Session I

Young Researchers' Overseas Day
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Spatial accessibility to health facilities in Sub-Saharan Africa: comparing existing models with survey-based perceived accessibility

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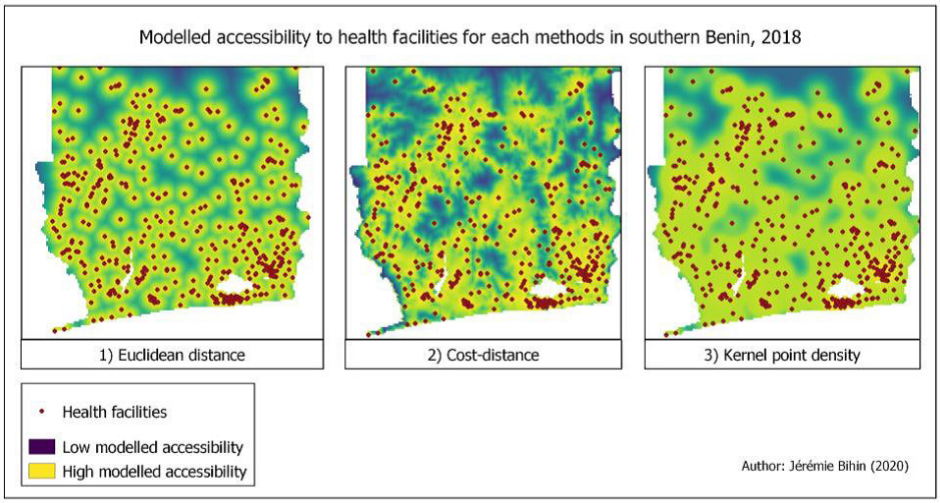
KEYWORDS. — Access to health; Spatial Modelling; Geographical Information Systems; Sub-Saharan Africa.

SUMMARY. — Scientific evidence has clearly shown that spatial accessibility to health services has a direct influence on morbidity and mortality in Sub-Saharan Africa (SSA). Mapping geographic accessibility to health facilities is often needed for researchers or decision makers in order to evaluate regional disparities in health access and identify populations that are spatially isolated from a health care system. However, accessibility models based on Geographic Information Systems (GIS) software and methods can strongly simplify reality and may not relate to the population's perceived accessibility (PPA) to health facilities. Yet, PPA to health facilities can have a strong influence on someone's decision to seek medical attention when a sickness or injury occurs. Moreover, accessibility models can reach widely varying levels of complexity. The goal of this study is to evaluate to what extent modelled access (MA) is related to PPA, and how different models of varying complexity levels perform in explaining this PPA. Data on PPA were extracted from DHS surveys performed in 15 SSA countries from 2015 to 2020 and then compared to MA values computed from three different GIS-based models. Those models are simple Euclidean distance, travel time estimation with cost-distance method and Kernel point density. A multiple logistic regression was then carried out to identify the variables that best explain PPA. Those variables include MA, but also socioeconomic variables extracted from the DHS surveys such as income and education. Preliminary results on 5 countries suggest that if MA values are generally positively and significantly correlated to PPA, the correlations are relatively low (Spearman correlation indexes of 0.37, 0.37, 0.38 for the three models) and more complex models do not necessarily perform better. The three MA models also perform very differently from a country to another, but Kernel is the one that has the highest correlation to PPA in most countries. We suggest that different geographic contexts can favor different models. Model based on travel-time estimation have generally a lower correlation index to PPA. This could question the validity of cost-distance based method when trying to assess the population experience of accessibility. The multiple logistic regression shows that MA is significantly associated with PPA, but less so than socioeconomic variables such as education or income, suggesting that socio-economic characteristics may play a larger role in the perception of spatial accessibility to health services than localization. In conclusion, our results give an overview of the strengths and limitations of accessibility to health facilities models and allow to discuss when and how those models should be used as a decision making tool. In addition, data and methods developed here are exclusively based on open datasets and codes and can be easily applied anywhere in the world, making their usage easier for low-income and data-scarce countries.



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Au pied du mur.
Politiques migratoires, parcours et temporalités des personnes migrantes à Tijuana

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Mots-clés. — Anthropologie; Ethnographie; Migrations et frontières; Tijuana (Mexique).

Résumé. — En janvier 2019, le gouvernement des États-Unis a mis en place la section 235(b) (2) (C) de la *Immigration and Nationality Act* – INA qui établit que tout étranger qui arrive par voie terrestre depuis un territoire contigu étranger (le Mexique et le Canada, par exemple), que cela soit par un port d'entrée désigné ou non, peut être renvoyé dans le pays par lequel il entre et doit y attendre la résolution de sa demande d'entrée. Cette application des *Migrant Protection Protocols* – MPP, oblige donc les personnes demandeuses d'asile à la frontière mexicaine-étatsunienne à demeurer au Mexique dans l'attente de la résolution de leur dossier.

Cette communication se base sur une recherche de terrain menée à Tijuana en 2019 dans plusieurs centres d'hébergement pour personnes migrantes. A l'heure actuelle, il y aurait plus de 15 000 migrants à Tijuana originaires d'Amérique centrale (Honduras, Salvador, Guatemala principalement), de la Caraïbe (Cuba, Haïti), d'Amérique du Sud (Venezuela), d'Afrique (RD Congo, Burkina Faso, entre autres) et d'Asie (Pakistan, Inde, entre autres). Cette communication interroge les parcours migratoires jusqu'au Mexique, ainsi que les politiques migratoires mexicaines et étatsuniennes, leurs mécanismes de mise en application, et leurs effets sur la population migrante en termes de temporalités et d'ancrage plus ou moins temporaire. Elle aborde également les stratégies mises en place par les migrants pour tenter de contrer ces politiques migratoires et/ou d'obtenir une autorisation de séjour au Mexique. Elle interroge finalement les effets de ces nouvelles réglementations migratoires sur les centres d'hébergement et autres organisations qui travaillent à la protection des personnes migrantes (surpopulation dans les centres d'accueil, criminalisation des défenseurs des personnes migrantes, illégalisation des déplacements, etc.).

A travers cette recherche, cette communication interroge plus largement les politiques migratoires du Nord Global et comment elles mettent en péril le droit international à l'asile.

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Poster session

A

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A multi-sensor satellite method to spatial and temporal detection of landslides and flash floods in cloud-covered tropical environments: The western branch of the East African Rift

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Keywords. — Geomorphology; Natural Hazards; Satellite Earth Observation; Tropical Climate; Africa.

Summary. — Geomorphic hazards such as landslides and flash floods (hereafter called GH) often result from a combination of complex interacting physical and anthropogenic processes across multiple spatial and temporal scales. In many instances, landslides and flash floods occur very quickly, sometimes in a matter of a few hours occasionally leading to catastrophic impact on human lives. Given that they are mostly related to common meteorological events, landslides and flash floods frequently co-occur and interact, leading to more severe impacts. The tropics are environments where GH are under-researched while, in the meantime, GH disproportionately impact these regions. In addition, GH frequency and/or risks in the tropics are expected to increase in the future in response to increasing demographic pressure, climate change and land use/cover changes. To unravel the role of climate and landscape (topographic and land use/cover) in controlling the spatio-temporal distribution of GH in the context of environmental changes, establishing a regional-scale inventory of GH events that are localised accurately in space and time is essential. Since the tropics are frequently cloud covered, an accurate characterization of the timing of GH at a regional scale can only be achieved through the combined use of optical and Synthetic Aperture Radar (SAR) remote sensing. Here, the objective is to present the first phase of the ongoing development of a remote sensing methodology that aims to identify accurately in space and time the GH events in the western branch of the East African Rift using a multi-temporal change analysis approach combining optical and SAR amplitude and coherence data. Copernicus Sentinel 1 (SAR imagery) and Sentinel 2 (optical imagery) are the key satellite products used. Next to being open access, they offer a very good trade-off between frequency of acquisition and spatial resolution. The detection methodology is calibrated and validated using information from three citizen observer networks and higher spatial resolution imagery. Preliminary results show clear changes in SAR amplitude time-series at the time of the GH events. Various change detection approaches are explored and provide ideas for detection of landslide timing within the time-series. We present the ongoing method development with a specific focus on recent extreme GH events in the region.

