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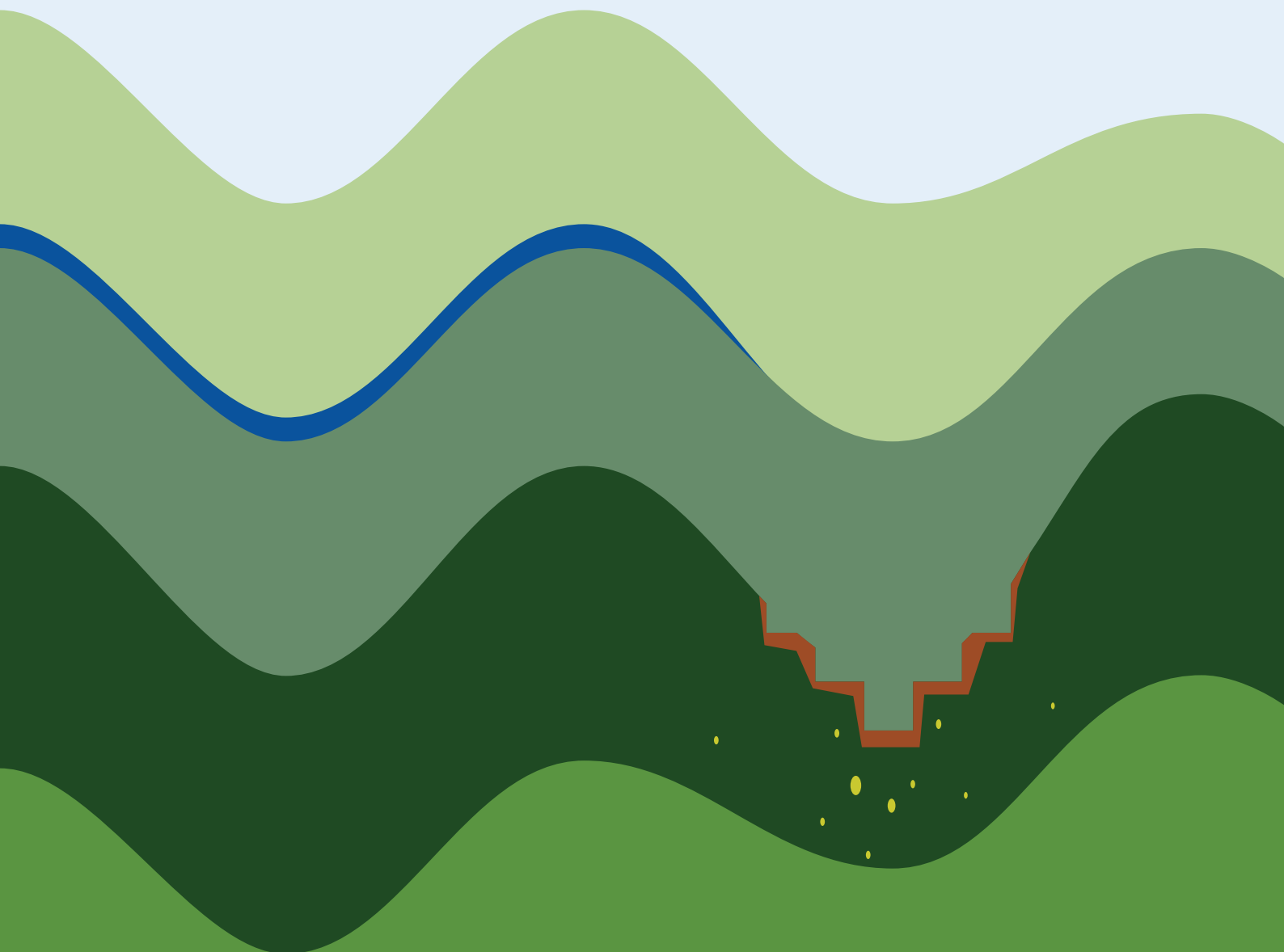
OPEN SOURCE INVESTIGATION

HALTING THE ECOLOGICAL CRISIS AND ECOSYSTEM COLLAPSE OF THE CONGO BASIN EDGE



WATSA TERRITOIRE,
KIBALI RIVER BASIN
(DEMOCRATIC REPUBLIC
OF CONGO)

THE LAST LINE OF DEFENCE



Environmental Defenders,
April 2022

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Open Source Investigation

THE LAST LINE OF DEFENCE
Halting the ecological crisis and ecosystem collapse of
the Congo Basin edge



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INTRODUCTION

SOLUTIONS AND TECHNIQUES ARE NOT NEUTRAL. THE LENSES OF POLITICAL ECOLOGY AND ECOFEMINISM

Worldviews and cosmological views, values and imaginaries shape both individual and societal narratives, including those concerning sustainable development, deliberately or unconsciously, particularly when solutions to complex challenges are sought and option spaces scrutinised. Building solutions in complex domains requires processes and techniques that are not neutral; they fall within a specific economic, political and social framework. This report uses the lens of political ecology and ecofeminism to interpret the complexity and come up with recommendations to mitigate the ecological degradation of the territory under investigation, which implicitly promote a development model.

As decisions by governments and policymakers and medium to large-scale development projects continue to have severe impacts on land and resources, political ecology re-centers traditional and indigenous ways of knowing the land as the foundation for discussing the ways in which extractivism and climate change, among other socio-ecological issues, are both a political-economic-environmental problem and an epistemic-spiritual problem. Therefore, political ecology in this context focuses on monitoring ongoing colonial practices and what forms of cultural resistance to these practices are in place, bringing traditional and indigenous knowledge systems back to the core, recognizing and prioritizing the self-determination of the communities. Furthermore, it conceptualizes governance as an all-encompassing structure of relationships and responsibilities between individuals, families and non-human relatives in a specific place.

Ecofeminism fuses ecology and feminism and seeks to draw parallels between the exploitation of the environment and the exploitation of women. It condemns all societal practices and cultural norms that value masculinity as a trait of conquest and domination. It also propagates a certain form of environmentalism which, specifically for this region, is defined as eco-bio-communitarian, which differs from the predominant anthropocentric and individualistic model: it calls for a model characterized by mutual dependence, cooperation, harmony, relationality and communion in order to promote the common good of the people in addition to the good of the environment for both current and future generations. Reclaiming the practices of the ancestors as a society cosmically

humble, cautious in their approach to nature (held divine and with healing grace), reverentially respectful of nature and other human beings, and more mindful of both animate and inanimate beings, including the various invincible forces that surround them.

While political ecology allows us to question the environmental transformations starting from the concept of (social, ecological, climate) justice, ecofeminism via a model based on mutual dependence and an intersectional perspective allows us to build practices and solutions that begin with the mitigation of ecological degradation and end with its reversion as an alternative to extractivism.

Therefore, this report is conceptually divided into two parts. The first questions the ecology of the territory to learn how it is being transformed and the second makes recommendations grounded in ecofeminism.

CLAIM A HUMAN RIGHTS BASED APPROACH

Political ecology brings together geographical approaches to the environment and society with political approaches to governance and human rights. That accounts for the importance in using the human rights based approach for the regional context with specific actions to empower people to know and claim their rights and increasing the ability and accountability of individuals and institutions who are responsible for respecting, protecting and fulfilling rights.

Widely known examples of limitation of rights include the failure to respect the decisions of local communities exercising the principle of Free, Prior and Informed consent, or that produced by the violation of women’s rights by cultural norms in opposition to laws.

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THE ECOLOGY OF THE KIBALI RIVER BASIN

FRAMING THE TERRITORY COVERED BY THE REPORT IN 1,000 CHARACTERS

The Kibali river flows through the northern limit of the Congo basin for about 1,000 km in the Ituri and Haut-Uélé *Provinces*. Its watershed is blessed with enormous ecological complexity, marked by a multitude of ecotones, inhabited by numerous clusters of humankind groups mostly at low densities. By sectioning the watershed from the mountains at Lake Albert where it originates, until it joins the Dungu River forming the Uele River, a distinction can be found between areas under intensive agricultural use (located in the territories of the administrative province of the Ituri), agricultural ensembles in dense rainforest (a mixture of forest fallows, home gardens, food crops and village plantations that have gradually replaced the dense rainforest), and almost intact sections of the Northern Congolian forest-savanna and the Northeast Congolian lowland forest. The natural resources of this territory and in particular those of the subsoil are abundant in this region, bringing national and international attention that has resulted in several forms of extractivism, dispossession of rights and inequality. In particular, the territories defined traditionally as the Kibali and Mangbutu *secteurs* and the Mari-Minza *chefferie* will be investigated. (Fig.1)

THE DISRUPTION OF ECOLOGICAL CYCLES BY ANTHROPOGENIC DISTURBANCES. HOW QUICKLY WE ARE ALTERING THE LOCAL BIOSPHERE THROUGH ITS COMMODIFICATION

Earth has entered its 6th mass extinction of species and human activities are at the center of this crisis. To grasp its progression, understanding the processes shaping biological communities under interacting disturbances is a core challenge. Among all the detectable disturbances, the impacts of human-induced disturbances on ecosystems have been extensively reported. Forest and savanna degradation by both intense, episodic disturbances (e.g., extensive logging, forest conversion to other land uses or mining) and low intensity, chronic disturbances (e.g., grazing, selective logging or invasion of exotic species and fires) have been documented. We know that the combination in certain magnitudes of these cycles of disturbance, episodic and chronic, can result in the irreversible loss of specific environmental conditions with effects on the natural communities.

Some of the most common human-induced episodic disturbances on the local biosphere of the Kibali river basin are reported.

- A RECENT AND GROWING FOOD DEMAND FUELING THE AGRICULTURAL PARADOX

The trade-off between agricultural potential and nutritional status is clearly established among almost all provinces in the Democratic Republic of Congo, including the province of Haut-Uélé. The potential is to produce at least 2,500 kcal per capita on a daily basis, while the vast majority of regions could actually produce more than 20,000 kcal, especially those in which agriculture is widely practiced such as the northeast savanna bordering the territory under investigation. But despite its potential, it currently fails to adequately feed its own population.

Understanding why forest clearing in the eastern provinces seems unstoppable involves understanding the agricultural paradox (why agricultural potential is so far out of alignment with its food security status), combining the transitory demands brought by migrants both because of employment opportunities (e.g., in the mining towns and neighboring areas)

and internally displaced people because of conflicts (ongoing armed conflicts and land disputes).

A significant proportion of agricultural production meets the crossborder market demand with Uganda. So new lands are pursued in order to increase the amount of cultivated area. The dense rainforest of the eastern sector of the Kibali river basin is being cleared at a high rate to create agricultural areas, and consequently the river ecosystem of the section of the Kibali River flowing in Ituri *Province* up to the early kilometers in the Haut-Uélé *Province* is compromised.

In the Kibali and Mangbutu *secteurs* and in the Mari-Minza *chefferie*, subsistence agriculture is widely practiced, while the rest of agricultural production is outsourced to a very limited number of small and medium-sized enterprises (50 were surveyed in 2016). Agri-food chains are in place in the territory, although some are abandoned from the post-colonial era, as well as cash crops (e.g., coffee, which has plummeted since the mid-1970s). Agriculture in this area is necessary to feed the thousands of people who live and migrate from neighboring villages and provinces to mining towns like Watsa and to artisanal mines. But climate and weather variability heavily affect production. Indeed, since February 2021 Watsa territory is classified as IPC Phase 3 in the Acute Food Insecurity Situation index as compiled by the Integrated Food Security Phase Classification (IPC). IPC Phase 3 class includes areas where at least 20 percent of households have significant food consumption gaps or are marginally able to meet minimum food needs only with irreversible coping strategies such as liquidating livelihood assets. Levels of acute malnutrition are high and above normal.

- TRADITIONAL CULTIVATION TECHNIQUES TURNED INTO A THREAT

Shifting, swidden or slash-and-burn agriculture, all they refer to land uses where a cropping period is rotated with a fallow period that is long enough to enable the growing of dense, woody vegetation, and where the biomass is eliminated from the plot by cutting, slashing, and burning it, prior to the next cultivation cycle. It is generally considered as an extensive land use, maintained through time by expansion over uncultivated land following population growth (extensification), in contrast with more intensive land uses, where the biomass is incorporated to the soil through plowing or other practices. In the slash-and-burn system, the conversion is long-

term, often permanent. Shifting cultivation is a more ephemeral use of the land for cultivation.

Forests that are allowed to regenerate in long-fallow systems (that is, left for more than 10 years) have a range of products that provide farmers with a safety net and allows them to diversify their livelihoods. Short fallow periods reduce the availability of pasture and lead to overgrazing, and sometimes to crop damage by roaming animals. It is therefore clear that the choice of fallow period is among the decisive variables to calculate the impact of this disturbance.

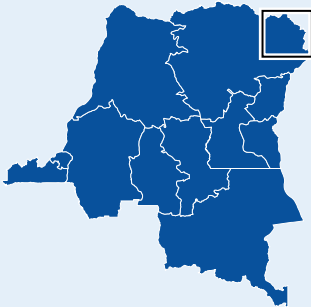
On average in Haut-Uélé *Province*, the duration of the continuous running of a given cropland approximated almost three years and the average fallowing timespan is around 3.3 years. A dissimilar condition to the integral swidden system that is practiced primarily by indigenous communities and is associated with their subsistence. Indeed, for reasons pertaining to production due to food security and crop yield (translated into household income), those who cultivate are forced to encroach on more and more areas in the dense rainforest.

- MORATORIUM ON NEW LOGGING CONCESSIONS DOESN'T YIELD IMAGINED RESULTS

Forestry companies, which are usually among the biggest contributors among those who exploit wood in the forest area for commercial purposes, have stopped their activities because of the bad economic situation (difficulties for the company to have the necessary credits and foreign currency for the purchase of spare parts and for the renewal of equipment; the non-electrification of the environment and of the processing plants). There are no active logging concessions in the Kibali river basin area. Despite being first introduced in 2002, and reaffirmed in a presidential decree in 2005, the ban on logging has been repeatedly violated in recent years. In the savanna or in areas with negligible forest potential, the population exploits the few valuable species that can be found there in a larger proportion than necessary for survival purposes, mostly to generate alternative sources of income, however, resulting in competition over resources. In the dense rainforest areas most of the logging operations are naturally located near roads (logging roads), which is particularly detrimental to the conservation of forests.

