & potential risk*)	1, 2	1	1	3	5
f	Overharvesting NTFPs	5	1	1	2	4
g	Hunting paths	1	1	1	1	3
h	Fire	1, 2, 3, 4	2	2	2	6
i	Water pollution	1, 4.1	2	2	1	5
j	Mining (*potential risk*)	1, 3	1	2	3	6

a. **Habitat loss through agricultural expansion:** this is the main driver of land use change in the project zone with the potential to increase the rate at which HCV species are lost in the area. Many new farms within the PPA boundary were identified during the field assessment. When speaking to community members, many said they were clearing new farms far from their villages in anticipation of gazettement of the protected area. This was done in order to stake their claim on the land between their village and these new far reaching farms to enable farming activities to continue in future. The reduction in forest habitat may also put the status of HCV 2 at risk as forest loss may lead to further fragmentation of the contiguous block of forest now >50,000 ha in size. Land use change many also cause the loss of some critical ecosystems such as swamps or primary forest which can threaten HCV 3. Deforestation on sloped areas can cause a risk to erosion control (HCV 4.2), and in primary forest it can also affect fire protection, especially if close to the communities (HCV 4.3).

b. **Habitat loss in riparian areas:** farms and communities tend to be built near permanent water sources. However, an increased level of deforestation around streams can cause the water to evaporate and dry up more rapidly. It can also lead to erosion and an increased sediment load in the water. This land conversion in these areas can put pressure on already vulnerable or endemic species of amphibians like the Ringed River Frog (EN; *Phrynobatrachus annulatus*) as it uses the

forest around riparian areas for breeding affecting HCV 1.2 and 1.3. Critical ecosystems such as wetlands and swamps can be threatened directly though habitat loss in these areas (HCV 3). The potential drying of streams and increased sedimentation can affect the water quantity and quality, which surrounding communities depend on (HCV 4.1).

c. **Selective logging:** Some valuable timber species are also species that are threatened and/or endemic. Therefore, selective logging for high value timber species can be a threat to HCV 1.2 and 1.3 species. Four vulnerable class A timber species were found in the Project Zone: *Heriteria utilis*, *Lophira alata*, *Entandrophragma angolensis*, and the endemic *Tetraberlinia tubmaniana.* These species therefore face a high threat from selective logging. If selective logging takes place in areas with a steep slope or near water catchments, then this may also threaten HCV 4.1 and 4.2.

d. **Hunting:** This is the main direct external threat to wildlife in the Project Zone. The most common hunting method used is guns, but traps, dogs, and snares are also used. During the field assessment, the team encountered hunting signs across the entire area surveyed. Four gunshots were heard during the 7 nights spent in the forest and 156 cartridge shells were seen during the 8 days and 84.4 km of survey. In addition, five hunters were encountered directly in the PPA with their rifles and hunting knives in hand. Three hunting camps were also encountered, one of which had hunters currently living there. They were made of strong bamboo structures with their own vegetable gardens and near permanent streams. At one location a skull of a Maxwell's Duiker was seen. The local guides indicated that most of the hunters in the region were from Ziggida village, where they estimated there being at least 40 trained hunters, whilst any other village has about 10 or less. This may be explained by the larger population size in Ziggida, but the general feeling from the local guides (from Vetesu and Goyala) was that the main threat from hunters comes from Ziggida. There were also small mammal traps found on the trail near Goyala farmland.

e. **Roads (*current and potential*):** There is currently a dirt road that enters the PPA that links Barwen, Kargbota, and I-Mah villages to the national road. There is potential for this road to become paved at some stage in the future with infrastructural development in this region of the country. The paving of the road will increase the trade potential, opening wildlife trade and timber markets. This may cause an increased pressure on the already rare forest resources. It may also drive an increase in the human population in the area, creating a need for more land conversion. Increased traffic on roads has been found to decrease frog and toad population size in the habitat surrounding the roads[44]. Therefore, the presence of a paved road may increase traffic and thus cause a negative impact on amphibian populations. In addition, HCV 2 is defined by a contiguous block of forest, therefore any activity that will split the forest and increase fragmentation is a threat to this HCV.

f. **Overharvesting of NTFPs:** There is a large pressure on the NTFP resources within the Project Zone due to it containing some of the last remining intact forest in the region and because of the growing human population. Managing these resources is instrumental to ensuring that they will continue to be available to the communities in the years to come.