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Unravelling natural and anthropogenic controls on the dynamics of deep-seated landslides in the tropics

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Keywords. — Geomorphology; Remote Sensing; Kivu Rift; DR Congo.

Summary. — Because they commonly show persistent and long-term motion slow-moving deep-seated landslides often represent exceptional natural laboratories to study the mechanisms and controls on the dynamics of unstable hillslopes. Here we investigate and compare two deep-seated landslides in the tropical environment of the Kivu Rift (DR Congo). The first one is a thousand-year-old landslide, that, sited in the rapidly expanding city of Bukavu, experienced rapid and informal urbanisation over the last decades. The second one is only a few decades old and has been largely preserved from anthropogenic activity. While these two landslides share similar environmental conditions – at the notable exception of the human activities, we aim at investigating how environmental conditions (climate, geology, tectonics) and external forcing (rainfalls, earthquakes, urbanisation) influenced their activity. We focus over two temporal resolutions: the week-to-week landslide kinematic is detailed using 5 years of temporally dense kinematic data from satellite interferometry and pixel tracking applied on radar, optical satellite and UAS images; the yearly-to-decadal kinematics are analysed using aerial photographs from the '50s and '70s and high-resolution satellite imagery. We find that seasonal rainfall is the principal regulator of weekly to yearly motion of both landslides, with a very tied relationship between change in pore-water pressure in the slope and landslide kinematic. But our results also highlight the influence of human activity on landslide motion over decadal timescale. We show that urbanisation interfered with the dynamic of the urbanised landslide through a series self-reinforcing feedbacks involving landslide motion, rerouting of water flows and pipes rupture. Such relationship is not surprising, but as hillslopes of the world's cities are being urbanised at accelerating paces, the observation of such causative mechanisms urges for a better understanding of how anthropogenic activity influences deep-seated landslides. This would ensure the valid evaluation of landslide hazard and the optimisation of mitigation strategies in the area, as well as across the other many cities of the tropics where similar environmental and societal conditions are met.

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Geotechnical characterization and slope stability analysis of soils along Gedo-Dilb road section, northern Ethiopia

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Keywords. — Landslide; Safety Factor; Road Infrastructure; Northern Ethiopia.

Summary. — Landslides and associated hazards are common problems in the hilly and mountainous areas of the highlands and rift escarpments of northern Ethiopia. The Gedo-Dilb road is highly affected by landslides which caused substantial damage to infrastructures and agricultural lands. The 32 km length of road section is rested on fractured basalt rocks and quaternary deposits and characterized by rugged topography which ranges from 1646 to 3651 m. Characterizing soils along the road has paramount importance for numerical modeling of landslide mechanisms. The main objective of this research was to characterize the geotechnical properties of soils and evaluate the slope stability along the Gedo-Dilb road section, which is an economically important road corridor that connects Woldia town with Bahir Dar city. A total of 8 disturbed and undisturbed soil samples were taken to evaluate the physical and geotechnical properties of soils. The soil samples were collected from the alluvial and residual soil types at a spacing of 3 km from each other and the depth of sampling ranges from 0.6 to 3.2 m. Results revealed that the soils are classified as sandy silt (medium to highly plastic silts), with liquid limits in the range of 34.3 to 56.8 %, plasticity index of 14.6 to 36.8 % and moisture content ranges from 10.9 to 14.7 %. From the direct shear test results, the cohesion and internal friction angle of soils range from 27 to 34.9 kN/m3 and 18.8° to 25.6° respectively. Slope stability results calculated using the limit equilibrium method on the selected alluvial and residual soils of slope sections showed that the safety factor is 1.963 and 1.369 under dry and 1.192 and 0.727 under saturated conditions, respectively. The results imply both slope sections are unstable under fully saturated conditions. Therefore, landslides in the study area are expected to be triggered by rainfall. The result of this study could be used for future research on landslide susceptibility zonation and regional road infrastructure development.

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Characteristics and distribution of natural and human-induced landslides in the Rift flank west of Lake Kivu (DR Congo)

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Keywords. — landslide processes, inventory, field survey, deforestation, susceptibility assessment, Africa.

Summary. — Tropical mountainous regions are often identified as landslide hotspots with particularly vulnerable populations. Whereas both natural (*e.g.*, rainfall, lithology) and anthropogenic (*e.g.*, deforestation) factors are expected to be involved in landslide occurrence, the relative importance of such factors remains poorly documented. The objective of this study was to understand the distribution of landslides and the role played by natural and anthropogenic factors in the occurrence of landslides on the Rift Flank west of Lake Kivu. To achieve this, a multi-temporal landslide inventory was carried out using Google Earth imagery, together with a 5 m resolution DEM derived from TanDEM-X images, aerial photographs from 1955-1958 and intense field survey. Currently observable landslides were classified as old or recent depending on whether they were visible or not on aerial photographs from the 1950s. Multi-decadal forest dynamics were reconstructed from orthomosaïcs generated from the aerial photograhs of the 1950s and satellite-derived forest cover of 2016. Analyses focused on the size and the spatial distributions of the landslides; the latter being done through susceptibility models (via a logistic regression approach) and frequency ratio models. We inventoried 2856 landslides. Among these, old and recent deep-seated landslides, shallow landslides and mining landslides were selected for analysis (2782). The difference in size distributions and in susceptibility patterns between old and recent deap-seated landslides indicates that natural factors contributing to their occurrence were either different or changed over time. The window of observation for the recent landslides is too short to capture, for example, the direct impact of large earthquakes on slope failure occurrence; which could explains why recent landslides have smaller size. The shallow landslides are all recent. The susceptibility analysis shows that their regional pattern is mainly controlled by forest dynamics and the presence of roads. The landslides that occur in forest areas, *i.e.* in natural environments, are strongly dependent on the slope gradient. In areas with similar topographic conditions where deforestation has occurred since the 1950's, shallow landslides are more frequent, but of smaller size, highlighting the role of forest cover on regolith availability and landslide mobility. In areas that were already deforested in 1950's, shallow landslides are less frequent, larger, and occur on less steep slopes. This suggests a combined role between regolith availability and soil management practices that influence water infiltration. Landslides associated with mining activities are larger than shallow landslides but smaller than the recent deep-seated instabilities. They are also not well predicted by the susceptibility models, showing that they respond to environmental factors that are not present under natural conditions. This research highlights the importance of human activities on the occurrence of landslides and the need to consider this context when studying the regional patterns.

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Poster session

B

Le plurilinguisme à Mayotte à l'ère du numérique

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Mots-clés. — Sciences de l'information et de la communication; Entretiens directifs; Plurilinguisme; Mayotte; «Digital natives».

Résumé. — À l'instar de Patrick Charaudeau dans son article Langue, discours et identité culturelle, nombre de chercheurs en linguistique s'accordent sur la théorie suivante: «la langue est nécessaire à une constitution d'une identité collective» (Charaudeau 2001), cependant pour que cette langue identitaire soit conservée plusieurs facteurs doivent s'accorder. Nos recherches de fin d'études ont démontré qu'à Mayotte, les jeunes ne maîtrisent ni les langues premières locales (le kibushi et le shimaoré) ni le français, l'unique langue officielle et de scolarisation. Ainsi les premières semblent souffrir de la domination de la seconde et la culture locale de l'influence grandissante de la culture occidentale à travers les médias sociaux, domestiques et les flux migratoires. Cet état de fait a l'air de s'aggraver avec l'arrivée récente, en 2012, de l'internet haut débit sur le sol mahorais. C'est la raison pour laquelle il est important de se questionner quant à l'avenir des langues à Mayotte et de la conservation du génie du peuple mahorais : la génération actuelle est-elle dépositaire du don naturel de la langue-source? Quel est l'état linguistique actuel sur le département de Mayotte? Afin de répondre à nos inquiétudes, une enquête qualitative sera faite auprès des jeunes et des familles mahorais. Malgré la situation sanitaire actuelle, nous pensons introduire un premier questionnaire par voie numérique qui nous permettra d'approcher les jeunes les plus intéressés et leur famille afin d'effectuer les entretiens directifs par la suite.