Deforestation rates around the oldest roads in the Congo Basin are about four times higher as they were in

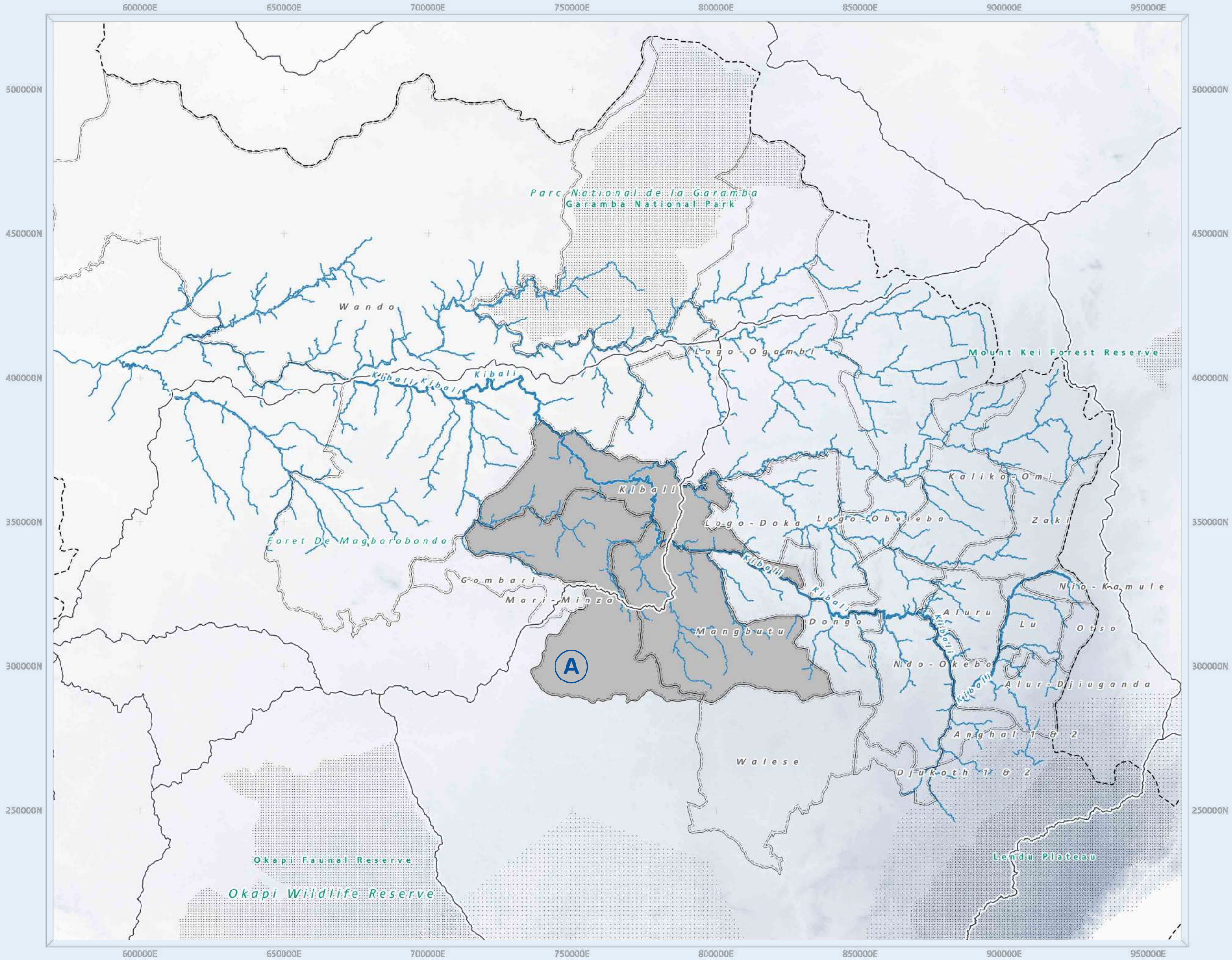
Fig. 1
Location of the Kibali river basin. In detail, the areas investigated



DEMOCRATIC REPUBLIC OF THE CONGO
HAUT-UELÉ PROVINCE
Watsa Territoire (Kibali and Mangbutu secteurs and Mari-Minza chefferie)

*
WGS 84 / UTM zone 35N
EPSG: 32635

 **A** Area investigated



the early 21st century, and numbers of key species have dropped off considerably (length of roads increased by 87,000 km to 231,000 km in the Congo Basin between 2003 and 2018). The 90 percent of logging takes place informally, and often illegally, making areas easily occupied by small-scale agriculture and artisanal and small-scale mining.

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DIGGING FOR SURVIVAL. THE LONG BLOODY HANDS OF COLONIALISM

Among intense and episodic human-induced disturbances, mining activities are those that produce the deepest and permanent alterations in the biological communities.

Artisanal mining labor is generally speaking well-structured: mineral extraction is executed by teams of diggers who work under the management of pit owners. Once extracted, rocks are crushed manually or mechanically, washed and transported. When a mine site is uncovered, biomass around the exploration area is cleared to facilitate mining operations. A portion of the biomass is processed to obtain timber used in mining operations, such as supports for mining tunnels and shafts, to build mine camp shelters, to produce charcoal and used as fuelwood. Waste is poorly managed leading to spoil heaps being created around the site (made by tailings and slag material). Mining operations are typically located near, or are supported by water bodies. Water sources are unprotected and the same water, which should be safeguarded, is contaminated by mineral washing. Pollutants are introduced into the water and the environment in general, particularly mercury or cyanide around gold mines. Metals mining and milling operations provide one of the most important sources of contamination in the environment. When the mine is depleted, the miners move onto the next mine site without any effort to rehabilitate the mine site they have used. Hazards such as drowning of animals and humans, erosion, soil degradation and contamination turning it unfavorable for vegetation growth, and alteration of water systems at abandoned mine sites are the normal scenario.

In addition to the industrial exploitation which is concentrated in Doko (Durba) in the Watsa *Territoire*, the artisanal exploitation is scattered over a large area in the territory. The presence of few mining centers has led to the creation of several towns with an average population of over 20,000 people. We can mention Dilolo, Zambula, Gbaramota, Tora, Dubele, Beverendi, Wanga, Ngangazo, Moku. Minerals from the Eastern provinces are smuggled (primarily by air) across borders into Rwanda, Burundi,

and Uganda, as well as other parts of the DRC. There are trade centers for artisanal miners, which are collected and channeled by *négociants* to larger traders and exporters. A large proportion of the minerals smuggled into the Kibali river basin flow through the Ariwara smuggling hotspot, and then into Uganda near Arua. From here to Kampala and Nairobi, the largest market. (Fig.2 and [Interactive Map](#))

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A FULLY INTEGRATED GOLD MINE IN THE MIDDLE OF NOWHERE?

For practitioners interested in industrial mining, Barrick Gold Corporation (Canada) and AngloGold Ashanti Limited (South Africa) are two well-known operators in DRC as well as other countries across the planet. Together with the state-owned company Société Minière de Kilo-Moto (SOKIMO) they constitute the only industrial operator in the entire Haut-Uélé *Province*, the Kibali Gold Mines, having their operations in place across the Mari-Minza, Dhongo, Logo-Ogambi, Logo-Doka *chefferies* and the Kibali and Mangbutu *secteurs*. This company holds the ISO 14001 certification about environmental management systems enhancing environmental performance; claiming this certification and Kibali gold mine being one of the most technologically advanced autonomous underground mines globally does not mean that there are no associated environmental and social risks, even though Barrik’s CEO proudly describes the project as “a fully integrated gold mine in the middle of nowhere.” Forecasted production for 2022 is between 750,000 and 850,000 ounces, while the proven and probable reserve is an additional 9.5 million ounces. According to the mining cadastre, the exploitation permits issued to Kibali Gold Mines in the Doko (Durba) area expire in 2029 (an exploitation permit cannot exceed 25 years and is renewable for another 15 years).

In the whole Kibali river basin the massive surface of 700,000 ha is subject to exploration permits. The mining sector was liberalized in 2002 with the adoption of the 2002 Mining Code, modified recently with the introduction of the new Mining Code of 2018 (consolidated as Law No. 38/2003 of March 26, 2003) placing a greater emphasis on local sustainable development (10% of royalty must be paid to a sovereign mining fund dedicated to future generations, 0.3% of turnover to development projects for communities affected by the mining activities, 0.5% of turnover for mine rehabilitation). DRC has ratified a few international conventions related to the protection of the environment in the mining industry such as the global standard for the good governance of oil, gas and

mineral resources or the World Heritage convention. Government agencies provide guidelines dealing with environmental and social governance. The Environmental and Social Management Plans, as stated by Decree No. 18/024 of 8 June 2018 commits: to reducing adverse effects on the atmosphere, on water sources and watercourses; protecting wildlife and vegetation; reducing erosion, water and chemical leaks in the land relief (analyzing samples, monitoring waters and radioactivity in the air, dust, soil, plants, sediments, wildlife and food chains); reducing adverse effects of noise and dust on human and animal populations; avoiding the spread of disease; promoting the rapid regrowth and renewal of plant species. The mining industry blames artisanal and small-scale mining for causing tremendous environmental damage, particularly by connecting it to the risk of chemical contamination (as well as the loss of tax revenue and the presence of criminal agents) and the NGOs by defining them as a troop of anti-mining extremists or even terrorists.

Certainly the regulatory framework and social responsibility are enablers that compel mining industries to incorporate and address environmental and social concerns, but claiming to have built a fully integrated industrial plant in the middle of nowhere, a nowhere that is an enormous reservoir of biodiversity in some of the most important and vulnerable biomes on the planet, denounces a lack of understanding of ecological systems and embodies the idea of colonial extractivism that considers the African continent as an enormous empty space to be occupied.

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Among chronic human-induced disturbances, however, charcoal production and selective logging are notable.

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SMUGGLING CHARCOAL

Charcoal constitutes the primary energy supply for 70–90 percent of households in the Central African region. With rapid population growth and urbanization, the demand for charcoal continues to grow, and is likely to increase threefold by 2050. In neighbouring Uganda, Rwanda and Burundi, deforestation is well advanced with most of the natural forests having been cleared. Currently, charcoal consumption in these countries is substantially higher than domestic production and supply. The character of the trade in charcoal varies according to local circumstances, and ranges from systematic

production and logistics for cross border smuggling and to local business opportunities integrated with local livelihoods where the majority of the charcoal is consumed locally.

The easternmost region of the Kibali river basin, is where charcoal production and trade is most practiced. Charcoal after being produced is moved to Beni and Butembo (in the North Kivu *Province*), two emerging hotspots for charcoal smuggling and informal activities. The rest of the production is destined for crossborder trade with Uganda, following the Isiro-Mahagi-Arua (Uganda) transportation route. The mentioned transportation route crosses the territory of Watsa via the national road RN26 Isiro-Watsa, also known as an important logging road, along with the provincial road RP432 Watsa-Bunia.

United Nation Environment Programme – UNEP and the Mission de l’Organisation des Nations unies pour la stabilisation en République démocratique du Congo – MONUSCO report the area around the town of Watsa, and particularly the area to the south crossed by the RN26 route, as a charcoal production hotspot (2015).

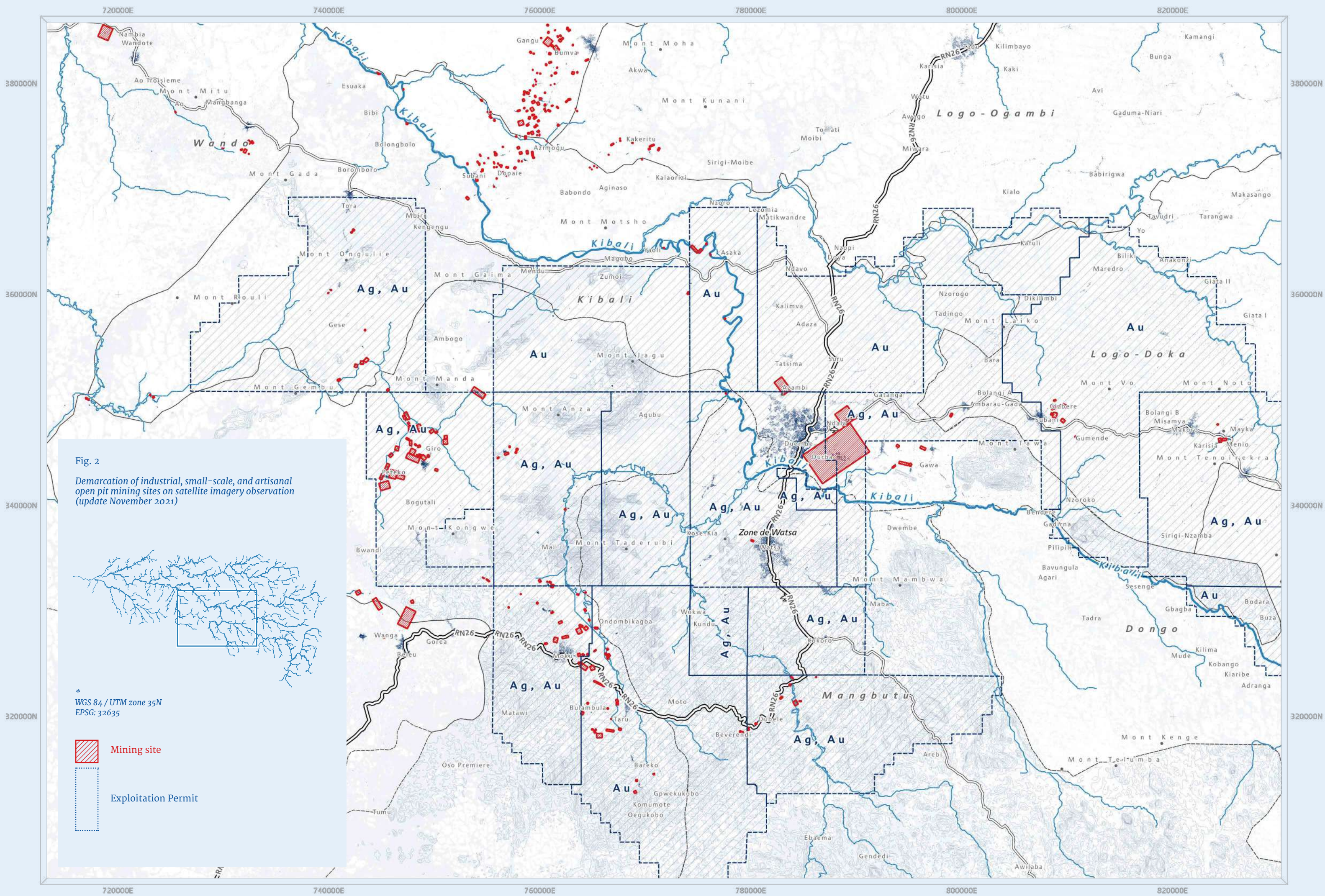
Much of the charcoal is commonly made in itinerant traditional earth and pit kilns within or adjacent to the forest, with low wood-to-charcoal conversion rate (in tropical areas it is on average around 20%). Therefore, the areas used for charcoal production have the potential for rapid forest recovery especially with good post-harvest management. As demand for charcoal rises, production points increase or become permanently localized, turning into a disturbance.