[44] Fahrig, L., Pedlar, J. H., Pope, S. E., Taylor, P. D., and Wegner, J. F. (1995). Effect of road traffic on amphibian density. Biological conservation, 73(3), 177-182.

g. **Hunting paths:** Numerous hunting paths run throughout the forest connecting almost every corner of the forest. The presence of these trails makes it easier to penetrate deeper into the forest to access resources, putting pressure even on remote areas. The trails are quite small (<0.5m width) and therefore are unlikely to create a barrier to dispersal but may create a small edge-effect.

h. **Fire:** The area is prone to fires which are seasonally started in farms to clear the land and which may spread if forest density is low. Keeping forest density >80% is key to reduce the risk of fires spreading and affecting HCVs.

i. **Water Pollution:** Pollution can enter the waterways through a variety of means. Runoff from farms if pesticides, herbicides, or too much fertilizer is used can cause negative effects to water quality. Waste from communities can also enter the water if no proper waste management or toilet facilities are in place. Contamination to the waterways can cause detrimental effects to the species that depend on them including amphibians and fish. The communities also depend on the water, and if the water sources are polluted, then this will affect the health of the residents. As the Project Zone is a critical watershed for the regions downstream, pollution that occurs here will affect thousands of people downstream.

j. **Mining (*potential*):** There were no signs of mining during the field assessment. There is still, however, a possibility that minerals may be discovered in the future which may lead to habitat loss due to the creation of mining operations. Rules should be created about potential mining operations in anticipation to mitigate the risk of mining having a negative impact if minerals are ever found in the area. Rules will include maps of areas that will never be permitted for mining, and rules about who can have mining rights, what tools or technologies can be used, and under what circumstances.