Ainsi, ce projet de recherche tente de comprendre la réalité linguistique et culturelle de l'archipel de Mayotte afin d'espérer trouver une solution favorisant la transmission et l'usage des langues mahoraises. Qu'est-ce qu'un peuple sans son identité linguistique et culturelle: n'est-il pas comparable à un être sans visage ni ADN?

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La posture d'autocréateur de Mongo Beti

Sharma Sonali[1*]

RÉSUMÉ. — Cette communication visera à un des aspects importants pour la notion de la posture d'auteur [1]; l'utilisation du pseudonyme dans le cas d'un écrivain francophone, Mongo Beti. Mongo Beti, un écrivain de l'origine du Cameroun, une ancienne colonie de France, écrit en français et ses œuvres font partie de la littérature francophone.

Certainement, le concept du pseudonyme dans les œuvres littéraires est bien mis en évidence par Jérôme Meizoz, selon lui le pseudonyme est à la fois un moyen de changer la posture de l'écrivain par lui-même et d'acquérir une nouvelle identité et nouvelle posture en revoyant l'auteur Romain Gary «*Romain Gary réinvente son identité auctoriale sous le pseudonyme d'Emile Ajar.* [2]» Tenant en compte de chercher pourquoi Mongo Beti a utilisé le pseudonyme en fonction de la littérature francophone, en effet pourquoi deux pseudonymes, donc, afin d'y répondre je prendrai en considération de son premier roman intitulé *Ville cruelle*, publié en 1954 sous le premier pseudonyme d'Eza Boto et par la suite, son deuxième roman intitulé *le pauvre christ de Bomba* en 1956 sous le pseudonyme de Mongo Beti.

En bref, le but de l'auteur est de se cacher son identité réelle permettant de dévoiler la réalité dans une période particulière, à savoir, pendant la période coloniale.

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Queer(y)ing the Chasms: Building Solidarities and Resistance Against Oppression in Queer Trinidadian Literature

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Keywords. — Postcolonial Literature; Gender Studies; Queer Theory; Intersectionality; Trinidad.

Summary. — In the Caribbean island of Trinidad, the recent debates regarding LGBTQI+ rights and the decriminalisation of homosexuality (2018) have testified to the importance of highlighting issues around non-normative genders and sexualities for "a decolonized Caribbean discourse" (Cummings 2011, 323). Although global interest in queerness has recently emerged, resistance against homophobia and transphobia in the region is nevertheless not a new social struggle imported from the 'global North', and to assume the opposite would be to neglect the existence of queer Caribbean memory. Actually, as showed by queer Trinidadian novels by authors such as Dionne Brand, David Chariandy, Shani Mootoo and Lawrence Scott, literary representations of non-hegemonic genders and sexualities in/from the region have been published for more than thirty years. In the face of current homonationalist discourses and neoliberal agendas, queer Trinidadian literature stands against 'one-dimensional queerness' (Ferguson 2019), that is, an understanding of LGBTQI+ identities that obfuscates their combination with other identity categories, such as gender, race or nationality.

This paper explores the ways in which queer Trinidadian literature bridges the chasms between different categories and identities. On the one hand, I argue that it draws attention to how queer Trinidadian characters face oppression in an intersectional way because of their non-hegemonic gender, sexuality *and* race/nationality (cfr. Crenshaw 1994). On the other hand, this paper shows how queer Trinidadian literature suggests the possibilities of creating solidarities and empathetic bonds between individuals and communities who experience different types of oppression (sexism, racism, homophobia and transphobia). Indeed, Trinidadian literary discourses on genders and sexualities actually highlight how systems of oppression are imbricated with one another.

Queer Trinidadian literature invites readers to acknowledge the commonalities between different types of oppression without occluding the specificities of each experience. With its emphasis on the collaborative exchanges for justice, the resonances of these works are not only relevant because they "[help] us to see some of the ways sexuality is imagined in the [Caribbean] region and the diaspora, both as it is and was, and how it *could be*" (King 2014, 13), but also because, on a global scale, the multifacetedness of queerness, in all its colours and shapes, is not always represented, even in nations where the rainbow flag proudly stands.

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Afratì-Arkades in context: rethinking an old excavation in South-Central Crete

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Keywords. — History of Archaeology; Late 19th - Early 20th Century Archaeology; Crete; Afratì.

Summary. — The site of Afratì (South-Central Crete), traditionally known as Arkades, was discovered and explored by Federico Halbherr (1894) and Gaetano De Sanctis (1908), members of the Italian Archaeological Mission in Crete. In 1924 extensive excavations conducted by Doro Levi, on behalf of the Italian School of Archaeology at Athens, brought to light a Geometric-Archaic settlement (8th - 6th cent. BC) and a necropolis in use from the Protogeometric to the late Orientalizing periods (10th - 6th cent. BC) (Levi 1927/9). The Italian research in the region also represented, according to the most recent critical reviews (*e.g.* Varouchakis 2017 and Kotsonas 2019), a human experience, rich in political and cultural implications. These "collateral" aspects of field research represent the object of this study which aims to define a poorly known part of the history of archaeological research in Crete.

The reconsideration of the Italian investigations at Afratì, topic of my doctoral research, led me to collect and analyse all the archival documents, mostly unpublished, preserved at the Italian School of Archaeology at Athens, with the aim of reconstructing the old archaeological contexts and prepare a new study of the numerous materials found during the excavations (local ceramics, imports, bronzes and jewels), currently preserved at the Archaeological Museum of Heraklion. In the framework of this preliminary analysis I have been able to develop some "related issues" useful for a wider reinterpretation:

1) The political meaning related to the presence of the Italians in the region in a period of important transformations for Cretan archaeology, marked by the shift from the colonialist approach of foreign scholars to the progressive formation of a local consciousness; 2) The field work experience or a glimpse of the daily activities, problems, logistical and economic issues implied with doing archaeological research on a Mediterranean island in the late 19th and early 20th century; 3) The travel impressions of the scholars committed on a "remote" island, their perception of the environment and their relations with the local communities, aspects generally excluded from the official reports and publications.

The analysis of these features has provided a more solid basis for the ongoing reanalysis of the Afratì-Arkades site, highlighting several unexpected and unpublished data. Reconstructing a past excavation is not only a useful exercise to establish a new step in the history of local archaeology, but also offers the opportunity to reflect more generally on the meanings, sensations and interactions connected, still today, to the overseas studies.

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Session II

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Regulatory Decisions on Interest Rate Restrictions in Microfinance: Does Competition Matter?

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Keywords. — Financial Inclusion; Regulation; Market Structure; Panel Data; Developing Countries.

Summary. — Microfinance institutions (MFIs) aim at providing sustainable financial services to poor, unbanked people, mainly in developing countries. Although the industry developed itself and became commercialized in only a few decades, severe crises, abusive practices, exacerbation of competition, and ethical debates, among others, have tarnished this development. As a response, many regulators have been tempted to cap lending interest rates, in an attempt to keep MFIs focused on their social mission. Yet, grey areas remain around the use of such regulations: is the outcome really the one desired? Is this outcome similar irrespective of market conditions they are implemented in?

With a consolidated dataset including 986 microfinance institutions from 73 countries over 2015-2018, we assess the effect of interest rate restrictions on the depth of outreach of MFIs via fixed-effect regressions. We then use a moderation analysis with several indicators, including the Herfindahl-Hirschman and Lerner indexes, to understand how competition affects this initial relationship. This way, we investigate to what extent competition interacts with regulation. Robustness checks are mobilized for independent as well as dependent variables, and we use a simultaneity test to make sure there is no reverse causality issues.

This research brings several contributions. Using unique data on interest rate restrictions collected specifically for this research, our findings first indicate that MFIs facing interest rate restrictions provide larger loans. This confirms what has long been debated in literature but not really tested so far: such restrictions present perverse effects including the exacerbation of financial exclusion. Going one step further, the findings suggest that competition amplifies this phenomenon. While most studies consider regulation on its own and set aside market conditions, this research provides regulators with relevant insights to better understand the impact of regulatory decisions, but also investigates how market conditions may affect their outcomes, in a financial inclusion context.