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COLLECTABLE RESOURCES FOR INHABITING

Beyond the rare hard and semi-hard houses (mostly located in urban areas), the majority of the dwellings are made of collectable resources from nature such as earth, wood, reed, bamboo, straw. These are dwellings that do not expect to endure over time and are frequently refurbished or rebuilt. Exclusively in the urban centers, there is an availability of building materials other than those that can be collected directly from nature such as cement and sheet metal. Dwellings are grouped together either according to traditional rules of distribution of public and private space or especially near urban areas huddled together. These are the areas with the highest population density.

Selective biomass logging and soil removal are the two main disturbances associated with the building materials demand, which become critical at locations where there is a concentration of human groups



matching the demand for stable or semi-nomadic livelihoods. Fuelwood production is on the rise to meet the growing needs of an increasingly urban population that cannot afford charcoal (or depending on price fluctuation according to season) and who has no energy alternatives for cooking. Briquette or fuel-efficient stoves are not common and the use of the traditional open, three-stone fire is favored.

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BOX 1 - FEW INDICATORS TO UNDERSTAND DISTURBANCES

PROTECTED AREAS

- LEGAL STATUS AND DESIGNATION

The legal definition and purposes of protected areas are determined by *loi n° 14/003 du 11 février 2014 relative à la conservation de la nature* and *loi n°011/2002 du 29 août 2002 portant code forestier*. Protected areas are designated as:

- **Hunting domain.** Category of protected areas where hunting activities are allowed but regulated;
- **Hunting reserve.** Category of protected areas or an area within a protected area in which hunting activities are prohibited in order to promote wildlife reproduction;
- **Wildlife Reserve**
- **National Park.** Category of protected areas consisting of a large natural or near-natural area set aside to protect large-scale ecological processes, species and ecosystem features of the region, which also provide a basis for opportunities for spiritual, scientific, educational and recreational visits, respecting the environment and culture of local communities.

- DESIGNATED AND DELIMITED PROTECTED AREAS WITHIN AND ON THE EDGE OF THE KIBALI RIVER BASIN

Domaine de chasse (Hunting area):

- *Domaine de chasse* de la Maika (designation date 1970-01-01);
- *Domaine de chasse* de Gangala na Bodio (designation date 1970-01-01);
- *Domaine de chasse* des Azande - Bloc occidental (designation date 1970-01-01);
- *Domaine de chasse* des Azande - Bloc oriental (designation date 1970-01-01);
- *Domaine de chasse* des Mondo-Missa (designation date 1970-01-01).

Réserve de faune (Wildlife reserve):

- *Réserve de faune* à Okapis (designation date 1992-05-02, *arrêté ministériel N°045/CM/ECN/92*, Integral Natural Reserve included in the list of UNESCO World Heritage Sites since 1996).

Parc national (National park):

- *Parc national* de la Garamba (designation date 1970-01-01).

Source

BirdLife International (2021) Important Bird and Biodiversity Area (IBA) digital boundaries: September 2021 version. BirdLife International, Cambridge, UK

KBA Standards and Appeals Committee (2020). Guidelines for using A Global Standard for the Identification of Key Biodiversity Areas. Version 1.1. Prepared by the KBA Standards and Appeals Committee of the IUCN Species Survival Commission and IUCN World Commission on Protected Areas. Gland, Switzerland: IUCN.

BIODIVERSITY HOTSPOT

Immediately south of the Kibali river basin the Eastern Afromontane Biodiversity Hotspot is identified. The Eastern Afromontane represents a merging of several of the ecoregions recognized by WWF including the East African Montane forests, Southern Rift Montane Forest–Grassland mosaic, the Albertine Rift and the Ethiopian Upper Montane Forests, Woodlands, Bushlands and Grasslands, and the addition of the Southern Montane islands in Malawi, Zimbabwe and Mozambique. In the Eastern Arc Mountains, ranging from about 300 to 2,600 meters, vegetation types include upper montane, montane, submontane and lowland forests, with Afromontane grassland and heathland plant communities at higher altitudes.

Source

Conservation International (2005). Eastern Arc Mountains & Coastal Forests of Tanzania & Kenya. Ecosystem Profile.

TERRESTRIAL ECOSYSTEM OF THE WORLD

- AT0124 - NORTHEASTERN CONGOLIAN LOWLAND FORESTS

The Northeastern Congolian Lowland Forests ecoregion is a part of the Guineo–Congolian regional center of endemism (White 1983). The ecoregion is distinguished by high rates of endemism. It is bound by the Uele River in the northeast, the Congo River and its tributaries (primarily the Elila River) in the south, and the Bomu River as it flows into the Oubangui River in the west. These rivers form distribution boundaries to some mammal species, such as the fishing genet (*Osbornictis piscivora*). The eastern flank of the ecoregion is comprised of ‘transitional forest’ in the foothills of the Albertine Rift Mountains and our boundary is placed arbitrarily at around 1,500 m. The majority of the southern boundary of the ecoregion abuts swamp forests, with the remaining portion following White’s delineation between wetter and drier lowland rainforest.

Status: Vulnerable

- AT0712 - NORTHERN CONGOLIAN FOREST-SAVANNA MOSAIC

This ecoregion is based on the mosaic of lowland rain forest and secondary grassland vegetation unit of White (1983). It is distinct from the Guinean Forest–Savanna Mosaic ecoregion as it is largely separated by the Cameroonians Highlands, which acts a range limit for several forest–savanna mosaic taxa. The

southern boundary is defined by the transition to more continuous forest cover. The northern boundary was verified with 1 km classified land cover data derived from AVHRR satellite imagery (Loveland et al. 2000).

Status: Critical/Endangered

Source

Dinerstein, E., Olson, D., et al. (2017). An Ecoregion–Based Approach to Protecting Half the Terrestrial Realm, BioScience, Volume 67, Issue 6, June 2017, Pages 534–545, doi:10.1093/biosci/bix014
Loveland, T.R., Reed, B.C., Brown, J.F., Ohlen, D.O., Zhu, Z., Yang, L., Merchant, J.W. (2000). Development of a global land cover characteristics database and IGBP DISCover from 1 km AVHRR data. International Journal of Remote Sensing. 21:1303–1330.
White, F. (1983). The vegetation of Africa, a descriptive memoir to accompany the UNESCO/AETFAT/UNSO Vegetation Map of Africa (3 Plates, Northwestern Africa, Northeastern Africa, and Southern Africa, 1:5,000,000). UNESCO, Paris.

BIODIVERSITY INTACTNESS INDEX

The Biodiversity Intactness Index (BII) estimates how much of an area’s natural biodiversity remains. It helps us understand past, current and future biodiversity changes. If the BII is 90% or more, the area has enough biodiversity to be a resilient and functioning ecosystem. Under 90%, biodiversity loss means ecosystems may function less well and less reliably. If the BII is 30% or less, the area’s biodiversity has been depleted and the ecosystem could be at risk of collapse. The lowest BII value in the Mari–Minza *chefferie*, Mangbutu and Kibali *secteurs*, recorded in 2020 is 81% (Fig. 3). Areas that have a BII value between 80% and 90% (that have retained enough biodiversity to be within the proposed planetary boundary of the Stockholm Resilience Center) are:

- surrounding the village of Giro, which is distinguished by a significant presence of artisanal mines;
- the area of Watsa/Durba extending to the eastern borders of the *secteur* Kibali;
- patches in the southern portion of the *secteur* Mangbutu.

CRITICALLY ENDANGERED (CR):

<i>Xyris exigua</i>	Plantae
<i>Rotala robynsiana</i>	Plantae
<i>Sylvietta chapini</i> (Chapin’s Crombec)	Animalia
<i>Necrosyrtes monachus</i> (Hooded Vulture)	Animalia
<i>Diceros bicornis</i> (Hook–lipped rhinoceros)	Animalia
<i>Loxodonta cyclotis</i> (African forest elephant)	Animalia
<i>Gyps africanus</i> (White–backed vulture)	Animalia
<i>Gyps rueppelli</i> (Rüppell’s vulture)	Animalia
<i>Trigonoceps occipitalis</i> (White–headed vulture)	Animalia

Source

Leclère, D., Obersteiner, M., Barrett, M. et al. (2020). Bending the curve of terrestrial biodiversity needs an integrated strategy. Nature 585, 551–556. <https://doi.org/10.1038/s41586-020-2705-y>
Hill, S.L.L., Gonzalez, R., Sanchez–Ortiz, K., Caton, E., Espinoza, F., Newbold, T., Tylanakis, J., Scharlemann, Jörn, P. W., De Palma, A., Purvis, A. (2018). Worldwide impacts of past and projected future land–use change on local species richness and the Biodiversity Intactness Index. bioRxiv 311787. <https://doi.org/10.1101/311787>

IUCN RED LIST

The IUCN Red List of Threatened Species provides conservation status and distribution information on animals that have been globally evaluated using the IUCN Red List Categories and Criteria. Within the Kibali River basin are listed by IUCN Red List under the following categories:

Tracheophyta	Liliopsida
Tracheophyta	Magnoliopsida
Chordata	Aves
Chordata	Aves
Chordata	Mammalia
Chordata	Mammalia
Chordata	Aves
Chordata	Aves
Chordata	Aves

ENDANGERED (EN):

<i>Vigna laurentii</i> (Umukaloko)	Plantae	Tracheophyta	Magnoliopsida
<i>Genlisea angolensis</i>	Plantae	Tracheophyta	Magnoliopsida
<i>Eggelingia ligulifolia</i>	Plantae	Tracheophyta	Liliopsida
<i>Ichnotropis chapini</i> (Chapin’s Rough-scaled Lizard)	Animalia	Chordata	Reptilia
<i>Okapia johnstoni</i> (Okapi)	Animalia	Chordata	Mammalia
<i>Okoubaka aubrevillei</i> (Death Tree)	Plantae	Tracheophyta	Magnoliopsida
<i>Nymphoides tenuissima</i>	Plantae	Tracheophyta	Magnoliopsida
<i>Psilotrichum axilliflorum</i>	Plantae	Tracheophyta	Magnoliopsida
<i>Psychotria palustris</i>	Plantae	Tracheophyta	Magnoliopsida
<i>Rhipidoglossum globuloso-calcaratum</i> (Liliopsida)	Plantae	Tracheophyta	Liliopsida
<i>Smutsia gigantea</i> (Giant Pangolin)	Animalia	Chordata	Mammalia
<i>Phataginus tricuspis</i> (White-bellied Pangolin)	Animalia	Chordata	Mammalia
<i>Pan troglodytes</i> (Chimpanzee)	Animalia	Chordata	Mammalia
<i>Euphorbia seretii</i>	Plantae	Tracheophyta	Magnoliopsida
<i>Cassipourea leptoneura</i>	Plantae	Tracheophyta	Magnoliopsida
<i>Deinbollia crassipes</i>	Plantae	Tracheophyta	Magnoliopsida
<i>Psittacus erithacus</i> (Grey Parrot)	Animalia	Chordata	Aves
<i>Polemaetus bellicosus</i> (Martial Eagle)	Animalia	Chordata	Aves
<i>Sagittarius serpentarius</i> (Secretarybird)	Animalia	Chordata	Aves
<i>Terathopius ecaudatus</i> (Bateleur)	Animalia	Chordata	Aves
<i>Loxodonta africana</i> (Elephant)	Animalia	Chordata	Mammalia
<i>Torgos tracheliotos</i> (Lappet-faced Vulture)	Animalia	Chordata	Aves
<i>Aquila nipalensis</i> (Steppe Eagle)	Animalia	Chordata	Aves

VULNERABLE (VU):

Microthrissa minuta, *Rotala smithii*, *Bitis gabonica*, *Bitis nasicornis*, *Polystachya stauroglossa*, *Colobus angolensis*, *Leptopelis mackayi*, *Hippopotamus amphibius*, *Caracal aurata*, *Afzelia africana*, *Balearica pavonina*, *Trionyx triunguis*, *Impatiens mildbraedii*, *Englerina schubotziana*, *Globimetula kivuensis*, *Zanthoxylum mildbraedii*, *Panthera leo*, *Ptilopachus nahani*, *Smutsia temminckii*, *Phataginus tetradactyla*, *Bubo shelleyi*, *Bucorvus abyssinicus*, *Isolona lebrunii*, *Giraffa camelopardalis*, *Synsepalum laurentii*, *Rinorea tshingandaensis*, *Panthera pardus*, *Piliocolobus oustaleti*, *Lophocebus albigena*, *Cercopithecus hamlyni*, *Ficus burretiana*, *Circaetus beaudouini*, *Fraseria lendu*, *Falco vespertinus*, *Aquila rapax*

Source

IUCN 2020. The IUCN Red List of Threatened Species. Version 2017-3. <https://www.iucnredlist.org>

SPECIES RICHNESS

IUCN Red List Species Richness, estimates the species abundance of terrestrial vertebrate species listed as threatened (categories CR - Critically Endangered, EN - Endangered, VU - Vulnerable) based on potential habitat. The minimum and maximum numbers of terrestrial vertebrate species in each 30 m x 30 m area for the Mari-Minza *chefferie*, Mangbutu and Kibali *secteurs* were calculated; the maximum value of species richness is 13 (updated to 2017), while the minimum is 8, identified to the south of the N26 route between Watsa and Isiro in the segment between Moto and Beleu, south of Mount Taderubi.

Source

IUCN 2020. The IUCN Red List of Threatened Species. Version 2017-3. <https://www.iucnredlist.org>

RANGE-SIZE RARITY

The weighted range size rarity of IUCN Red List of Threatened Species is a richness measure corrected for individual species’ weights and global range size, which is the proportion of the species’ range contained in each 30 m x 30 m for the Mari-Minza *chefferie*, Mangbutu and Kibali *secteurs*. Calculations were applied at the species-season level. Range-size values ranged from a minimum of 1.53 to a maximum of 6.46 (mean value of 2.89). The minimum value was recorded south of the N26 route between Watsa and Isiro in the segment between Moto and Beleu, south of Mount Taderubi.