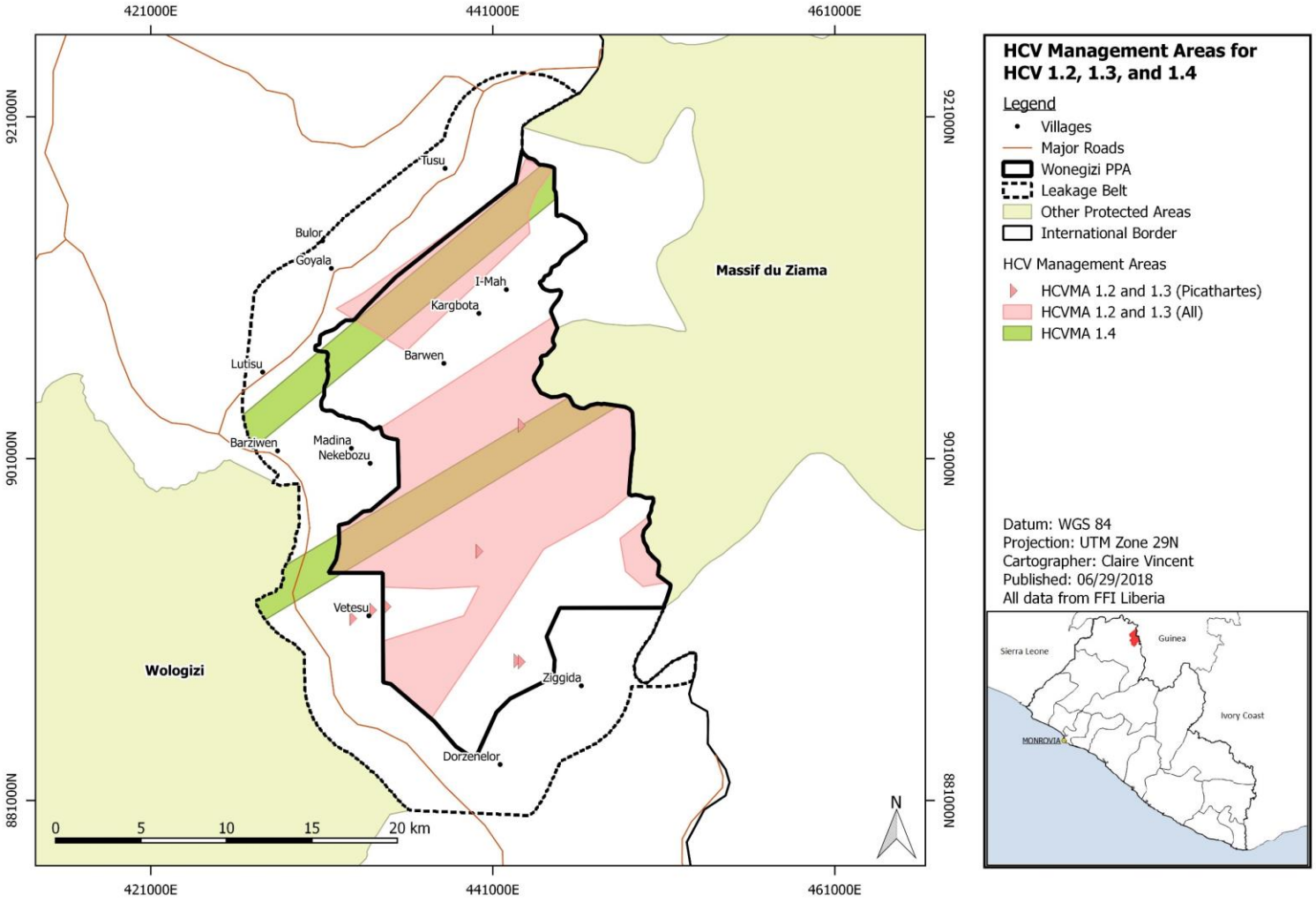

Figure 12: HCV Management Areas (HCVMA) for the protected of HCV 1.2, 1.3, and 1.4 in the Project Zone. The HCVMA 1.2 and 1.3 (23,725 ha) is selected to protect RTE and endemic species (shaded red). In addition, a buffer of 50m is placed around the White-necked Picathartes (HCV 1.2 and 1.3 species) colonies that were recorded during the field surveys (red triangles). The HCVMA 1.4 (9,084 ha) has been selected as key towards to protection of two migratory corridors used by Forest Elephants (shaded green) who use the Project Zone to move between Ziama Massif to the East and Wologizi to the West.