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The effect of rainforest disturbance on Coffea canephora in the Congo basin

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Keywords. — Population biology; Genomics; Pollinator networks; Congo basin.

Summary. — Coffee is one of the most traded agricultural commodities in the world and supports the livelihoods of millions of smallholder farmers. The coffee market is dominated by Robusta coffee (Coffea canephora) and Arabica coffee (Coffea arabica), which roughly account for 30 % and 60 % of the market share, respectively. Robusta coffee is a long-live, self-incompatible (SI) perennial understorey shrub species native to the rainforest of the Congo basin. Whereas it currently accounts for a lower share in the global coffee production, its global importance is expectd to increase because it has a higher disease resistance and is likely less susceptible to climate change than Arabica coffee. Yet, the wild Robusta coffee populations are increasingly threatened by rainforest degradation through the removal of the understorey layer for firewood, logging and defaunation through hunting and poaching. These processes may seriously disrupt the natural population dynamics and negatively affect population genetic diversity of C. canephora. As the wild gene pool of C. canephora still represents a unique but underused resource to improve coffee breeding, its conservation is of uttermost importance.

There is currently an important lack of knowledge regarding the effects of anthropogenic rainforest disturbance on genomic diversity and genetic integrity of wild C. canephora populations. Surveying a large set of C. canephora populations from the Yangambi region in the DRC will enable us to investigate the potential threats from different anthropogenic interferences, including introgression of alleles from introduced landraces, decreased fruit dispersal due to disapperance of large frugivores, and reduced genetic diversity and gene flow due to the disruption of the pollinator community. A twofold approach will be followed. First, we will develop sets of molecular makers that will allow us 1) to investigate population genetic and genomic diversity and levels of inbreeding, 2) to discriminate individuals for parentage and paternity analysis and addressing gene flow, 3) to discriminate landraces from wild populations to investigate introgression, and 4) to detect variability in SI genes. Second, we will perform a set of in situ experiments and observations to 1) assess the structure of the pollinator networks, 2) assess the extent of frugivory, and 3) track potential breakdown of the SI-system.

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Landslide risk in the Kivu Rift: the legacy of a political and environmental crisis

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KEYWORDS. — Landslide Hazard; Human-environment Interactions; Deforestation; Historical Analysis; Africa.

SUMMARY. — Scarcening land and resources in the tropics incite more and more people to resort to steep terrain where landslides inflict thousands of casualties every year. Landslides are particularly abundant in areas that experienced recent deforestation. Forest cover changes thus play an important role in assessing landslide activity, yet most landslide susceptibility research – focussing on the spatial likelihood of landslides – considers these environmental conditions to be constant. Moreover, although the impact of deforestation on landslide hazard and the resulting risk is often invoked as a plea for forest conservation, this argument is rarely supported by a quantitative foundation. In this work, we aim to quantify the evolution of landslide risk between 1973 and 2016 in the Kivu Rift, encompassing parts of Burundi, the Demographic Republic of the Congo (DRC, Nord & South Kivu), and Rwanda. In the past decades, this study area experienced widespread deforestation and large shifts in demography, a result of both the strong population growth and transnational refugee fluxes induced by conflicts.

In order to assess the landslide risk evolution in the Kivu Rift, we first reconstruct the forest cover changes since 1958 by using a unique catalogue of historical aerial photographs. Second, we incorporate these forest dynamics into a temporally dynamic landslide susceptibility assessment. We then use a logit function, calibrated with landslide data for our study area, to link susceptibility to the yearly proportion of the land affected by landslides (m^2/km^2/year), a proxy for landslide hazard. Finally, the landslide hazard allows for coupling with population density grids (inh./km^2). As such we obtain estimates of the landslide risk, reported as the number of cases whereby a person is exposed to a landslide, at different points in time (1975, 1990, 2000, 2015). Overall, the landslide risk is roughly twice as high in the DRC compared to Rwanda and Burundi. This difference is mainly due to the higher exposure of the Congolese population of which a larger proportion is located on hazardous terrain. Up to the 90s, the contribution of deforestation on risk in the DRC remained limited to ca. 21 %. In the aftermath of the Rwandan civil war there was a strong influx of refugees in the Kivu provinces, leading to accelerated deforestation which contributed ca. 55 % to the total risk between 2000 and 2015.

We statistically demonstrate that landslide risk exhibits a strong response to deforestation. This response is especially large in areas where deforestation patterns coincide with the allocation of livelihoods, for example in the eastern DRC where hundreds of thousands of refugees were resettled during the 90s. We show that the quantification of landslide risk at a certain place and time requires knowledge of prior environmental changes. In other words, landslide risk cannot be assessed accurately without understanding both the spatial and temporal context of the population and its environment.

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Imaging the extent of salt water intrusion in the Luy river coastal aquifer (Binh Thuan) using electrical resistivity tomography (ERT)

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KEYWORDS. — Saltwater Intrusion; Groundwater; Electrical Resistivity Tomography; Luy River.

SUMMARY. — Binh Thuan is one of the driest provinces in Vietnam. During the dry season, seawater intrudes through estuaries and threatens groundwater resources. The latter are under increasing pressure due to water extraction for agri- and aquaculture. To evaluate the current state of salinity in the shallow coastal aquifer, electrical resistivity tomography (ERT) measurements were collected along the downstream part of the Luy river. 21 profiles were collected in July-August 2019 based on the previous saltwater intrusion boundary which was estimated from water samples collected from shallow boreholes in the area. The data were processed to get the resistivity distribution of the subsurface. The results show that resistivity zones lower than 10 Ohm.m and corresponding to saltwater dominate in lowland areas with almost the entire thickness of the aquifer filled with brackish to salt water. On the right bank of the river, the higher elevation dune area contains a freshwater aquifer which limits the intrusion of salt water. At shallower depths, the aquifer displays a complex distribution of fresh and saline lenses. Those variations are correlated with the soil occupation (types of culture) and the irrigation practices. ERT data also reveals the depth of the rock basement. The geophysical observations show that the extension of salt water intrusions is much larger than expected from existing borehole data and is not limited to interaction with the river.

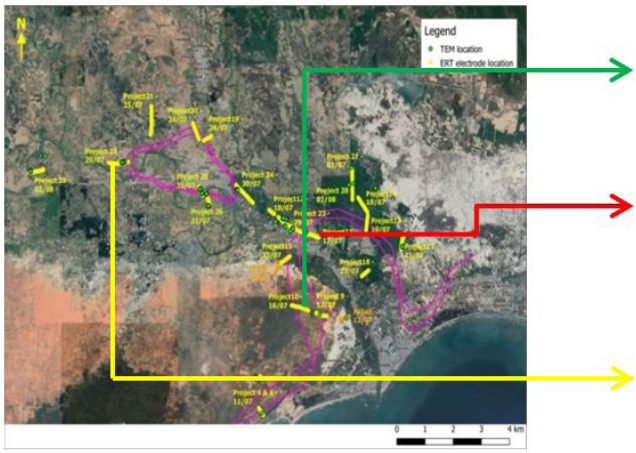

Fig. 1. — Pink line: previously-determined salt water- freshwater boundary with TDS= 1.0 and 1.5g/l; Yellow lines: ERT measurement profiles.

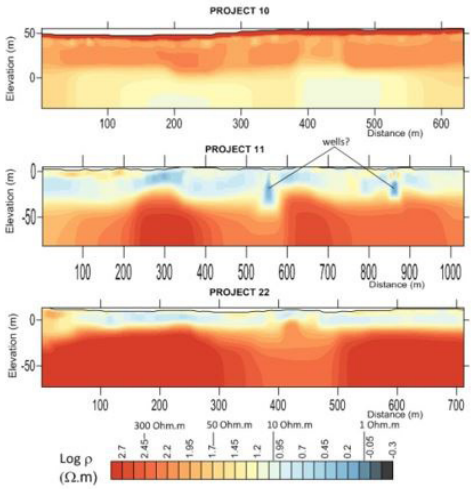

Fig. 2. — Inverse model of 03 representative ERT profiles.