Source

IUCN 2020. The IUCN Red List of Threatened Species. Version 2017-3. <https://www.iucnredlist.org>

FIRE ALERTS AND THERMAL ANOMALIES

Processing data recorded by the NASA VIIRS mission, there were 57,733 events in the entire Kibali river basin from 2012-12-01 to 2021-12-01, including 3,186 marked high confidence (confidence=h), from which 99.3 % were observed during daylight hours. These events are evenly distributed in areas where permanent upland streams are concentrated (particularly in the southern section of the Kibali catchment area - hydraulic left). The data reveal a large human presence homogeneously distributed within the Mari-Minza *chefferie*, Mangbutu and Kibali *secteurs* (Fig. 4), as a large proportion of the alerts actually refer to the traditional open, three-stone fire used for cooking. Narrowly refers to fires associated with slash-and-burn agriculture.

Source

NRT VIIRS 375 m Active Fire product VJ114IMGTDL_NRT. Available on-line [<https://earthdata.nasa.gov/firms>]. doi: 10.5067/FIRMS/VIIRS/VJ114IMGT_N

FOREST COVER LOSS

Looking at the period between 2001 and 2019, the following forest cover losses in the survey areas are detected, accompanied by a list of the most sensitive areas:

- SECTEUR KIBALI

YEAR	Forest Loss (m²)
2001	12,044,724
2002	5,286,334
2003	445,075
2004	13,451,441
2005	10,267,495
2006	2,721,958
2007	9,393,486
2008	3,129,368
2009	5,790,599
2010	8,852,322
2011	7,869,158
2012	4,905,060
2013	4,063,336
2014	10,786,366
2015	8,819,268
2016	13,725,097
2017	25,277,855
2018	25,836,698
2019	13,701,268

Sensible areas:

- The entire Doko-Durba site is undergoing a process of deforestation due to urban expansion and industrial mining with great impetus since 2014. The expansion is happening particularly northward, while it is restrained to the west side where there is the natural limit of the Kibali river.
- North of the city of Durba where there are notable agricultural areas of recent formation that are

- flanked by some active and inactive industrial mining activities.
- Along the R433 route leading from Durba to Ndedu, along the Ao Troisieme–Mangbanga corridor, and around the villages of Tora and Mendu (main driver of deforestation is agriculture).
- The whole region to the south–east of the Kibali *secteur*.

Widespread growth in forest cover loss is witnessed beginning in 2017, with logging surface double those occurring when industrial mining operations began.

-
SECTEUR MANGBUTU

YEAR	Forest Loss (m²)
2001	2,621,686
2002	4,078,946
2003	563,381
2004	4,891,354
2005	5,752,183
2006	1,780,840
2007	8,096,406
2008	1,678,616
2009	7,821,248
2010	8,838,102
2011	-
2012	7,154,105
2013	9,047,929
2014	23,467,587
2015	15,992,976
2016	14,119,136
2017	30,893,007
2018	20,056,551
2019	18,258,033

Sensible areas:

- The whole eastern slope of Mont Taderubi and Mont Zambula, with the Arumvo river valley.
- The area surrounding the locality of Maba at Mont Mambwa.

-
CHEFFERIE MARI-MINZA

YEAR	Forest Loss (m²)
2001	6,791,930
2002	4,858,186
2003	594,111
2004	2,045,188
2005	6,137,870
2006	970,715
2007	8,759,492
2008	1,293,518
2009	4,545,375
2010	3,118,124
2011	9,269,828
2012	3,141,181
2013	3,685,335
2014	10203,652
2015	7,342,233
2016	10,456,514
2017	16,946,394
2018	17,072,440
2019	12,680,013

Sensible areas:

- N26 road between Watsa and Isiro in the segment between Moto and Beleu. The N26 is considered a logging road and actually an area of strong exploitation is reported south of the town of Moku up to the mountains. The main causes are artisanal mining and the formation of agricultural areas in the flat land, while it is the result of illegal logging along the relief up to the locality of Matawi on the opposite side.
- Western slope of Mount Taderubi into the villages along the Terow river.

Source

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

GLAD DEFORESTATION ALERTS

Each GLAD deforestation alert indicates a 30 x 30 meter area that has been disturbed in the forest canopy, indicating that trees in that area may have been lost or removed. The primary purpose of the GLAD alert system is to warn people of potential deforestation, but GLAD alerts also detect other disturbances such as rotation cycles in plantations, forest degradation from fires and storms, and natural changes such as landslides and windthrow. GLAD alerts are intended to provide an early indication of where new deforestation may be occurring so that law enforcement officers, local communities, advocacy organizations and other responders can take targeted action. Considering the alerts recorded in Mari–Minza *chefferie*, Mangbutu and Kibali *secteurs*, their total number was 24,787 in 2020 grown to 28,569 in 2021, and in particular they were clustered in these locations:

- Western and eastern slopes of Mount Taderubi;
- South of Maba locality (*secteur* Mangbutu) in the area prevailing permanent upland streams;
- Surrounding the village of Tora (*secteur* Kibali);
- Near the village of Agubu, close to Mont Jagu;
- The entire region southeast of the *secteur* Kibali.

Source

Hansen, M.C., Krylov, A., Tyukavina, A., Potapov, P.V., Turubanova, S., Zutta, B., Ifo, S., Margono, B., Stolle, F., and Rebecca Moore. (2016) Humid Tropical Forest Disturbance Alerts Using Landsat Data. Environmental Research Letters 11, 3:034008. <https://doi.org/10.1088/1748-9326/11/3/034008>

TREE BIOMASS LOSS

The calculation of CO₂ emissions associated with the loss of above-ground live woody biomass is based on the calculation of above-ground live woody biomass density values for the year 2000 with annual tree cover loss data from 2001 to 2018, both at approximately 30 m spatial resolution. All of the aboveground carbon is considered to be committed emissions to the atmosphere upon clearing. Emissions are gross rather than net estimates, meaning that information about the fate of land after clearing, and its associated carbon value, is not incorporated. Emissions associated with other carbon pools, such as soil carbon, are not included. Loss of biomass, like loss of tree cover, may occur for many reasons, including deforestation, fire, and logging in the course of forestry operations. In the Mari–Minza *chefferie*, Mangbutu and Kibali *secteurs*, CO₂ emissions associated with the loss of

aboveground live woody biomass averaged 1.708 tCO₂/ha between 2001 and 2008, with approximately 78% concentrated in the Mari–Minza *chefferie* (1.343 tCO₂/ha). The maximum value was recorded south of the N26 route between Watsa and Isiro in the segment between Moto and Beleu, south of Mount Taderubi.

Source

Harris, N.L., Gibbs, D.A., Baccini, A. et al. (2021). Global maps of twenty-first century forest carbon fluxes. Nat. Clim. Chang. 11, 234–240. <https://doi.org/10.1038/s41558-020-00976-6>

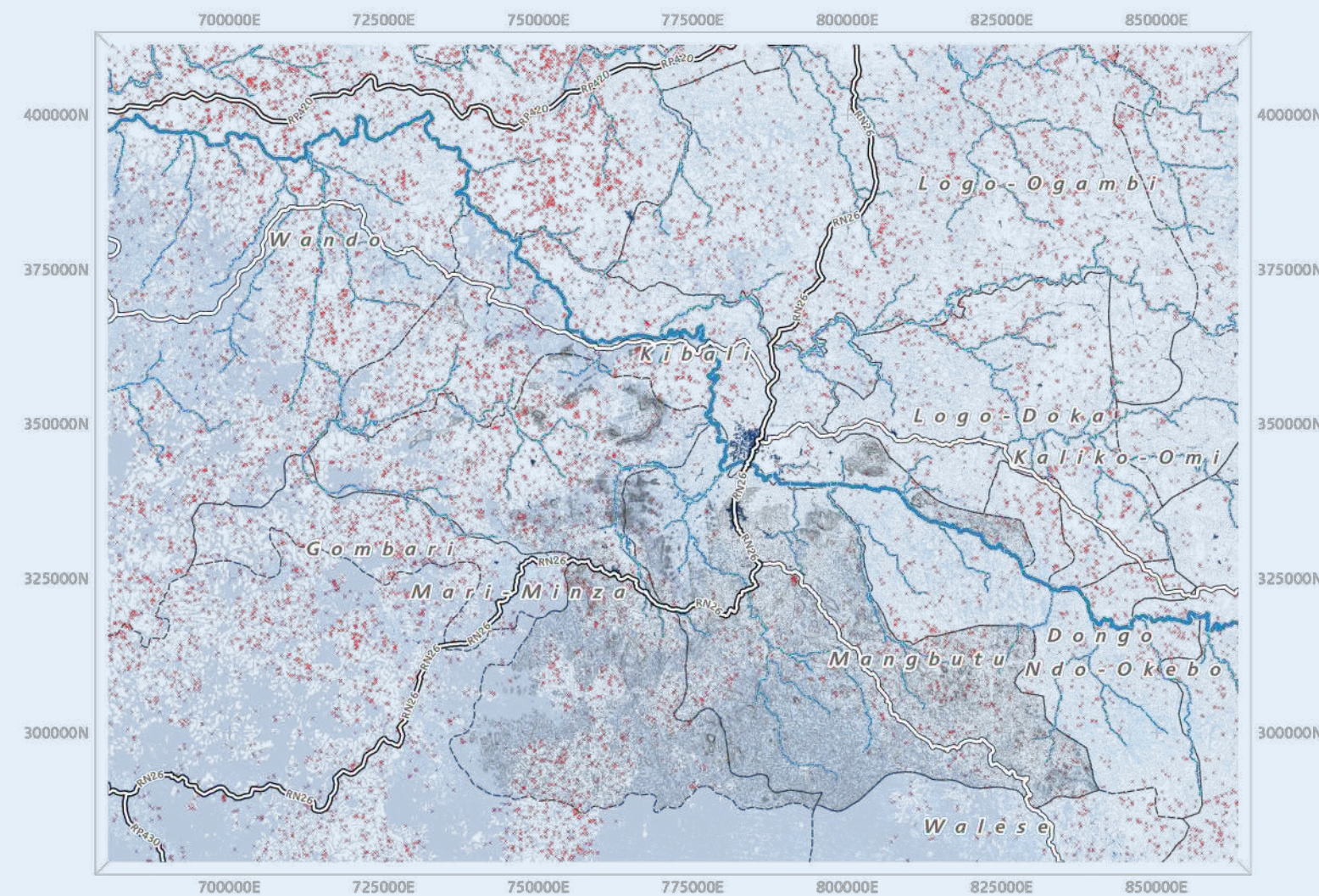
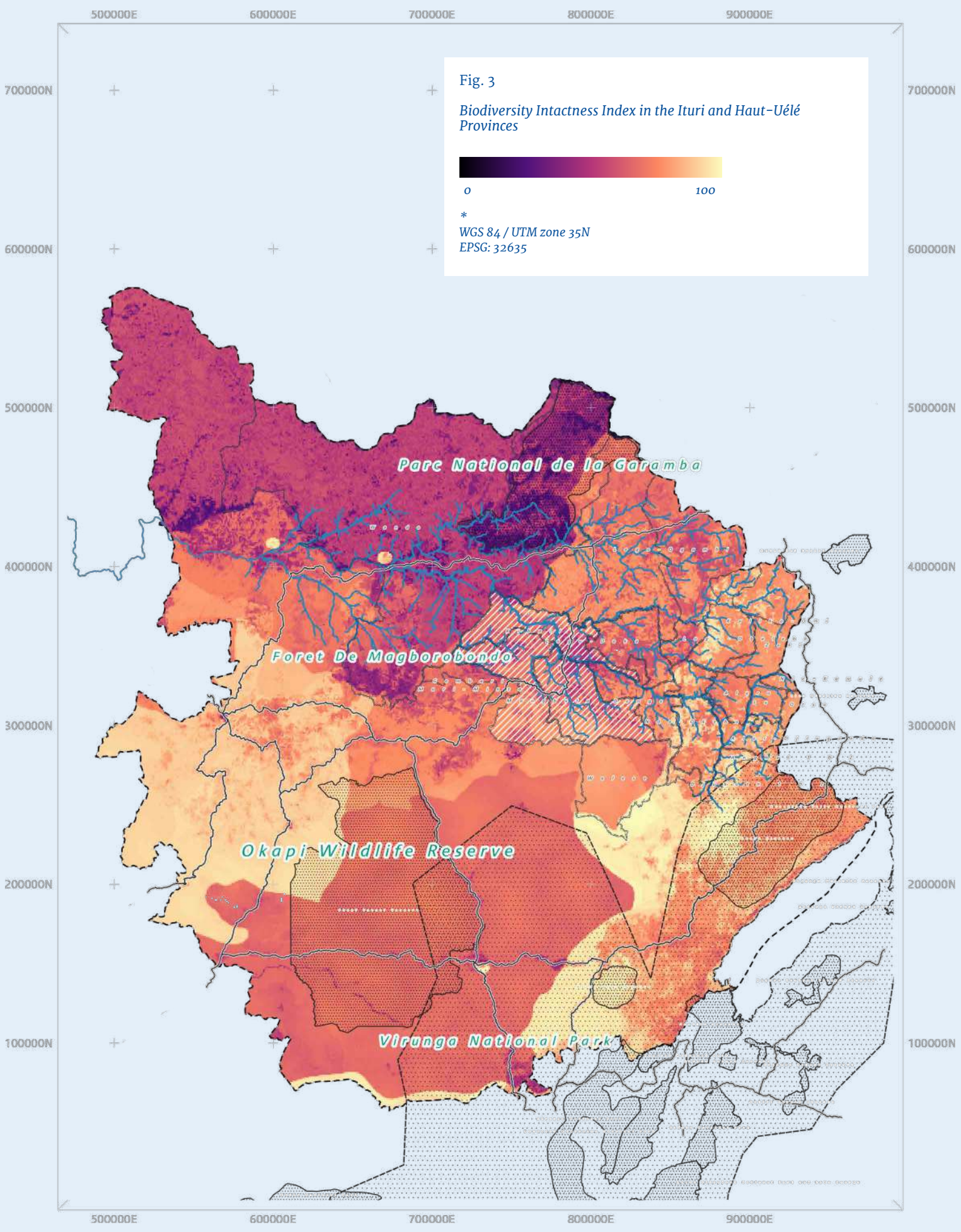
FOREST CONDITION