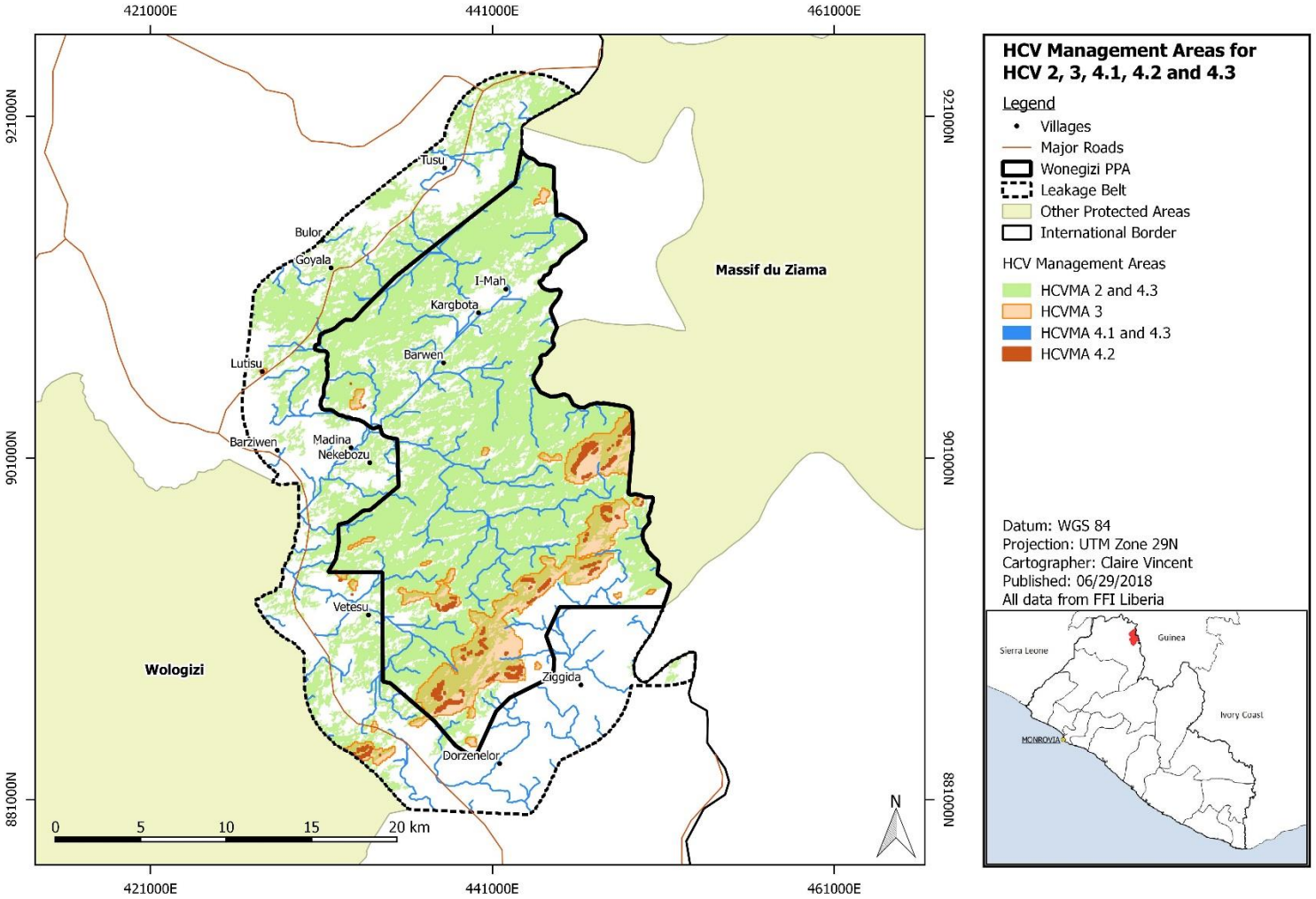

Figure 13: HCV Management Areas (HCVMA) for the protected of HCV 2-4 in the Project Zone. All forest areas (>80% density) that form patches greater than 100 ha are considered HCVMA 2 and 4.3 (47,762 ha; shaded green) as it protects the greater landscape and is important for fire prevention. HCVMA 3, for important habitats, includes all montane forest that form a continuous block of greater than 10ha (5,556 ha; shaded orange). HCVMA 4.1, for water catchments, is a buffer of 50m around riparian zones (4,403 ha; shaded blue) and is also an important management area for fire protection (HCV 4.3). HCVMA 4.2 encompasses all areas with a slope 30° or steeper (473 ha; shaded red) for erosion control.

Management and Monitoring Recommendations

For each threat to each HCV found in the Project Zone, we have identified management strategies to mitigate these threats. There are recommendations of how to monitor these threats and the efficiency of the management strategy. These recommendations can be used by FFI when establishing the protected area to ensure targets to protect HCV are met. All recommendations should undergo adaptive management to evaluate their effectiveness and be adapted when necessary. A total of 43,374 ha is set aside for HCV Management Areas (HCVMA) which is broken down in Table 9 and shown in Figures 12 and 13.

Table 4: Management and monitoring recommendations for the threats to each HCV found in the Wonegizi PPA Project Zone.