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Poster session

C

Until where can we hear Polynesian coral reefs from the open ocean?

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Keywords. — Soundscape; Bioacoustics; Passive Acoustics; Post-larvae; French Polynesia.

Summary. — In the context of climate change, the increased frequency of damaging events causes an acceleration of the degradation of coral reef soundscapes impacting the attraction of marine larvae [1]. The ability for fish and invertebrate larvae to use acoustic cues is known [2]–[4] but the maximal detection distance of coral reef sounds is still unknown [5]. Using drifting antennas (made of a floater and an autonomous recorder connected to a hydrophone), six transects were realized from the reef crest to 10 kilometers in the open ocean on Moorea island, we estimated that the chorus created by the sounds of benthic invertebrates (3500 – 5500 Hz) is a major contributor to the ambient noise up to more than 90 kilometers in the open ocean under flat/calm sea state conditions and more than 50 kilometers with an average wind (6 knots wind regime), while fish sounds (200-500 Hz) can be detected up to less than two kilometers. These distances decrease when the wind or the ship traffic increase. Using audiograms of different taxa, we showed that fish post-larvae likely hear the reef up to distances of 0.5 kilometers, while it is half this distance for invertebrates. Some cetaceans would be able to detect reefs up to more than seventeen kilometers. These results are essential to understand larval recruitment and the effect of soundscape degradation on different zoological groups.

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Marine distribution of *Lepidochelys olivacea* along the Pacific coast of Nicaragua outside the breeding season

Mertens Géraldine[1*], Kochzius Marc[1] & De Weerdt Joëlle[1,2]

Keywords. — Marine Biology; Opportunistic Sighting; Pacific Ocean; Nicaragua.

Summary. — Olive Ridley turtles (*Lepidochelys olivacea*) are classified as vulnerable in the International Union for Conservation of Nature IUCN Red List of Threatened Species (Abreu-Grobois 2008) and are known to migrate between breeding and foraging sites (Da Villa 2011). Most research studies and conservation efforts focus on nesting beaches, but coastal distribution and habitat use patterns have been poorly investigated (Peavey 2017). It is unclear where sea turtles foraging sites are located and how their distribution overlaps with anthropogenic activities, especially with the fisheries. Nicaragua is a known breeding area for Olive Ridley turtles, but little is known on the ecology and marine distribution of the species. This study aims to identify hotspots outside the breeding season and critical habitats to ensure effective and successful management plans for the recovery of Olive Ridley turtles.

To reach this objective, sightings of turtles were opportunistically collected on boat-based surveys initially planned for cetacean research expeditions along the Pacific coast of Nicaragua. Two study sites were considered: Padre Ramos (north-western site) that is pristine compared to the second site San Juan del Sur that is facing coastal anthropogenic pressure (south-western site). Expeditions took place between January and April from 2016 until 2020 (except 2019), outside the breeding season. Whenever a turtle species was encountered, the number of individuals, their behaviour (surfacing, swimming, mating), gender, time, date and the geographic position were gathered. In addition, the presence of boats was assessed every 30 minutes during survey. The Kernel Density Estimation algorithm was used in the GIS software to generate maps of marine hotspots of Olive Ridley turtles. Our preliminary results show that turtle occurrence vary between sites. Two hotspots were identified; one in the north further away from the coast and one in the south located closely to a beach known for hosting particular mass-nesting events of Olive Ridleys.

Increasing knowledge of turtle distribution will contribute to the efficiency of conservation measures in the future. Our research will further investigate the influence of environmental parameters on their distribution patterns and verify whether they overlap with fishing activities, which will give important information for decision makers to reconsider the size of their marine protected areas.

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Ocean warming effects on a mesophotic antipatharian species from French Polynesia

Godefroid Mathilde[1*], Mercière Alexandre[2,3], Lacube Yann[2,3], Hédouin Laetitia[2,3] & Dubois Philippe[1]

Keywords. — Marine Biology; Global Change; Respirometry; Antipatharians; French Polynesia.

Summary. — In the current context of global climate change, studies on the effects of ocean warming are multiplying. Many taxa have already been investigated, revealing a great variability of responses according to the taxa under consideration. This highlights the need for further studies focusing on the effects of heat stress on less classic marine organisms, such as antipatharians.

Antipatharians, also called black corals, are widely distributed ahermatypic hexacorallians that form dense populations providing structural habitat for many species. They differ from scleractinian corals by having a non-calcareous skeleton (made of chitin and proteins) and being, for the majority of known species, azooxanthellate. Most studies to date have been conducted on shallow-water populations (<50 m) and studies dedicated to the biology of antipatharians are scarce. In particular, the response of global change stressors has remained hardly explored since recently.

In this context, the present study assessed the effects of heat stress on a mesophotic (70-90 m) Stichopathes species from French Polynesia. Nubbins were maintained for 16 days at four different temperatures (control, +1.5°C, +3°C and +4.5°C), selected according to the natural variability of the environmental conditions retrieved from data loggers deployed during two months. Respiration, excretion, tissue necrosis, healing capacity, mucocyte tissue density and antioxidant responses were measured and analyzed by regression methods.

Oxygen consumption, tissue necrosis and healing increased with temperature up to a tipping point around 28.7°C, after which they sharply decreased. Mucocyte tissue density increased linearly with temperature. Altogether, these results demonstrate that *Stichopathes sp*. lives close to its thermal maxima. It could be able to cope with a moderate increase in temperature but values expected for the end of the century are very likely to exceed their acclimation abilities.

Further studies should focus on the comparison of responses of antipatharians with other species collected at similar depth to evaluate their respective resilience to ocean warming and discuss it in the context of the "Deep Refugia Hypothesis". Indeed, it was proposed that mesophotic coral ecosystems (ranging from 30 to 150 m) will be less impacted by global stressors than shallow-water reefs and might thus provide a refuge to sustain coral diversity.

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Benchmarking the value of mangrove ecosystem goods and services in Ghana

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Keywords. — Mangrove; Ecosystem Services; Community; Questionnaire; Transects; Ankobra.

Summary. — The Ankobra mangrove ecosystem in Ghana, West Africa is one such mangrove system that benefits numerous surrounding communities and companies, and serves as a significant source of national revenue. Despite the socio-economic and ecological services provided by this type of wetland, it remains one of the most threatened ecosystems in Ghana, mainly due to uncontrolled harvesting of mangroves and the use of the mangrove system in general for various purposes. Impacts of these activities in mangrove forest ecosystems are the changes in mangrove vegetation structure, which increases the vulnerability of surrounding communities. Therefore, an assessment of the trends in the conditions of the forest over time through characterising and monitoring changes in the forest structure will be important for long-term sustainability management of the mangrove ecosystem.

Therefore, this study investigates the ecosystem goods and services of the Ankobra mangrove system, the extent to which humans depend on the mangrove system, and the changes in mangrove vegetation structure. We will also propose the nature of the future of the Ankobra mangrove forest.

Semi-structured questionnaires with open- and closed-ended questions were used to gather data on ecosystem goods and services the community derives from the mangrove ecosystem. To know the changes in vegetation structure and predict the future of the mangrove forest, 10 × 10 m² and 5 × 5 m² belt transects along line transects were used to sample adult and juvenile mangrove vegetations, respectively in the adjacent sites of the estuary. Stem diameter at 130 cm aboveground (D_{130}), and height of adult vegetation were measured and grouped into diameter classes. Important Value (IV) of each species of mangroves was determined likewise.

Complexity indices for each site were calculated, with juveniles grouped into regeneration classes. Spatial differences in densities, heights, and diameter of adult and juvenile vegetation were determined. Morisita's index will be used to find dispersion among plots. Using De Lacourt's distribution and model fitting, the future of the mangrove forest stand will be determined. It is expected that there will be significant spatial variation in density, height and diameter of adult vegetation and in densities among different regeneration classes. It is also expected that there will be more juveniles than adult vegetation.