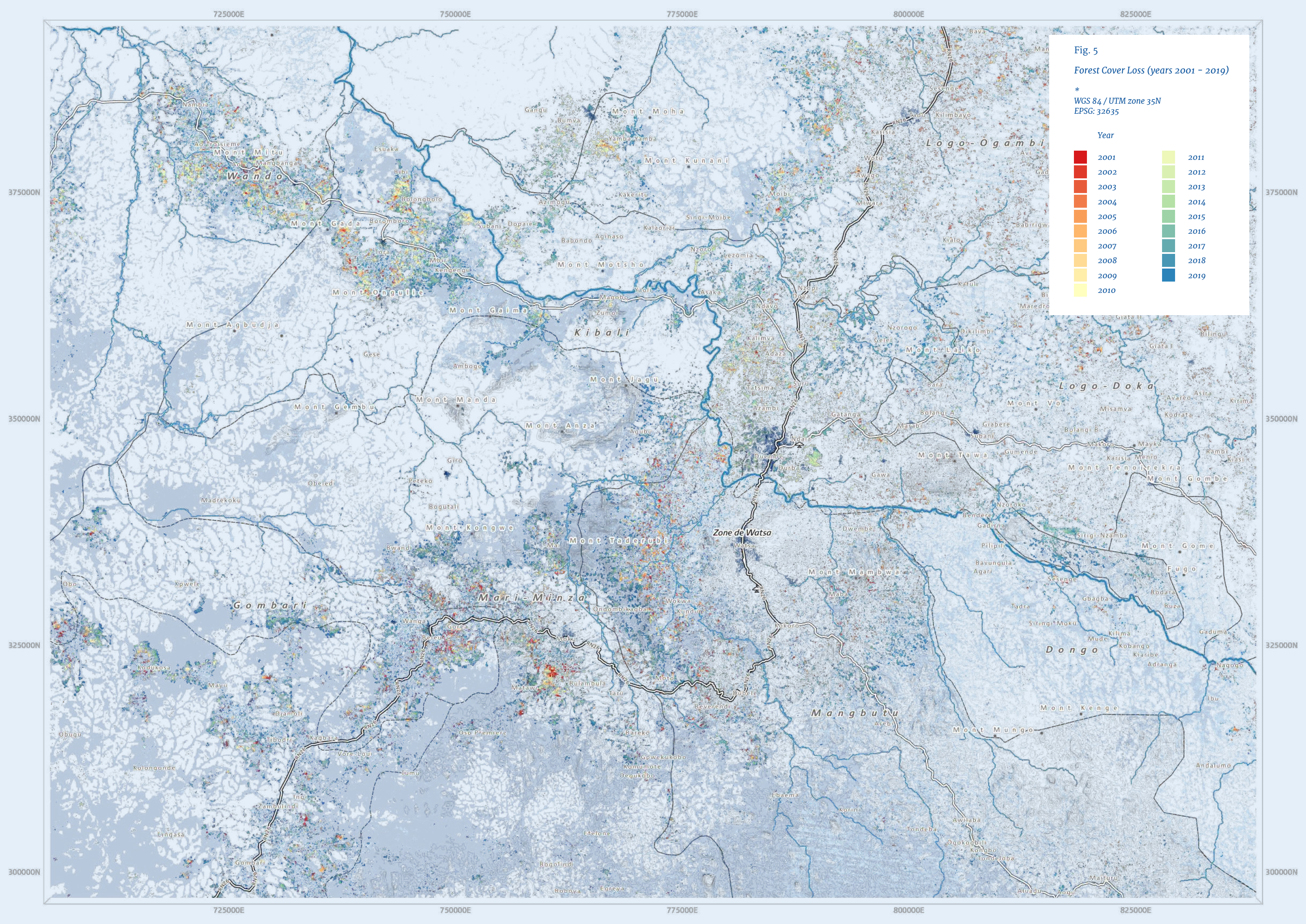
Forest condition (FC) is a continuous metric that aims to measure the degree of forest degradation on a scale of 0 to 100, incorporating the temporal history of forest change over any spatial extent. This metric is parameterized based on estimated changes in above-ground biomass in the context of forest fragmentation over time to estimate a continuous measure of forest degradation specific to the Congo Basin countries over the time period of 2000 to 2014. (Fig. 6)

The 74.3 % of the forest cover in the Mari–Minza *chefferie*, Mangbutu and Kibali *secteurs*, has a Forest Condition of 100 (fully intact). The Forest Condition returns a measure of the fragmentation of the lowland forests that originally occupied the southern part of Watsa territory up to the Kibali river and to assess the continuity of ecological corridors. Under observation are the lost connections between the primary forest and the forest fragments covering Mount Tadeburi and those connecting Mount Tadeburi with Mount Jagu, Mount Gaima, and Mount Gada. At least 20,420 ha of forest in the Mari–Minza *chefferie*, Mangbutu and Kibali *secteurs*, have a Forest Condition value above 50, at some clearcuts within the primary forest (often leading to deforestation contagion from agriculture and increased animal hunting, and which are usually found along forest penetration routes originating from main logging roads).

Source

Shapiro, A.C., Grantham, H.S., Aguilar-Amuchastegui, N., Murray, N.J., Gond, V., Bonfils, D., Rickenbach, O. (2021). Forest condition in the Congo Basin for the assessment of ecosystem conservation status. Ecological Indicators, 122. <https://doi.org/10.1016/j.ecolind.2020.107268>





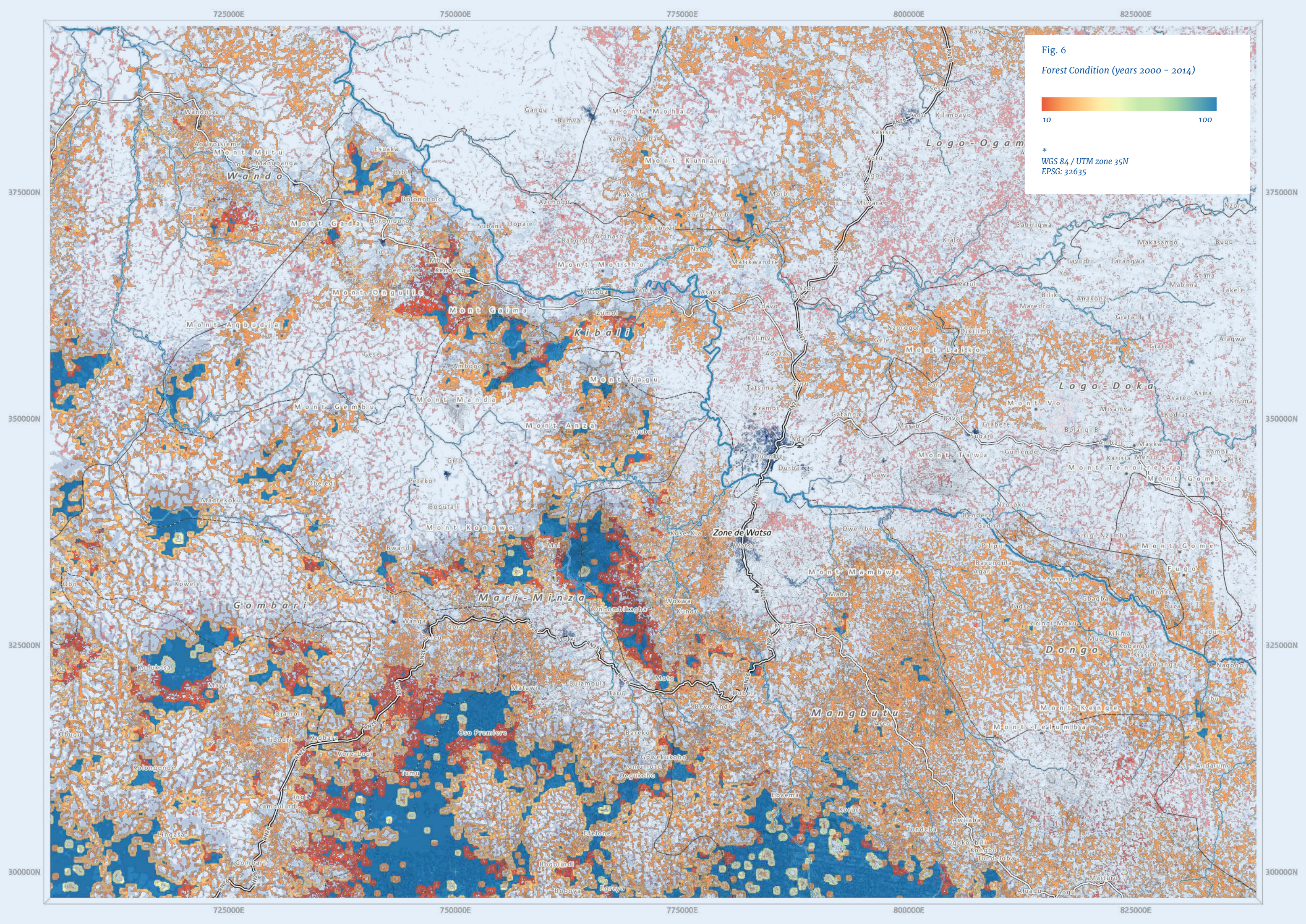


Fig. 6
Forest Condition (years 2000 - 2014)

10 100

*
WGS 84 / UTM zone 35N
EPSG: 32635

HOW COMMUNITIES ARE STRUCTURED AND HOW THEY SHAPE ECOLOGY

Western common sense has most of us believing that the Congo Basin and the territories in its edge are a pristine paradise, untouched by human hands for thousands of years. Colonialism took advantage of this vision to narrow an entire continent to an empty space. But even Western knowledge is catching up to the truth that the Congo Basin hasn't been untouched for at least 10,000–12,000 years, and was actually much more inhabited in the past than it is today.

Communities inhabiting the Kibali river basin live in a chieftaincy society, a centralized political system consisting of a regional entity within which several local groups report to a chief with privileged access to resources. The hierarchy is built by *Provinces*, where different *Territoires* are identified, consisting of *Secteurs* and *Chefferie*, or *Communes*. Each of *chefferie*, *secteurs* or *communes* are endowed with a high cultural and linguistic diversity as a result of migrations between sedentary groups and passages of semi-nomadic or nomadic peoples. As in the neighboring province of Ituri, all four African ethnolinguistic groups are present in the Haut-Uélé *province* (Pygmées, Bantu, Sudanese and Nilotiques). To be specific, the languages spoken in the Kibali *secteur* are the Bangba (Libangba) and the Bari. The Mangbetu (Nemangbetuti), Mamvu, Mangbutu, and the Bomi in the Mangbetu *secteur* (with the addition of the Logoti, Mangbutu, Lese in Watsa town). The Mamvu, and the Efee in the Mari-Minza *chefferie*. Considering also the use of the Lingala language and colonial French (widely used in education), the cultural complexity in just 6,800 square kilometers across the three *chefferie* and *secteurs* is demonstrable.

- AN AMALGAM OF ARRANGEMENTS GOVERNING A PATRIARCHAL LAND SYSTEM

Traditional economic and subsistence activities rely on freedom of movement and the availability of land for fishing, farming and hunting purposes. Constricted land use has restrained the way of life of community members and their ability to survive. Occupation by industrial mining, land encroachment by artisanal and small-scale miners, competition over

shrinking resources for livelihood purposes, and the involvement of armed agents and security forces are directly affecting land security, the impact of which is felt in unique and acute ways by women, minority and marginalized groups.

Land and security issues are tightly linked, with land management systems operating in patriarchal ways that are evolving in the context of insecurity. A very large amalgam of arrangements governs land access and distribution in the DRC, overlapping and often conflicting interests and jurisdictions. Besides the state, there are other institutions that produce rules and norms governing land relations. Despite agreements that are historically informed and locally specific establishing lands defined as customary, communal, or informal, there have been several attempts to institutionalize or deny this normative and legal plurality.

- SHIFTING POWER DYNAMICS

Customary chiefs and their hierarchical leadership structures have traditionally governed land access in northeast DRC, however these power structures are operating within an increasingly contested space. Significant amounts of power are connected to land and the amount of people within a chief's area.

Insecurity has drawn power away from lower-level traditional chiefs as entire communities have left their territories for more secure locations, leaving chiefs with no one living in their region. In addition, traditional chiefs have occasionally fled their territory out of safety concerns which complicates the land allocation process in their absence. Upon return, some traditional chiefs have faced questions about their legitimacy.

The introduction of the state administered Land Code in 1973 has also encroached on the governing space of traditional chiefs who are no longer permitted to be the sole authority on land matters. They have shifted instead into a complementary role supporting the state administrated system by providing signatures on land documents.

- SECURING LAND RIGHTS. AN IMPOSSIBLE TASK WITHOUT THE FULL SUPPORT OF NON-STATE ACTORS

The Congolese state proposes an approach based on participatory land governance, promoting land–tenure security in order to eradicate food insecurity and (land) conflict, and to increase the viability of subsistence agriculture. The pillars are those of clarification, recognition and formalization of land rights. Securing property rights, as well as the delivery and registration of land ownership and tenure rights, are roles that are classically associated with the state. However, the management of these rights and its related conflicts requires arbitration by a public authority, often outside of the state.

Different non-governmental actors and local elites set up mechanisms to ensure this public role. Non-state actors such as civil society organizations, individuals and customary authorities are involved in land governance with regards to filling a void in the state's capacity to deliver services, as important drivers of processes of social change, and ultimately as part of a process of statebuilding.

- THE BUMPY ROAD TO RECOGNITION OF WOMEN'S LAND RIGHTS

Women access land through both customary and state-administered legal systems, however in the customary land system access is differentiated from ownership. In the customary land system women are unable to own land, as inherited land is almost always given to sons rather than daughters.

Women's access to land-based agriculture is possibly secured through marriage, but this mechanism does not ensure them land ownership and especially does not comply with the individual decision-making power. The customary land management system is primarily overseen by the male-dominated chieftainship structure and relies on oral methods and testimonies to function.

The state-administered land system came into force in 1973 with the introduction of the Land Code which uses formal documentation and essentially confers ownership of the land and all underground resources to the state, while customary law recognises the right to land through inheritance from ancestors. Land ownership for women in the state-administered legal system is possible due to their ability to buy land. However, this happens very little in practice because women tend to have low levels of access to the financial means to purchase land, which requires them to pay additional fees to customary chiefs.

Dispute resolution processes in the state-administered system take place through the legal courts, which also requires financial resources for access and travel since these structures are concentrated in provincial capitals and Kinshasa, leading many women to pursue cases in the customary system. Furthermore, with the lack of knowledge of the state-administered system in rural areas, women are less likely to attempt to pursue formal legal processes.