HCV	Threats	Management	Monitoring
1.2 & 1.3	Habitat loss through agricultural expansion Habitat loss in riparian areas Selective logging Hunting Roads (current & potential) Hunting paths Fire Water pollution Mining (potential risk)	An HCV Management Area (HCVMA) of 23,725 ha has been selected as key towards to protection of RTE and endemic species. It is recommended that these are no-go zones that forbid human access. In addition to this HCVMA zone, a buffer of 50m is placed around the White-necked Picathartes colonies as they fall under both HCV 1.2 and 1.3 and because they are stationary and require specialised habitat (rocky outcrops). These areas will prohibit hunting and cutting trees, but collection of NTFPs is allowed because of their proximity to villages. Awareness raising campaigns and sensitization events to teach the communities about the benefits they gain from the animals in the forest. Physical demarcation of HCVMA zones and creation of regulations and punishment for rule-breakers. This must be done through engagement with local communities who will be part of creating and enforcing the rules. No new farms or cutting of any tree in areas with high concentrations of RTE/endemic species, or in riparian areas	Regular patrols by FDA rangers are needed to enforce rules and to disincentivise people from breaking the rules. Analysis of satellite imagery to monitor the rate and location of deforestation on a yearly basis. Patrols in the areas zoned as HCV 1.1 and 1.3 protected. Any new farms or trees that have been cut in these zones will be reported using SMART software[45], and the culprits fined. Patrols will also assess the amount and type of hunting in the area through collection of snares and cartridge shells. The location of which will be marked in the GPS for a spatially explicit indicator of hunting pressure. Yearly biodiversity surveys to assess the presence and abundance of RTE/endemic

[45] www.smartconservationsoftware.org

		critical for RTE/endemic species survival. This will also mitigate fire risk. Absolutely no hunting within the boundaries of the Project Zone. Hunting outside the project zone can only target species that are listed as Least Concern on IUCN Red List, non-endemics, and those that are not protected by law. Limit new roads that can be built in the area. If existing roads within the PPA are to be improved, then the works should consider their effect on wildlife. Animal corridors, low speed limits, and one-lane traffic are ways to manage the threat to wildlife. Introduction and support of alternative livelihoods to draw youth away from hunting, as well as implementing an alternative protein source (e.g. fish ponds, poultry farms). Waste management and toilet facilities should be introduced in the forest-edge communities. Priority should be given to the communities that are located within Wonegizi PPA and that are near to a large river, namely Barwen, I-Maa, and Korgbota as they have a more direct impact in the Project Zone. If minerals are found, it will be forbidden to mine in or disturb HCVMA zones. Creation of a patrol team (partnership between community rangers and FDA) who can enforce the above rules.	species (e.g. Pygmy Hippo, West African Chimpanzee, Timneh Parrot, *Neolemonniera clitandrifolia* tree). Monitoring of the effectiveness of alternative livelihoods through questionnaires with communities.
1.4	Habitat loss through agricultural expansion Habitat loss in riparian areas Selective logging	An HCVMA of 9,084 ha has been selected as key towards to protection of two migratory corridors used by Forest Elephants who use the Project Zone to move between Ziama Massif to the East and Wologizi to the West. It is recommended that these are limited-use zones that forbid extraction of any resources. The North corridor does not border the neighbouring protected areas but is joined to	Regular patrols by FDA rangers are needed to enforce rules and to disincentivise people from breaking the rules. Yearly biodiversity surveys to assess the presence and abundance of Forest Elephants.