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Mangrove Ecosystem Degradation by Shrimp Farming in the Pambala-Chilaw Lagoon Complex, Sri Lanka

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KEYWORDS. — Ecological Monitoring; Remote Sensing and GIS; Nutrient Analysis; Coastal Ecosystems; Mangroves.

SUMMARY. — Amongst the several mangrove ecosystems present in Sri Lanka, the mangrove forests in the Puttalam district have suffered the greatest level of degradation arising from human activities, particularly shrimp farming. The occurrence and spread of the White Spot Disease (WSD) on shrimps in both shrimp farms and natural waters of Sri Lanka during 1994-1995 promoted the abandonment of infested ponds and the clearing of mangrove forests to create new shrimp farms. This situation coupled with pollution of the Chilaw lagoon with effluents from the shrimp farms has led to the limited potential of the current mangrove and lagoon ecosystem in providing its full ecological services.

Because of the existing proximity between the shrimp farms, the Chilaw lagoon and its surrounding mangrove forest, one can predict a higher possibility of organic contamination across these systems. Apparently, the continual discharge of effluents from shrimp farms into the Chilaw lagoon since the 1980's has led to the massive growth of algae and seaweeds at surface and bottom waters, respectively. The further consequence has been a vast reduction in the population of some fish species and shrimps in the Chilaw lagoon. Moreover, there has been a decline in population of bird species that found their habitats around the lagoon and/or in the mangrove forest.

As an ongoing research, the objectives are: *i*) To quantify the areal extent of change in mangrove forest and shrimp farms in the Pambala-Chilaw lagoon complex from the year 1980 to 2020 using very high spatial resolution (VHSR) imagery; *ii*) To discriminate between the current active and abandoned shrimp farms in the Pambala – Chilaw lagoon complex using VHSR satellite imagery; *iii*) To measure the physico-chemical parameters of mangrove soil samples, water and sediments samples of the Chilaw Lagoon; *iv*) To measure the levels of Nitrates and Phosphates present in mangrove soil samples, water and sediment samples of the Chilaw Lagoon; *v*) To assess the sociological impacts of mangrove forest destruction and lagoon water contamination on the fringe communities.

This study will therefore serve as a more detailed report on the influence of shrimp farming on mangrove forest and lagoon water in the Pambala-Chilaw lagoon complex and bring to light the extent to which the local community has been impacted.

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Mapping Groundwater Potential using Machine Learning methods: Application to Chad

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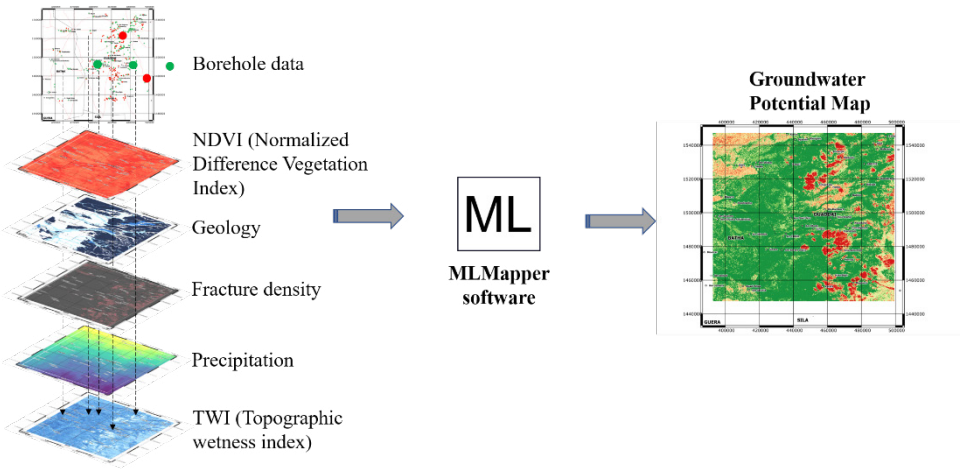
KEYWORDS. — Hydrogeology; GIS; Machine Learning; Groundwater Potential; Chad.

SUMMARY. — Groundwater resources are critical to safe drinking provisions in África, especially where arid conditions do not allow for the presence of surface resources. Furthermore, climate change will result in a more complicated situation in the future. In this context, the application of machine learning methods could increase drilling success rate and increase the performance of wells. This work presents a machine learning method to develop groundwater potential maps.

The methodology presented is based on an ensemble of 12 supervised classification algorithms from the SciKit-Learn Toolbox 0.19.2 (PEDREGOSA *et al.* 2011). Each classifiers learns the patterns leading to the presence of groundwater by comparing a subset of the national borehole database with a series of explanatory variables. Explanatory variables include geology, lineaments, soil, vegetation, landforms and precipitation data, among others. Then, each classifier predicts a binary target (positive or negative borehole) throughout the study area where the explanatory variables are known. For the study area in Abeche region (Chad) most algorithms achieved good rates in terms of test score, which implies that the outcomes provide an accurate picture of field conditions.

This technique may be used to rapidly map groundwater potential for rural supply or humanitarian emergencies in areas where there is sufficient historical data but where comprehensive field work is difficult.



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Geochemical characterization of groundwater and saltwater intrusion processes along the Luy River, Binh Thuan, Vietnam

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KEYWORDS. — Seawater Intrusion; Geochemistry; Groundwater Extraction.

SUMMARY. — With an average annual rainfall of 800-1150 mm/year, the Binh Thuan province is one of the driest places in Vietnam. The quantity and quality of groundwater play a significant role in the agriculture, aquaculture development and daily life of the local communities. In 2012, the national center for water resources (Nawapi 2012) delineated the seawater intrusion extent in Binh Thuan based on the total dissolved solid (TDS) content of water samples taken from shallow boreholes. The threshold of 3g/L and 1.5g/L were exceeded in the estuaries of the Luy, Long Song and Ca Ty rivers. In the recent years, the prolonged droughts combined with the sea level rise and the over-extraction of groundwater during the dry season increased dramatically the seawater intrusion process especially in the estuaries of the province.

The geochemistry of groundwater in the Luy River catchment was studied to investigate the contamination of the aquifers and identify the processes taking place. From 1991 to 2015, 98 water samples had been taken from the wells in the area in both dry and rain seasons. 71 % of the water samples were fresh while 21 % and 5 % were lightly saline and moderately saline respectively. In the summer 2020, 110 new water samples from both shallow and deep wells were collected in the Luy river catchment in wells from 3m to 40m. The TDS values are ranging from 105 to 23080 mg/L and can be classified into 4 groups: fresh water (48 %), slightly saline (40 %), moderately saline (8 %) and very saline (4 %). The samples show that the seawater intrusion expands not only horizontally at shallow depth along the river but also deeper down the aquifer in most of the study area, what is also confirmed by geophysical data. Freshwater samples were mostly collected at depth lower than 10m. The chemical composition of water samples was analyzed showing evidences of seawater intrusion, but also the occurrence of freshening processes within the study area. Together with the presence of saltwater at larger depths, this points towards a situation more complex than previously thought. Saltwater intrusions are likely not only related to interaction with the river estuary, but also to the presence of fossil saltwater in the aquifer, and to groundwater pumping and irrigation practices.

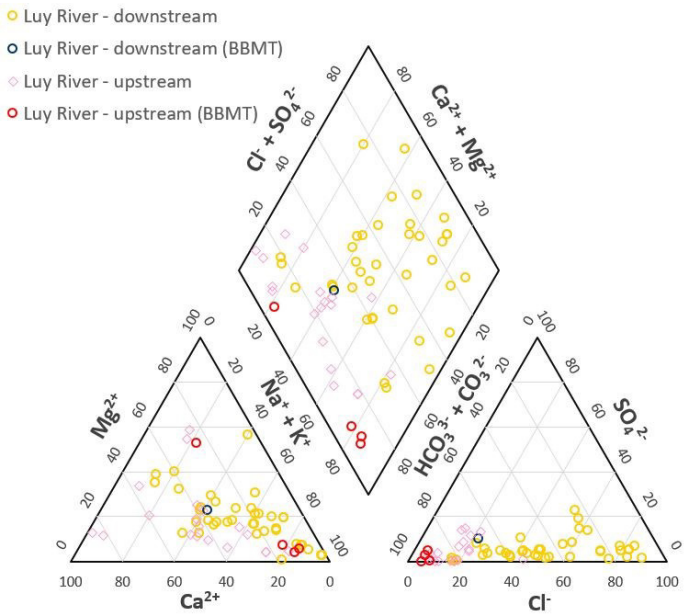

Fig. 1. — Piper Diagram of the water samples

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Monitoring water quality and presence of microplastics in a glacial lake in N. Pakistan

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Keywords. — Water Quality; Microplastics; Gilgit-Baltistan Region; Satpara Lake.