- A PEACELESS REGION

Some parts of the Kibali river basin have been disrupted in recent times or are currently in an extremely insecure situation due to the presence of armed groups and security forces involved in regional conflicts.

In the northern section of the water basin, Lord's Resistance Army LRA groups are active even though the UN Security Council reports that, by 2019, their activities have been reduced and sporadic in the Niangara and Dungu territories (from mid-2010 LRA went into survival mode whereby it was primarily looting to survive, abducting people for a short time to carry food items), while South Sudanese armed groups are reported in Faradje territory and Garamba National park. On the contrary, in the segment where the Kibali River originates and flows in the territory of Alur-Djuganda, increasing violent incidents and raids on properties are reported from 2021, probably by armed groups of CODECO-URDPC. These events force local communities to flee their villages and shelter in the

Internally Displaced People camps in the Mahagi, on the shores of Lake Albert.

Conflict inevitably has environmental impacts, whether intentional or accidental. Conflict when as in this case triggers mass displacement of human populations, drives the decline or near collapse of state functions and consequently a stronger dependence on wild resources by groups growing in numbers of individuals, and overall uncontrolled exploitation of natural resources.

- **HERDERS AND FARMERS, A HISTORICAL CONFRONTATION THAT YIELDS LAND DISPUTES**

The Mbororo are nomadic cattle keepers who have a long history of moving through central Africa, but who started entering the DRC from around 2000 onwards, and became active in Bas and Haut-Uélé from 2005–2006. The number of Mbororo was estimated at between 10,000 and 20,000, with between 100,000 and 160,000 head of cattle. Because of these large numbers of cattle the Mbororo occupy plots of land in the northern section of the Kibali water basin (especially in the territory of Dungu) and the animals destroy many crops and other assets. The local communities complain that no compensation is given and this has led to major tensions, with many wanting the Mbororo to leave the area.

- **THE BOUNDARIES OF HUMAN-LIVESTOCK-WILDLIFE CO-OCCURRENCE**

Human–livestock–wildlife interactions and co-occurrence has significant consequences for human health, safety, and welfare, as well as biodiversity and ecosystem health. To some extent this interaction turns into conflict (actions by humans or wildlife that have an adverse effect on the other) when it is perceived that wildlife threatens human safety, health, food, and property.

Human–wildlife conflict and co-occurrence occurs with species that are rare and protected, abundant and considered pests, heavily managed or even domesticated, and occur in diverse ecological systems of the eastern provinces of the DRC. We know in which areas conflicts are potentially generated, identifying major causes of conflict as recent agricultural expansion associated with extractive operations and rapid growth of human settlements requiring uncontrolled growth in demand for resources, overgrazing of livestock, illegal deforestation, and poaching.

There is a vast and uncontrolled illegal exploitation of wildlife, mainly for bushmeat on which those who

inhabit the new human settlements in the Kibali and Mangbetu *secteurs* and Mari–Minza *chefferie*, and the militias are heavily dependent for their food security. But besides providing a modest source of protein, they are also a source of money for which smuggling routes have emerged leading even across provincial and national borders, with the Garamba / Dungu / Ariwara – Kampala route originating in the territory studied.

- **THE ZOONOTIC SPILLOVER**

Ebola reservoirs are (thought to be) fruit bats, and primates that are often infected by eating fruit previously masticated by bats. The exposure to infected bats and primates or their carcasses enables human infection. From the current evidence, we can say that exposure to sick or dead animals is how the majority of outbreaks emerge. Exposure to bats is suspected as a pathway of transmission, yet there is no real evidence yet for bat–to–human transmission.

Some authors report a higher likelihood of zoonotic spillover to humans due to changes in migration patterns of host species (influenced by climate change), as well as increased human pressure on the forest edge resulting in higher prevalence within reservoir species and higher likelihood of human contacts with infected hosts. The accurate designation of the area we are covering.

Ebola emergence in forest regions is shaped by the interplay of climatic, social–economic and ecological dynamics. Given the acceleration in recent decades of deforestation and urbanization, it is necessary to study the correlation between habitat change and the increased interactions between people and wildlife, to understand the responsibilities of local populations.

Bushmeat consumption can potentially be a source of Ebola infection. The virus stays active in the carcass for at least four days. Infection can occur when a person touches the carcass of an infected dead animal during hunting or butchering. However, cooking kills the virus. In Ebola outbreaks, the initial emphasis of the response has often been put on zoonotic spillover through bushmeat consumption, but according to several authors actually, the most important form of transmission is direct person–to–person contact.

In the Watsa *territoire*, the predicted distribution of zoonotic niche, the environmental suitability for occurrence of zoonotic viruses determined by assessing a number of environmental covariates at locations with occurrences of reported cases in animals and human index cases, is determined by the Institute for Health Metrics and Evaluation between 10% and 70% per unit area. Very high values for predicted zoonotic niche

distribution by other viruses are reported: between 70% and 90% in the Watsa *territoire* for Marburg Virus (where occurrences around Doko–Durba have been recorded since 1998) or values between 40 and 90% for Onchocerciasis and for Zika virus.

- **UNRAVEL THE COMPLEXITY OF TRADITIONAL MEDICINE**

Traditional medicine remains a complex field. It is based on traditions, pragmatism and knowledge, transmitted orally. Pharmacological and clinical studies have researched and demonstrated the effectiveness of some traditional practices (while the majority remain scientifically unproven by conventional medicine), especially when they go beyond the scope of the body and health, and when referring to medicine as being local (grounded in the family circle with forms of self-medication, or that of traditional healers). Traditional medicine practitioners, moderately or highly specialized, use drugs from plants and a large proportion of these plants are obtained from wild sources and particularly from the forest. The province of Haut–Uélé has a notable ethno–medicinal potential.

Traditional practitioners have a positive role to play as one of the stakeholders in the conservation of plant diversity. Their contribution is demonstrated and recognized through the practice of cultivating medicinal plant species because as long as a plant is known and successfully used by healers, it will be harvested. This suggests highlighting the best practices and knowledge of traditional healers based on their specialties. Active involvement in conservation efforts is a concrete way to protect a wide variety of plant species.

- **REVIVE ANCESTRAL (ECOLOGICAL) KNOWLEDGE**

Researchers advance two important empirical observations during fieldwork in northeastern Democratic Republic of Congo. First, there has been a marked and recent resurgence of customary authority in local governance, characterized by an important ritual dimension and a particular discourse on legitimacy. Second, local perceptions of the ongoing social, economic, and political crisis in the region often include the idea that there is a causal link between the decline of ancestral knowledge by the loss of the tangible cultural heritage (attributed to colonial collecting and emergency displacement caused by war), and the current state of poverty in society. The revitalization of the culture, ancestral knowledge, language and traditions in these territories is a call to ensure peace and survival of all peoples who coexist in the region.

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LACK OF CONSULTATION WITH LOCAL COMMUNITIES

In 2014, 70 researchers, advocacy groups, and other representatives issued an open letter calling for change in policies to shift focus on local dynamics and the root causes of conflict, such as access to land, identity, and political contest in the context of a militarized economy, rather than a narrow focus on minerals in the eastern DRC. This letter is among the earliest in exposing the so-called minerals conflict, denouncing that minerals are not the cause of the conflict but are the way to perpetuate it, fueled instead by the struggle over power and influence, as well as issues of land access, citizenship and identity. Most of all, it calls for local communities and civil society to be involved and represented in decision-making processes. Call to improve consultation with local communities is not limited to the mining sector but is also applicable to other sectors where greater knowledge of the local context is required. Civil society struggles to fulfill its mandate given the long list of stakeholders, the complexity of the physical and human geography of the region where it has to act.

THE STRUGGLES OF CIVIL SOCIETY

In October 2021, the *Nouvelle société civile du Congo* NSCC reports that 5 human rights defenders are being sought by the police for supporting peaceful demonstrations on 22 October 2021 following the eviction and demolition of several buildings at Site B of the Kibali Gold Mine concession in the Bandayi and Mege areas in Durba. Civil society organizations complain about the working conditions of artisanal miners and report deaths due to poor safety conditions and natural events; like on 15 December 2019, when a landslide killed 28 people at the Ndiyo gold mine in the Mangbutu *secteur*. Labor rights are also backed by civil society, such as when for the first time on 29 August 2016 a peaceful march was organized in Watsa to denounce the Société minière de Kilomoto SOKIMO for owing wages. But apart from the mining sector, it is the armed conflict that has engaged the most. Fears are raised over the possibility of armed conflict resurfacing, still not forgetting the horrors of the past. That’s why between December 2019 and March 2021 a possible massive return of the Lord’s Resistance Army LRA is reported following some incursions down to Dungu. Quite a different situation in the Alur-Djuganda *territoire*, where since 2019 the presence of armed actors is registered with increasing concern.

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CLIMATE IS COMPLEX
AND SHOULD CONCERN
EVERYONE

The IPCC’s Sixth Assessment Report, *AR6 Climate Change 2022: Impacts, Adaptation and Vulnerability*, assesses the vulnerability of socio-economic and natural systems to climate change, negative and positive consequences of climate change and options for adapting to it. This report reaffirms the concept that exposure and vulnerability to climate change are multidimensional with intersecting socioeconomic, political and environmental factors.

Scientists see climate change processes as consisting of the interactions between climate, aerosols, and biogeochemistry: the study of the chemical, physical, geological, and biological processes and reactions that govern the natural world, especially the cycles of chemical elements, such as carbon and nitrogen. But it is far more than that. While in “wealthy” countries, the looming climate crisis is a matter of concern because it will affect the wellbeing of the economy, in Africa (which is hardly a contributor to climate change) it will be a matter of life and death.

A complexity that youth seem to have unveiled with concern, by organizing around climate justice movements (*Lutte Pour Le Changement* LUCHA, Rise up Movement, Extinction Rebellion, aside from the tens of community groups and university collectives).

-
WHAT FUTURE LIES AHEAD?

Climate change has increased heat waves and drought on land. Frequency and intensity of heavy rainfall events will increase at all levels of global warming, increasing exposure to pluvial and riverine flooding. Multiple African countries are projected to face compounding risks from: reduced food production across crops, livestock and fisheries; increasing heat-related mortality; heat-related loss of labour productivity. Recent extreme variability in rainfall and river discharge (-50% to +50% relative to long-term historical means) across Africa have had largely negative and multi-sector impacts across water dependent sectors. Hydrological variability and water scarcity have induced cascading impacts from water-supply provision and/or hydro-electric power production to health, economies, tourism, food, disaster risk response capacity and increased inequality of water access.

Future warming will negatively affect food systems in Africa by shortening growing seasons and increasing water stress. There is a large agreement on the perspective that climate change is projected to increase migration, especially internal and rural-to-urban migration.

African biodiversity loss is projected to be widespread and escalating with every 0.5°C increase above present-day global warming. Above 1.5°C, half of assessed species are projected to lose over 30% of their population or area of suitable habitat. At 2°C, 36% of freshwater fish species are vulnerable to local extinction, 7-18% of species assessed are at risk of extinction. Above 2°C, risk of sudden and severe biodiversity losses becomes widespread. Climate change is also projected to change patterns of invasive species spread. Climate change is altering the structure and species composition of tropical tree communities.

-
RECOGNITION OF THE ROLE OF LOCAL
COMMUNITIES

Community-based adaptation, built on Indigenous Knowledge and Local Knowledge over centuries or millennia, is often identified as an effective adaptation strategy to climate change. For successful adaptation of tropical forest communities, it is vital to consider Indigenous Knowledge and Local Knowledge in addition to modern scientific approaches, together with consideration of non-climatic vulnerabilities, marginalization of minority groups, and discrimination or degradation of their homelands by local and international actors.

An important recognition of the traditional knowledge about local communities and their value system, as the capacity to adapt to climate change is inevitably linked to the cultural, linguistic and historical context, unfortunately still underrated resources.

BOX 2 -
SCENARIOS FOR THE
KIBALI RIVER BASIN TO
2050

Climate scientists, economists, and energy system modelers have developed a range of storylines known as Shared Socioeconomic Pathways SSP, describing different scenarios of societal change over the next century. From the fully sustainable scenario SSP1 (low challenges to mitigation and adaptation) to the less optimistic scenario of fossil-fueled development SSP5 (high challenges to mitigation, low challenges to adaptation). Each scenario should be read together with the Representative Concentration Pathways, which describe different levels of greenhouse gases and other radiative forcing that might occur in the future (2.6, 4.5, 6.0, and 8.5 watts per meter squared by 2100). Although RCP8.5 is seemingly unrealistic and sensationalistic in its results, one reason to use it is that a pathway with a large change in forcing allows one to better distinguish between signal (the response to the change in external forcing) and noise (the natural variations). Still, given the uncertainties in carbon cycle feedback, we cannot rule out that an emissions pathway typically associated with a lower RCP may lead us to follow a concentration pathway close to RCP8.5. For these reasons, land use shift is estimated according to the GLOBIO model consistent with the SSP5 RCP8.5 pathway.

The core of the GLOBIO model is a set of quantitative relationships that assess the impacts of anthropogenic pressures on biodiversity. The GLOBIO model combines the pressure-impact relationships with maps of the pressures (e.g. climate change, land use, roads, atmospheric nitrogen deposition and hunters’s access points) resulting in maps with impact-specific Mean Species Abundance MSA values. Applying the GLOBIO 4 model at 2050 according to the SSP5 RCP8.5 scenario on the Ituri and Haut-Uélé *Provinces*, it can be seen that 5,388 Mha of forest cover might shift in this proportion (Fig. 7): urban area (5,780 ha), rangeland (138,990 ha), cropland at low intensity (845,750 ha), while changing the forest composition for over 4 Mha (in particular by switching from Tree cover needleleaved evergreen closed >40% to Tree cover broadleaved evergreen closed to open >15%). Noteworthy is the 79% growth in agricultural land over the area surveyed in 2015 (the most striking shift is south of Mari-Minza *chefferie* and Mangbutu *secteur*).