	Hunting Roads (current & potential risk) Hunting paths Fire Water pollution Mining (potential risk)	them by contiguous forest cover. These gaps in official protected areas may need additional management in partnership with other stakeholders. Physical demarcation of HCVMA zones and creation of regulations and punishment for rule-breakers. This must be done through engagement with local communities who will be part of creating and enforcing the rules. Absolutely no hunting within the boundaries of the Project Zone. Hunting outside the project zone can only target species that are listed as Least Concern on IUCN Red List, none endemics, and those that are not protected by law. Introduction and support of alternative livelihoods to draw youth away from hunting, as well as implementing an alternative protein source (e.g. fish ponds, poultry farms). Creation of a patrol team (partnership between community rangers and FDA) who can enforce the above rules.	Monitoring of the effectiveness of alternative livelihoods through questionnaires with communities.
2	Habitat loss through agricultural expansion Roads (current & potential risk) Fire	All primary and mature secondary forest areas that form patches greater than 100 ha are considered HCVMA as they form part of the greater landscape, protecting a zone of 47,762 ha. There is increased importance to the forest at the international border as part of this HCV is that it the forest forms a contiguous block with that in Guinea. Any future development project, including roads or agricultural expansion, must be at least 1km from the international boundary that borders the Ziama Massif.	Analysis of satellite imagery to monitor the rate and location of deforestation on a yearly basis.

3	Habitat loss through agricultural expansion Habitat loss in riparian areas Fire Mining (potential risk) Invasive species (potential risk)	All montane forest (land above 600m elevation) that form a continuous block of greater than 10ha formed part of this HCVMA (5,556 ha). This montane forest HCVMA contains all of the identified wetland and grassland microhabitats identified, therefore no extra area is needed to protect the microhabitats. These are limited-use zones that forbid extraction of any resources, including sand mining. Physical demarcation of HCVMA zones and creation of regulations and punishment for rule-breakers. This must be done through engagement with local communities who will be part of creating and enforcing the rules.	Regular patrols by FDA rangers are needed to enforce rules and to disincentivise people from breaking the rules.
4.1	Habitat loss through agricultural expansion Habitat loss in riparian areas Selective logging Fire Water pollution	A buffer of 50m to be placed around riparian zones to form a total HCVMA of 4,403 ha. No trees can be cut within this riparian buffer zone. Establish limits on fertilizer use and types to reduce the risk of runoff into the freshwater systems. Guidance provided to communities on sustainable use of water resources for agricultural activities. Establish limit on the amount and regulate the sources of water diverted for agriculture.	Biannual testing for water quality to test for pollution levels. This can be done visually as the technology for a chemical test may not be feasible. If the water clarity is reduced from precious years or dead animals are seen on shores, then chemical testing is recommended. Analysis of satellite imagery to monitor the deforestation in riparian buffer zones on a yearly basis.
4.2	Habitat loss through agricultural expansion Habitat loss in riparian areas Selective logging Fire	An HCVMA of 473 ha to be set aside to encompass all areas with a slope 30° or steeper. No trees can be cut in this area to safeguard soil stability to prevent erosion. Physical demarcation of HCVMA zones and creation of regulations and punishment for rule-breakers. This must be done through engagement with local communities who will be part of creating and enforcing the rules.	Patrols in the areas zoned as HCV 4.2 protected. Any trees that have been cut in these zones will be reported using SMART, and the culprits fined. If restoration activities take place, they should be monitored biannually to ensure success.

		If any deforestation occurs within this HCVMA, management should restore the lost vegetation to regain soil stability.	
4.3	Habitat loss through agricultural expansion Habitat loss in riparian areas Selective logging Fire	Zones critical to prevent fires are covered under HCVMAs for HCV 2 and HCV 4.1, therefore no new areas are demarcated. Undertake awareness raising campaigns about the danger of fires and the importance of forests in preventing the spread of fire in communities. Encourage communities to control fire when clearing new farms by keep a watchful eye and having water on hand in case of spread.	Monitoring is covered under HCV 2 & 4.1.

Appendix A

List of reports used for secondary data collection, date of report and towards which HCV the information gathered from each was used.