Summary. — The Gilgit-Baltistan region (GB), located at the extreme north of Pakistan, host more than 5000 glaciers. The melting ice of the Dosai plain feeds the Satpara lake, which in turn supplies water to the Skardu valley. Because of the hydrological and geographical importance of GB, and the severe risk of microplastics and coliform for the environment and human health, a proper assessment and monitoring of water resources are needed. Recreational and construction activities can alter water quality. Moreover, summer snow storms may additionally add pollutants. Therefore, the objective of the present study is to investigate the water quality and to determine the microplastic content in the glacial lake water and its sediments. The sources and depositional processes must be identified for a better management. For this purpose, water and sediment samples were collected from 4 sites in the Satpara lake during April, August and October 2020. The result shows an average abundance of MPs in the water samples of 23 pieces/100 ml and 36 pieces/10g of sediment. The dominant types of microplastics were filaments and fragments. The average abundance of coliform in April, August and October was 10 cfu/ml, 30 cfu/ml and 20 cfu/ml, respectively. Other physio-chemical parameters related to water quality were within the permissible limits as determined by the WHO. However, the presence of microplastics and bacteria (*E.coli, and S. typhi*) in the lake water pose a severe risk to the human health and ecosytem. Currently, chlorination is done after 2 to 3 months and continous chlorination is not possible for whole lake water. Half of the population still receives unchlorinated water. Therefore, there is dire need for the control of microplastic pollution and pathogenic bacteria.

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Microplastic pollution: An evaluation of personal care products sold in Pakistan

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Keywords. — Microbead pollution; Personal care products; Water extraction, Pakistan.

Summary. — Microplastics emerged as pollutants of concern in the last 20 to 15 years. The primary sources of microplastic are microfibers from clothing and microbeads that are used in many personal care products (PCPs). According to International Union for Conservation of Nature (IUCN) the global release of primary microplastics into the ocean was estimated at 1.5 million tons per year (Mtons/year). Microbeads are solid plastic particles normally under 5 mm in diameter used in personal care product (PCPs) as an exfoliating agent or as a sorbent phase for delivery of active ingredients. Wastewater treatment plants (WWTPs) are identified as an important source of microplastics (MPs) released into the aquatic environments (Tang *et al.* 2020). As a result, they enter into water bodies where they are readily ingested by aquatic organisms (Cheung *et al.* 2017). Though in some countries legislative ban of microbeads has proven effective, many countries have not taken any legal action. Hence, microbead-containing products are openly sold in the markets. In Pakistan, the government has not declared any ban on use of microbeads in PCPs yet, therefore, we aimed to determine the microbeads (MBs) contents in PCPs sold in Pakistan. For this purpose, 12 PCPs (7 scrubs and 5 face wash) samples were collected and analyzed for microbead content, size, polymer type and buoyant behaviour. Buoyant behaviour was determined by mixing 10 ml of both fresh and saline water with 2 mg of isolated microbeads in conical centrifuge tubes mixed with vortex mixer for 30 sec and left for 24 hours (Möhlenkamp *et al.* 2018). Most microbeads showed negative buoyant behaviour in both saline and fresh water. The products were Golden Pearl (GP), Himalaya Herbals (HH), Neutrogena (NT) Clean and Clear (CC), Heaven Dove (HD), Vivid Natural (VN), Skin Glow (SG), Super Silk (SS),Yong Chin (YC), Rivaj UK (RI), Nivea (NI), Cool and Cool (CC). We used chemical-free method (*i.e.*, boiling in deionized water) for the isolation of microbeads, in which 3 g of sample was mixed and fully dissolved with 150 ml of boiling deionized water. After that the solution was allowed to pass through suction filtration assembly, isolated microbeads were washed with 50 ml of deionized water and kept in an oven at 50 °C for 24 hours. The isolated mass was in the range of 0.00096 to 0.0558 g/g of each sample. Sun *et al.* (2020) reported that the geometric means of the abundance and mass of microplastics found in PCPs were 2162 particles/g and 0.04 g/g, respectively. The FT-IR spectras showed that the isolated microbeads were made up of polyethylene and size of microbeads was determined by Image J software. No research has been done so far on the content of microbeads in PCPs sold in Pakistan. Thus, the present study confirmed the presence of plastic microbeads in PCPs and highlights the need to ban their release in natural environments. Furthermore, there is a need to investigate microbead interaction with environmental pollutants to assess their impacts on living organisms.

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Poster session

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Acceptability study among mothers and key informants on Human Breast Milk Bank Establishment in Public Hospitals, Ethiopia: A qualitative study

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KEYWORDS. — Low Birth Weight; Neonatal Intensive Care Unit.

SUMMARY. — Introduction: A mother's breast milk provides optimal nutrition for growing infants. Low birth weight and premature infants that are fed non-human milk have a higher risk of developing complications such as necrotizing enterocolitis. The objective of this study is to test the acceptability of human milk bank establishment in pre-selected public hospitals in Addis Ababa, Ethiopia

Methods: The study was conducted in three public hospitals in Addis Ababa. A total of 11 Key informant interviews were held and 57 discussants participated in 7 focus group discusssions (FGDs) in both potential donors and receivers of breast milk. Among the 11 key informants (5 men and 6 women), there were 3 laboratory technologists, 3 nurses, 3 pediatricians and 2 general practitioners. All the 57 participants of the 7 FGDs were females. Framework analysis method was used to analyze the data. It is a qualitative method in which data is looked through, mapped and sorted in accordance with key issues and themes using five structured steps.

Result: A majority of health professionals and all mothers have no information about a donated human milk bank. Most participants agree they could have left over breast milk to donate. Majority of the discussants and almost all key informants agreed that donated breast milk is not a problem if the donor is healthy and the milk safety is checked. Majority of mothers who perceived they have extra milk would-be a volunteer to donate and a majority of discussants also showed a willingness to accept donated human milk if prescribed by professionals.

Conclusions: Donated human milk is an acceptable solution by both mothers and health professionals for the benefit of neonates who are admitted in Neonatal intensive Care Unit.

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A Study to validate a questionnaire for the screening of patients at risk of chronic respiratory diseases in Ho Chi Minh City – Vietnam

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Keywords. — Screening Questionnaire; Chronic Respiratory Diseases; Spirometry; Vietnam.

Summary. — Background: Chronic Respiratory Diseases (CRD) are the third leading cause of global mortality in the world, 90 % occurring in low and middle-income countries. The prevalence of CRD in Vietnam, a middle-income country, is estimated from 7.1 % to 12.6 %. Most CRD are diagnosed at a late stage, when symptoms become prominent. Early diagnosis in primary care is based on the measurement of the lung function by spirometry, but this technique requires investment in medical material and trained professional staff. Therefore, there is a need to develop a simple tool to screen for CRD in Vietnam.

Objective of the study: to develop and validate a screening questionnaire to predict abnormal spirometry in the general population of Ho Chi Minh City.

Methods: Cross-sectional design set in 2200 people in the general population in Ho Chi Minh City from June 2019 to June 2021. A questionnaire of 37 simple questions was presented to the subjects and spirometry was performed at the same time. After maximal inspiration, Forced Vital Capacity (FVC, the air volume that can be forcibly exhaled) and the Forced Expiratory Volume in 1 second (FEV1, the volume of forced air exhaled in the first second) were measured. CRD was diagnosed when patients had two criteria: having at least one chronic (lasting more than 3 months) respiratory symptom and meeting the following criteria at spirometry: a FEV1/FVC ratio and/or FVC below the lower limit of normal. The accuracy of the CRD screening questionnaire was evaluated by using logistic regression methods and receiver operating characteristic (ROC) curve analyses.