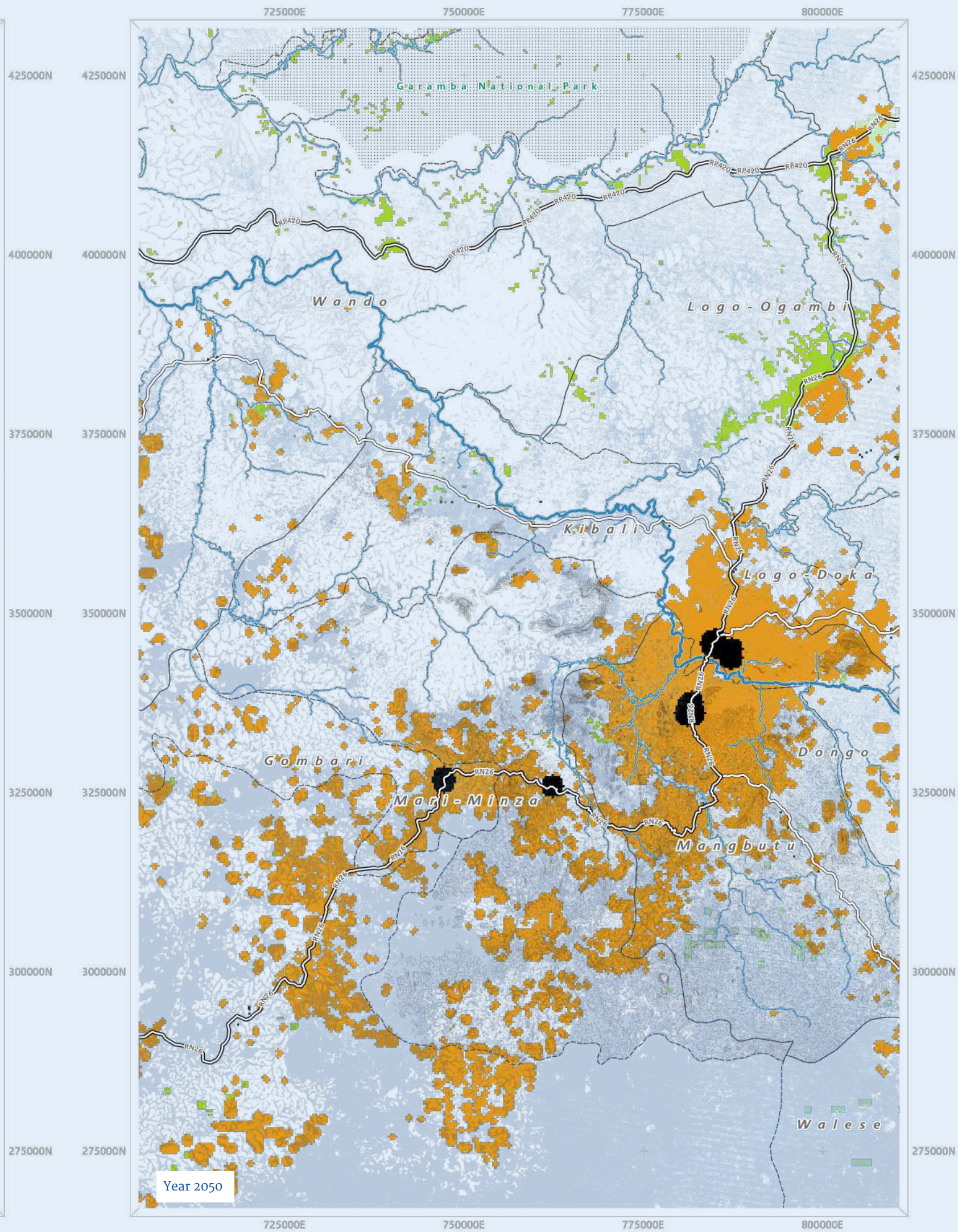
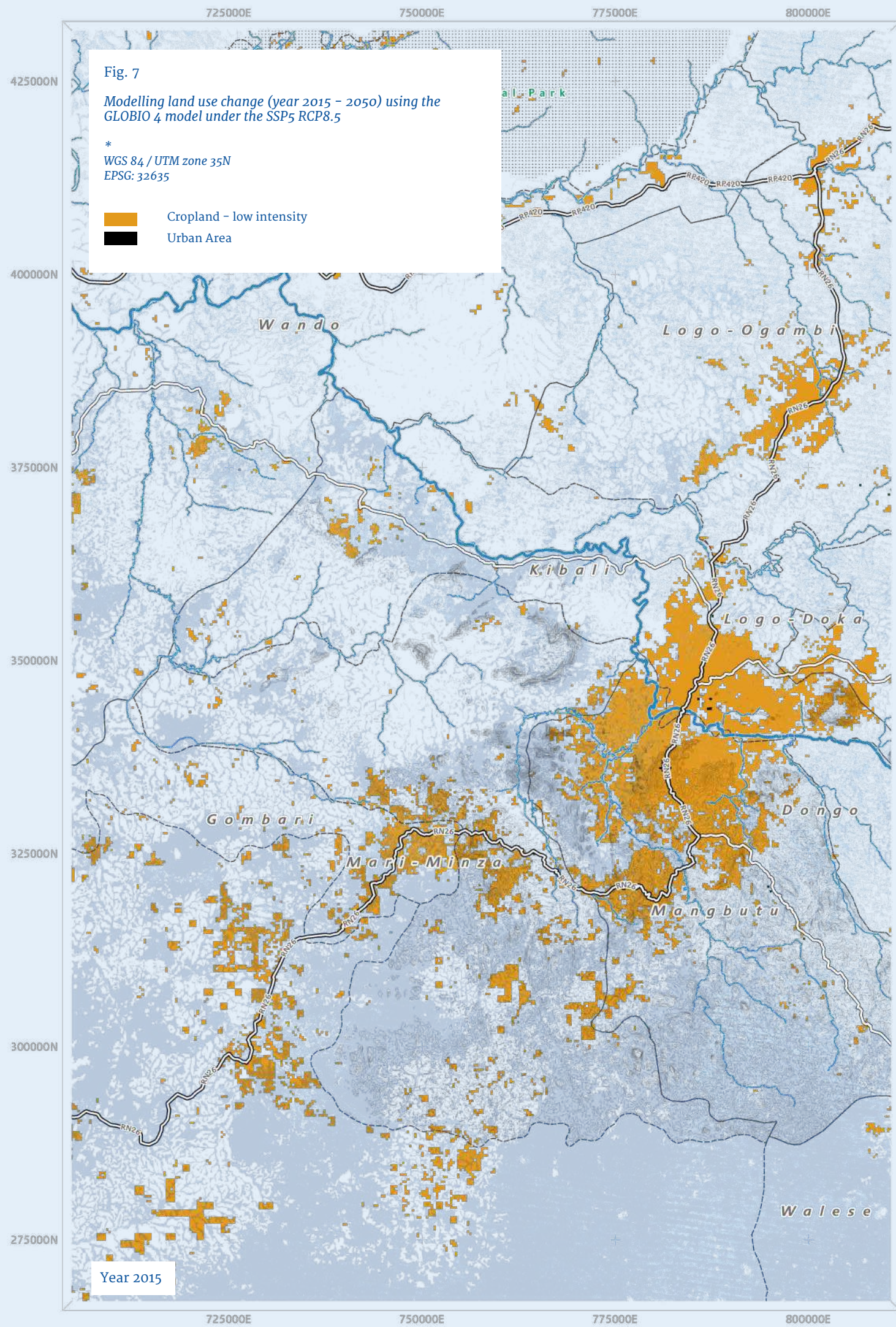
-
SSP5
SHARED SOCIO-ECONOMIC PATHWAY 5: FOSSIL-
FUELED DEVELOPMENT - TAKING THE HIGHWAY

(High challenges to mitigation, low challenges to adaptation)

This world places increasing faith in competitive markets, innovation and participatory societies to produce rapid technological progress and development of human capital as the path to sustainable development. Global markets are increasingly integrated. There are also strong investments in health, education, and institutions to enhance human and social capital. At the same time, the push for economic and social development is coupled with the exploitation of abundant fossil fuel resources and the adoption of resource and energy intensive lifestyles around the world. All these factors lead to rapid growth of the global economy, while global population peaks and declines in the 21st century. Local environmental problems like air pollution are successfully managed. There is faith in the ability to effectively manage social and ecological systems, including by geo-engineering if necessary.

Source

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TARGET LAND DEGRADATION

Land degradation occurs when a change in land use causes a loss of biodiversity, ecosystem functions or services, such as through deforestation. Degradation is a complex process and although conceptually it occurs in discrete steps, the activities are not isolated in time or space. Assessing degradation begins from a baseline condition. Where the baseline is a pristine state, the first step of degradation would be the destruction or removal of native vegetation cover (baseline need not be pristine conditions). Degradation that occurs without a change in land use can threaten the delivery of ecosystem services such as biodiversity, carbon sequestration, and other provisioning or regulating functions. Specifically, forest degradation is the temporary reduction in the ability of the forest to provide goods and services as a result of reduction in forest area and alteration through the process of fragmentation, inducing canopy opening, biodiversity loss, and modification of the vertical structure of the forest or change in other attributes. Such a forest has lost the structure, function, species composition and/or productivity normally associated with the natural forest. But degradation is also to be assessed from the perspective of mismanagement of natural resources, including the effects of heating and climate variability, alone and in combination with social drivers.

CALCULATE THE EXTENT OF DEGRADATION

The realization that simply preserving extant non degraded natural ecosystems will be insufficient to address global environmental problems has led to increased reliance on passive and active restoration to counter the effects of landscape degradation. Defining the level of degradation and spatial extent of these areas to plan for their recovery and restoration is critically embedded in the process.

Within the scope of this report, a spatial analysis is implemented through the Weighted Overlay Process to identify degraded areas over the Haut-Uélé Province. This was done using SE.PLAN, a spatially explicit decision-making tool that aims to identify locations where the benefits of forest restoration are high relative to the costs of restoration (restoration suitability), subject to biophysical (elevation, slope,

annual rainfall, baseline water stress), forest change (deforestation rate, climate risk, natural regeneration variability) and socioeconomic constraints (presence of protected areas, population density, land rights security, accessibility to inhabited areas) imposed by stakeholders to define areas where restoration is allowed/preferable. Adaptation to the context was done by taking into account those areas with a human presence density greater than 150 people/km², while excluding from the calculation all areas where local and indigenous communities have greater control over resources (including stewardship mechanisms). In addition, restoration objectives emphasize the need to avoid worsening the biodiversity integrity index and range rarity of endangered species, while at the same time prioritizing the need of local communities to harvest woodfuel given the lack of energy alternatives. In the calculation, the value of aboveground carbon accumulation in the implementation of forest restoration projects is also recognized as an important variable as included in the international frameworks.

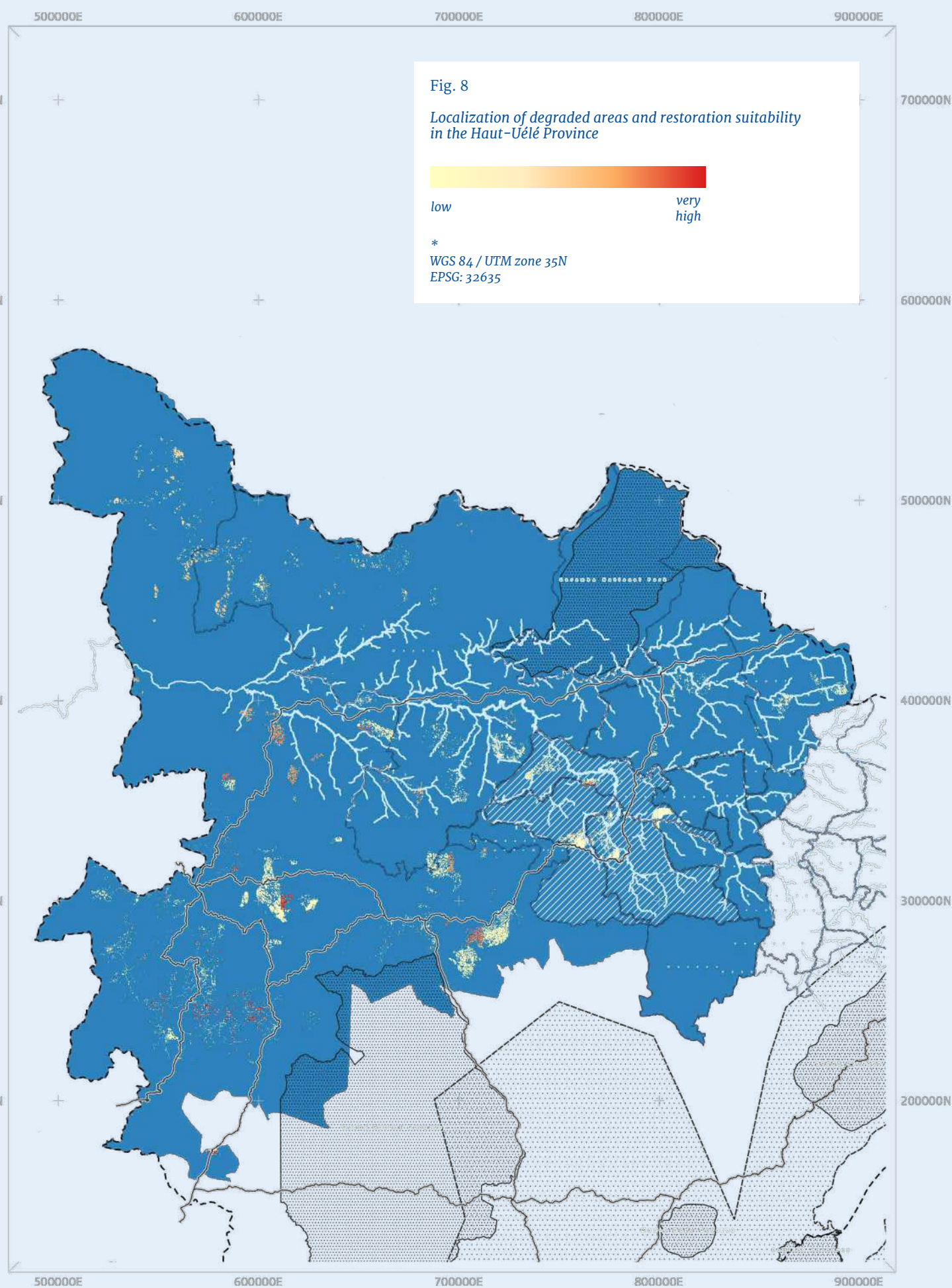
Beginning from the outlined context it has been simulated that in the Haut-Uélé Province 19,108 ha are resulted with a High and Very High value of restoration suitability (7% of which are located in the Mari-Minza chefferie, Mangbutu and Kibali secteurs), which would allow the possibility of harvesting an average of 0.39 m³/ha of woodfuel and maintaining an average aboveground carbon accumulation of 4.00 Tg C/ha/yr. The simulation also reports that for the Mari-Minza chefferie, Mangbutu and Kibali secteurs, the present vegetation cover is 57% less than potential. The highest suitability values are given around Mendu village (north of Mount Jagu) in the Secteur Kibali, and between the western slope of Mount Taderubi and the eastern slope of Mount Kongwe in the Mari-Minza chefferie. (Fig. 8)

Fig. 8

Localization of degraded areas and restoration suitability in the Haut-Uélé Province



*
WGS 84 / UTM zone 35N
EPSG: 32635



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SOLUTIONS AND RECOMMENDATIONS

IN THE LIGHT OF THE COMPLEXITY DISCLOSED

Given the complexity of defining the degraded land in the Mari-Minza *chefferie*, Mangbutu and Kibali *secteurs*, in light of the criteria studied (land cover/use shifts due to climate factors – GLOBIO 4 model, restoration suitability – SE.PLAN, restoration potential – Bastin et al., 2019, restoration of ecological corridors relying on the Forest Condition index – Shapiro et al., 2021, the socio-economic-cultural dynamics), the recommended areas targeted for rapid, effective and priority restoration action are as follows, with a total area of 12,160 ha (Fig. 9 and [interactive map](#)):

- Mount Taderubi in the *Secteurs* Mangbutu;
- the valley between Mount Tederubi and Mount Kongwe (main village is Mai) in the Mari-Minza *chefferie*;
- the mountains south of Moku town and the RN26 route in the Mari-Minza *chefferie*;
- areas crossed by the R433 route Durba-Ndedu around the villages of Mbiri and Kengengu.