HCV	Report Title & Source	Year
1	Sighting of the West African Linsang *Poiana leightoni* in the Wonegizi Protected Area, Liberia. **FFI Liberia.**	2014
1	Empowering local stakeholders for REDD+ implementation in Liberia: biodiversity survey report of Wakolor and Wonegizi. **FFI Liberia.** By Dr. S.T. Osinubi, J.D. Onoja, Dr. M.N. Molokwu and Dr N. Ndam.	2013
1	Important Bird Areas (IBAs) LR002 Wonegizi mountains. **BirdLife International.**	2001
1	Deforestation and bird species composition in Liberia, West Africa. **Tropical Zoology.** By C.P. Kofron and A. Chapman.	1995
1	Botanical survey of the Wonegisi area. **FFI Liberia.** By Dr. C.C.H. Jongkind.	2010 & 2013
4, 5, 6	Wonegizi REDD+ Project Socioeconomic Baseline Report. **FFI Liberia.** By V. Evans	2017
5, 6	Cultural valuation and biodiversity conservation in the Upper Guinea forest, West Africa. **Ecology and Society.** By J.A. Fraser, M. Diabaté, W. Narmah, P. Beavogui, K. Guilavogui, H. De Foresta, and A.B. Junqueira	2016
5	Social Impact Assessment Overview Wonegizi REDD+ Project, Lofa County, Liberia. **FFI Liberia.**	2013
5	NTFP awareness campaign. **Community Forestry Partnership**. By B. Goaneh, M.E. Taire and D.J. Sheppard	2010
5	Results of a Market Analysis and Development Baseline Survey conducted in communities around the Wonegizi proposed protected Area and Lake Piso Multiple-use Protected Area. **The skills and Agricultural Development Services (SADS).**	2010
6	Sacred forests of the Ziama clan: data base. **FFI Liberia.**	2008
6	Report of Okoubaka death tree. **FFI Liberia.** By S.T. George	2018
ALL	Gazettement package designating Wonegizi Proposed Protected Area as a multi-use reserve. **FFI Liberia.**	2016
ALL	Ecosystem Profile: Guinean Forests of West Africa Biodiversity Hotspot. **IUCN.**	2015

Appendix B

List of all species that are RTE under criteria from the national toolkit for HCV 1.2 that were recorded within the Project Zone.

COMMON NAME	SCIENTIFIC NAME	HCV CRITERIA[46]	EVIDENCE – SECONDARY DATA[47]	EVIDENCE – PRIMARY DATA[48]
MAMMALS				
African Forest Buffalo	*Syncerus caffer nanus*	Protected	NA	track (1)
Forest Elephant	*Loxodonta africana cyclotis*	CITES Appendix I; protected	photo (3), track (2)	track (4), dung (3)
Red River Hog	*Potamochoerus porcus*	Protected	photo (1), track (1)	feeding site (14), dung (1)
Jentink's Duiker	*Cephalophus jentinki*	EN; CITES Appendix I; protected	NA	track (1)
Ogilby's Duiker	*Cephalophus ogilbyi*	CITES Appendix II; protected	photo (1), track (1)	track (1)
Yellow-backed Duiker	*Cephalophus silvicultor*	CITES Appendix II; protected	photo (1), track (1)	track (2)
Zebra Duiker	*Cephalophus zebra*	CITES Appendix II; protected	photo (1)	NA
Water Chevrotain	*Hyemoschus aquaticus*	Protected	track (2)	heard (1), track (1)
Bongo	*Tragelaphus eurycerus*	Protected	photo (1)	track (1), dung (1)
Pygmy Hippopotamus	*Choeropsis liberiensis*	EN; CITES Appendix II; protected	photo (1)	track (2)
Liberian Mongoose	*Liberiictis kuhni*	Protected	photo (6), track (1)	track (3)
Giant Pangolin	*Smutsia gigantea*	CITES Appendix II; protected	photo (1)	NA
Long-tailed Pangolin	*Uromanis tetradactyla*	CITES Appendix II; protected	photo (1)	NA
Tree Pangolin	*Phataginus tricuspis*	CITES Appendix II; protected	photo (1)	NA

[46] Protected: fully protected by Liberian law.

[47] Mammal and bird secondary data was collected in 2013.

[48] Numbers in brackets indicate the number of locations each evidence was seen.

Sooty Mangabey	*Cercocebus atys*	CITES Appendix II; protected	photo (4), heard (4), track (1)	NA
Campbell's Monkey	*Cercopithecus campbelli*	CITES Appendix II; protected	photo (2)	NA
Diana Monkey	*Cercopithecus diana*	CITES Appendix I; protected	heard (1)	NA
Demidoff's Dwarf Galago	*Galagoides demidoff*	CITES Appendix II; protected	NA	seen (1), heard (1)
West African Chimpanzee	*Pan troglodytes verus*	CR; CITES Appendix I; protected	photo (2)	NA
Leopard	*Panthera pardus*	CITES Appendix I; protected	NA	track (1)
BIRDS				
Black-casqued Hornbill	*Ceratogymna atrata*	Protected	heard (1)	heard (3)
Brown-cheeked Hornbill	*Bycanistes cylindricus*	Protected	NA	seen (3), heard (2)
Dwarf Hornbill	*Lophoceros camurus*	Protected	heard (2)	heard (1)
West African Pied Hornbill	*Lophoceros semifasciatus*	Protected	seen (8), heard (9)	seen (1), heard (4)
Western Little Hornbill	*Horizocerus hartlaubi*	Protected	seen (2), heard (3)	heard (2)
White-crested Hornbill	*Horizocerus albocristatus*	Protected	photo (1), seen (1), heard (2)	NA
Yellow-casqued Hornbill	*Ceratogymna elata*	Protected	seen (7), heard (10)	seen (1), heard (3)
Great Blue Turaco	*Corythaeola cristata*	CITES Appendix II; protected	seen (1), heard (5)	heard (2)
Green Turaco	*Tauraco persa*	Protected	heard (1)	NA
Violet Turaco	*Musophaga violacea*	Protected	NA	seen (1)
Yellow-billed Turaco	*Tauraco macrorhynchus*	CITES Appendix II; protected	heard (26)	heard (5)
Akun Eagle-owl	*Bubo leucostictus*	Protected	NA	seen (1)
Greyish Eagle-owl	*Bubo cinerascens*	Protected	heard (1)	NA
Shelley's Eagle-owl	*Bubo shelleyi*	Protected	heard (1)	NA
African Wood-owl	*Strix woodfordii*	Protected	heard (1)	NA

Crowned Eagle	*Stephanoaetus coronatus*	Protected	seen (3)	NA
Lizard Buzzard	*Kaupifalco monogrammicus*	Protected	seen (2), heard (1)	NA
Palm-nut Vulture	*Gypohierax angolensis*	Protected	seen (2)	seen (1)
White-necked Picathartes	*Picathartes gymnocephalus*	CITES Appendix I; protected	photo (6), seen (1)	NA
African Harrier-hawk	*Polyboroides typus*	Protected	seen (4), heard (1)	NA
Ayres's Hawk-eagle	*Hieraatus ayresii*	Protected	seen (1)	NA
AMPHIBIANS				
Ringed River Frog	*Phrynobatrachus annulatus*	EN	NA	seen (1)
African Giant Toad	*Sclerophrys superciliaris chevalieri*	CITES Appendix I	NA	seen (1)
BOTANY				
Tiama	*Entandrophragma angolensis*	VU; threatened timber species	seen in 2010	seen (1)
Niangon	*Heritiera utilis*	VU; threatened timber species	seen in 2010	seen (17)
Iron wood / Ekki	*Lophira alata*	VU; threatened timber species	NA	seen (2)
Lovoa / Dibétou	*Lovoa trichiodes*	Threatened timber species	seen in 2010 and 2013	NA
Dahoma	*Piptadeniastrum africanum*	Threatened timber species	seen in 2013	seen (7)
Tet / Sikon	*Tetraberlinia tubmaniana*	VU; threatened timber species	NA	seen (1)
Wawa / Obeche	*Triplochiton scleroxylon*	VU; threatened timber species	seen in 2010 and 2013	seen (2)