Restoration actions to be implemented together with local communities following a rights-based approach, ensuring the Free, Prior and Informed Consent from the communities depending on their self-determination, promoting women leadership in the decision making processes about restoration practices and relying on the co-design of the actions.

THE PILLARS FOR LAND RESTORATION IN THE RECOMMENDED AREAS

A restoration project is multidimensional and solutions cannot be built on a single area of expertise but rather must arise from the cooperation of many actors aligned on the same vision of the future.

CONSERVATION AGRICULTURE AND AGROFORESTRY

FOREST RESTORATION

REMEDIATION (RECLAMATION) IN THE ABANDONED CONTAMINATED MINES

CLEAN COOKING

ADVOCACY AND ENVIRONMENTAL EDUCATION

HOLISTIC PROTECTION

CONSERVATION AGRICULTURE AND AGROFORESTRY

Conservation agriculture is a response to climate change and farmer vulnerability by providing improved ecosystem functioning and services. Conservation agriculture enhances biodiversity and natural biological processes above and below the ground surface, contributing to increased water and nutrient use efficiency and productivity, to more resilient cropping systems (avoiding or minimizing mechanical soil disturbance, maintaining year-round biomass mulch cover over the soil, diversifying crop rotations, sequences and associations, adapted to local environmental and socio-economic conditions), and to improved and sustained crop production.

Conservation agriculture meets smallholder farmers' need to spend less time on agricultural production (per unit of land), because it reduces intensive tasks, and, as a result, more time is available to diversify livelihoods especially for women, that represent the largest sector of the agricultural workforce. It should be remembered that greater cohesion among farmers could lead to greater adoption of conservation agriculture, since otherwise its adoption would be limited due to the lack of access to credit to implement this technology and would on the contrary produce an increase in food insecurity.

Conservation agriculture associated with agroforestry, allows the inclusion of high-value tree species, capable of further contrasting food insecurity as well as ensuring the survival of an ecological, social and cultural system inherited from the ancestors. Trees that also have greater ability to improve soil fertility, safeguard water quality along with biodiversity, reducing impacts of climate variability.

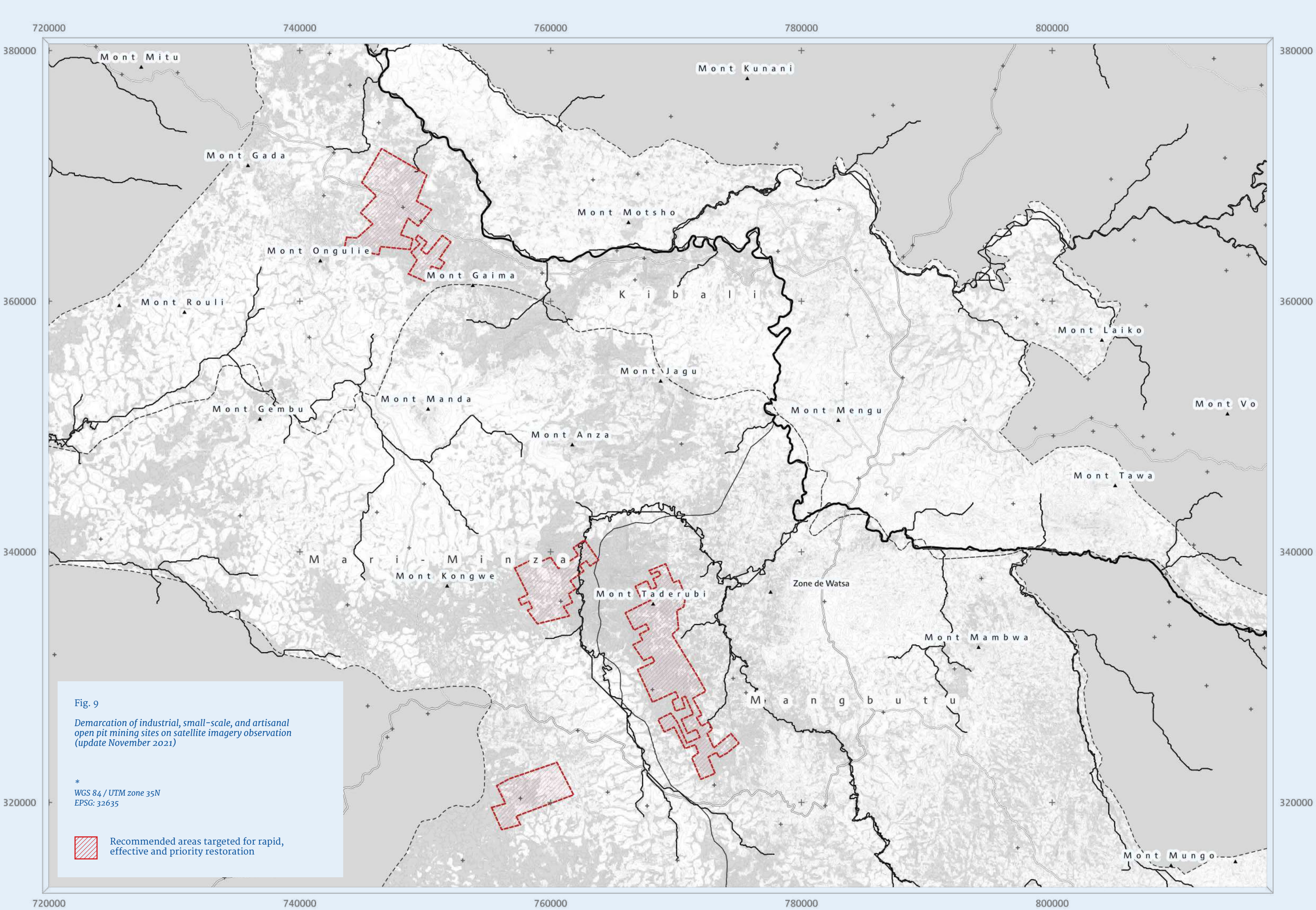
In the Mari-Minza *chefferie*, *secteurs* Mangbutu and Kibali, agroforestry is a common practice by farmers. Increased local demand for food could lead to a shift toward other, more invasive farming techniques, the use of which should be discouraged by supporting the adoption of agroforestry systems and conservation agriculture. To do this, besides facilitating access to credit, it is necessary to bridge the seed gap, support agricultural vocation and knowledge transmission in an intergenerational dialogue together with the dissemination of best management practices, but above all, ensure the customary and state-administered land system guarantees land rights especially for women.

FOREST RESTORATION

Forest restoration must be an inclusive process that depends on collaboration among a wide range of stakeholders, stewarded by local communities, along with government officials, non-governmental organizations, scientists, and funders/donors. Its ecological success is measured in terms of increased biological diversity, biomass, primary productivity, soil organic matter and water-holding capacity, carbon accumulation, as well as the return of keystone species, characteristic of the target ecosystem. But predicting the rate and degree of forest restoration is difficult and requires extensive study. An assessment would be required to evaluate: if limitations should be placed on the land use for restoration areas in order to accelerate recovery processes; where a combination of factors such as limited seed dispersal, aggressive exotic vegetation, microclimatic extremes, and/or soil degradation may result in excessively slow or no recovery; how to deploy active restoration strategies such as planting trees, modifying soils, and recomposing the topography without adversely affecting natural regeneration, resulting in less diverse forests, producing disservices such as reduced soil moisture, or may not be cost effective.

Passive natural or assisted natural restoration in the Mari-Minza *chefferie*, *secteurs* Mangbutu and Kibali, should be recognized as a viable and less costly restoration option in cases where initial recovery may be rapid (linked to environmental advocacy with local communities), while resources for active restoration (e.g. tree planting and/or sowing seeds) should be allocated when a specific assessment recognized it as the privileged solution on the basis of a detailed study of the forest ecology, also taken into account the presence and extent of mining sites.

Since 2008, the DRC has been implementing Payment for Ecosystem Services PES projects under the Clean Development Mechanism CDM of the 1992 United Framework Climate Change Convention (UNFCCC 1992), although there is no specific law. This is a mechanism that could ensure more effective restoration, but the clarity of legal instruments on land tenure is one of the priorities in the creation and the implementation of an effective PES scheme (implementation should be done on land which is properly and legally owned, de facto excluding a large part of communal and customary land outside protected areas). To secure the implementation of PES, the existing land-tenure laws should promote clear borders and compliance with land rights.



REMEDIATION (RECLAMATION) IN THE ABANDONED CONTAMINATED MINES

Almost all of the open-pit artisanal or small-scale mines in the Mari-Minza *chefferie*, *secteurs* Mangbutu and Kibali, are not rehabilitated. Metalliferous tailing spoil heaps host high concentrations of trace elements such as copper, lead, mercury, cadmium, and arsenic while threatening to enter the environment.

Mine soils containing mining refuse usually have poor quality and are unfavorable to plant growth, thus improving quality of mining refuse is necessary. The spontaneous ecological rehabilitation of a degraded area is possible, however, it can be a very slow process, especially if the artificial habitats and the local edaphoclimatic conditions are not favorable.

The success of ecological rehabilitation depends on both the neighboring biocenosis and on the biodiversity hosting capacity of the mine site (depends on its location, size, shape, geology, morphology and the geometry of the open-pit mine). Therefore, human intervention may be needed to allow a more rapid colonization of these areas. Given that topsoil management of degraded mine soils is important to the reclamation plan to reduce nutrient losses and improve fertility, it is critical to conduct a detailed scientific investigation over the identified areas (e.g. to identify which native trees, shrubs, grass and forbs can be used for phytostabilization, how to control pollutants, whether chemical and physical treatments or a morphological recovery are required, and remove threats to humans).

Reclaimed areas can be designated for productive land use (possibly transient use) such as conservation agriculture, agroforestry and forestry, or long-term uses that require wildlife habitat reparation.

CLEAN COOKING

Cooking over open fires on simple threestone hearths is commonplace in the Mari-Minza *chefferie*, *secteurs* Mangbutu and Kibali. Improving the efficiency of local cook stoves is a potential solution promoted to mitigate pressure on forest resources when employed to generate energy (a study carried out on a matched context in South Kivu *Province* estimated that fuelwood consumption decreased by 50%) and improve human health.

Stove design is not widely available locally, so it needs to be co-designed, with input from local groups and help from local builders, made from locally available materials at an affordable cost, using stoves built in neighboring regions as an initial reference.

Training on stove construction, use, and maintenance is necessary for women's groups and the community at large. It must also be accompanied by robust advocacy and campaigning (e.g. inperson and by weekly radio programs) followed by a validation on the acceptability (e.g. a potential barrier for the acceptance of improved stoves is that the taste of food prepared over an open fire is sometimes preferred).

ADVOCACY AND ENVIRONMENTAL EDUCATION

Collective approaches to communication and community engagement, popular and participatory communication can be strategized between communities and civil society with the double value of enhancing advocacy and strengthening civil society taking action in the Mari-Minza *chefferie*, *secteurs* Mangbutu and Kibali.

Advocacy and campaigning efforts should be on: secure land tenure and land rights; legal frameworks on land and environment with emphasis on the principle of free, prior and informed consent; environmental and health risks in mining operations; women's rights; transmission of traditional knowledge in an intergenerational dialogue. Some of the deliverables that might be produced are: handouts with the translation of technical information and the disclosure of the risks in mining operations; audiovisual materials about the territory and the threats it faces; debates on community radio stations followed by mobilizations; participatory mapping of the land with a focus on its cultural heritage; production and dissemination of shared traditional-scientific knowledge.

The creation or support of networks is valued as a strategy to amplify the voices of the territories, promote meetings, alliances and formulate criticism. Besides building political networks and meetings, the strategy also feeds on the exchange between communities and experiences of confrontation (pedagogy embodied in the exchange of experiences strengthens the process of resistance and allows to illustrate achievements, anticipate risks, rework mobilization strategies, building bridges of solidarity and identification between collective subjects). This alliance between communities and networks can be configured within an institutional framework to activate civil society in reporting violations, even up to legal international bodies.

HOLISTIC PROTECTION

Women Environmental and Human Rights Defenders have learned to care and preserve life, even if most of the time in exploitative situations, through centuries of colonization, inequality, dispossession, violence on bodies and territories. They have learned from ancestors that no one survives without the daily protection of those who feed us, hold us, heal us. They also work to safeguard what sustains us: water, harvest, forests. Every human being is vulnerable and needs collective care to survive.

Collective protection is achieved by building a network, which is configured as a space to address crises and coordinate the activities of those living at risk, their families, organizations and communities (mobilize resources, activate urgent alerts, campaigns to report, express solidarity and support, strengthen capacities, connect with other networks and global organizations).

The network serves to rebuild community connections where they have weakened, to sustain basic needs and ensure ongoing communication.

The **Environmental Defenders (ED)** is an ecofeminist and collaborative environmental justice organization that protects biodiversity and defends Indigenous People's rights. **ED** is dedicated to building resilience for human and environmental security, helping marginalized Indigenous Peoples and communities make a sustainable living and protect their water sources, land, and the local environment. We are active in the Albertine Rift and the Congo Basin. **ED** strengthens the resilience of individuals and communities to withstand environmental shocks.



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