Results: Preliminary data – questionnaire and spirometry – have been obtained for 973 subjects. The mean age was 56 ± 12.4 years, male/female ratio 1.092, mean body mass index 23.9 ± 3.3. Smokers represented 39.1 % of the sample. Twenty per cent of the sample (n = 197) met the criteria of CRD. The most important risk factors included age, sex, body mass index, smoking, number of packs of cigarettes per years ($p < 0.0001$), history of asthma, history of chronic bronchitis, history of having respiratory symptoms for more than 3 months, history of tuberculosis ($p < 0.0001$), symptoms of CRD such as cough, mucus, breathlessness, chest tightness, wheezing or whistling ($p < 0.0001$). These important risk factors will be scored to validate the CRD screening questionnaire.

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Effets d'exposition à la fumée et la poussière sur la fonction cardiorespiratoire et la capacité aérobie chez les charbonniers congolais

Lofuta Vuvu Pierre[1*], Kipula Augustin[1] & Deboeck Gael[2]

Mots-clés. — Physiologie cardiorespiratoire; Polluants respiratoires; Obstruction bronchique; Activité physique; Spirométrie.

Résumé. — CONTEXTE: La fabrication, le conditionnement et la manipulation de charbon de bois expose à la fumée et à la poussière où l'on retrouve entre autres des composés organiques volatils, des hydrocarbures aromatiques polycycliques, des micro- et macro-particules (1,0 à 10 µ) et des gaz toxiques pour le système cardiovasculaire et pulmonaire. Des études réalisées dans les pays où le métier de charbonnier est réglementé mettent en évidence une détérioration conséquente de la fonction ventilatoire : volume expiratoire maximal par seconde (VEMS) et débit expiratoire de pointe (DEP) au repos, mais sans fournir beaucoup d'information sur les fonctions du système cardiovasculaire ou sur la capacité d'effort. En République Démocratique du Congo (RDC) où le métier de charbonnier n'est pas réglementé, on estime à 400000 professionnels dans ce secteur, qui travaillent pour répondre à plus de 90 % des besoins en énergie domestique. Ces artisans et ouvriers protègent insuffisamment leurs voies respiratoires, et s'exposent régulièrement à ces substances toxiques sans surveillance ni précautions adéquates. Nous avons pour cette raison voulu mesurer des indices cardio-respiratoires de base au repos et la capacité d'effort, chez des charbonniers en RDC.

METHODOLOGIE ET RESULTATS: Il s'agit d'une étude descriptive et prospective, par enquête transversale, faisant suite à une étude pilote qui s'est déroulée en 2017 en RDC incluant 170 charbonniers (1). Elle a été conduite en Août 2020 incluant 45 sujets supplémentaires, recrutés par sondage aléatoire systématique. La fonction respiratoire des charbonniers a été évaluée par spirométrie, les indices cardiovasculaires (fréquence cardiaque et pression artérielle) ont été mesurés au repos à l'aide d'un tensiomètre à brassard de Marque Omron® et la pratique d'activités physiques a été évaluée par le questionnaire global d'activité physique (GPAQ) (2) proposé par l'Organisation Mondiale de la Santé. Nos résultats préliminaires sur 215 charbonniers démontrent une prévalence élevée (74,1 %) d'obstruction bronchique (modérée 40 %, sévère 30 %, grave 4,1 %), dépendant de la durée de la pratique, du type de métier réalisé dans la filière du charbon de bois et du tabagisme actif. La prévalence de l'hypertension artérielle est de 22 % chez les charbonniers, similaire à la population générale congolaise. Le niveau d'activité physique est estimé de modéré à élevé.

CONCLUSION: Bien que les charbonniers aient un niveau d'activité physique suffisant, ils sont exposés à des problèmes cardio-respiratoires au repos. Il est donc nécessaire d'investiguer d'autres indicateurs spirométriques et les conséquences de ces phénomènes sur la capacité d'effort physique aérobie, en lien avec le niveau d'exposition aux polluants.

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Contribution à l'étude de la pollution particulaire dans l'air en milieu urbain: Cas des $PM_{2,5}$ et PM_{10} le long de la route Kasapa, dans la Ville de Lubumbashi en R.D.Congo

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Mots-clés. — Pollution Atmosphérique; Rayon laser; ICP MS; Route Kasapa Lubumbashi.

Résumé. — La ville de Lubumbashi, R.D.Congo, comme la plupart des villes africaines, est confrontée à une démographie galopante avec un accroissement d'activités anthropiques dont le trafic routier qui, à coté de l'industrie, est souvent pointé du doigt comme emetteur des polluants atmosphériques notamment les matières particulaires (PM). Plusieurs études scientifiques ont prouvées que lors de leurs émissions dans l'atmosphère, les PM peuvent véhiculer de nombreuses substances toxiques telles que les éléments traces métalliques (ETM). Leur toxicité est également liée à leur taille qui favorise la pénétration dans le système respiratoire. Une relation claire a également été observée entre l'exposition aux PM et la survenance des divers effets sanitaires tels que les affections renales, cardiovasculaires et cerebraux, mais aussi l'incidence du cancer pulmonaire, la bronchite, la broncho-pneumopathie chronique obstructive,…

Afin de parvenir à mettre sur pied des politiques de surveillance, de prévention et de réduction de leurs émissions; l'étude de la concentration des PM dans l'atmosphère, des causes de leurs toxicités et de leurs impacts sanitaires s'avère indispensable. L'objectif de ce travail est d'étudier la variation d'une part de la concentration des matières particulaires $PM_{2,5}$ (diamètre < 2,5 µm) et PM_{10} (diamètre < 10 µm) dans l'air, et d'autre part, la variation de la concentration des certaines substances toxiques (ETM) que ces PM peuvent véhiculer. Les analyses chimiques effectuées par ICP des échantillons de dépôts atmosphériques solides (poussières) se sont concentrées sur le cuivre (Cu), le cadmium (Cd), le zinc (Zn), le Fer (Fe), et le Nickel (Ni). Notre étude a été effecutée le long de la route Kasapa : ce tronçon d'environ 5 km de long caracterisé par un trafic routier intense relie le centre ville de Lubumbashi, les cités universitaires et d'autres nouveaux quartiers lushois en pleine expansion.

Les mesures des concentrations des PM ont été faites *in situ* à l'aide d'un détecteur de particules à rayons laser de type Temtop 200. Les dépôts de poussières ont été recueillis sur des plaquettes en verre placées sur des supports à une hauteur comprise entre 2,5 et 3 mètres. Les mesures de concentration et l'échantillonage a été effecuté sur 25 points, répartis en 5 stations de mesure (A, B, C, D, E). Pour chaque station, 1 site se trouvait à proximité immédiate de la route et les autres situés de part et d'autre de celle-ci, à une distance de 100 et 200 metres de l'axe routier. Ces travaux se sont effectués pendant un mois, soit du 15 février au 15 mars 2020. 120 mesures des PM_{10} et $PM_{2,5}$ ont été réalisées, pour fournir des moyennes journalières.

Les resultats de mesures des PM obtenues révèlent qu'au-delà de la présence des PM le long de la route Kasapa, leur concentration dépasse le seuil journalier de l'OMS, fixé à 25 µg /m^3 les $PM_{2,5}$ et 50 µg /m^3 pour les PM_{10}. La mesure des teneurs des ETM dans les dépôts atmosphériques solides nous a permis d'avoir une indication relative d'un risque supplémentaire présenté par les PM en plus de leur taille; la présence du Cd, Ni, Cu, Fe et du Zn (Graphiques 2) qui une fois fixés sur les PM sont transportés jusqu'à la penetration dans l'organisme humain où certains génèrent des signes de toxicité aigue et chronique respiratoire; et certains d'entre eux sont même classés cancérogènes par l'Agence Américaine de Protection de l'Environnement et le Centre International de Recherche sur le Cancer; c'est le cas du Cd et du Ni qui en plus est à l'origine de signes de toxicité digestives.

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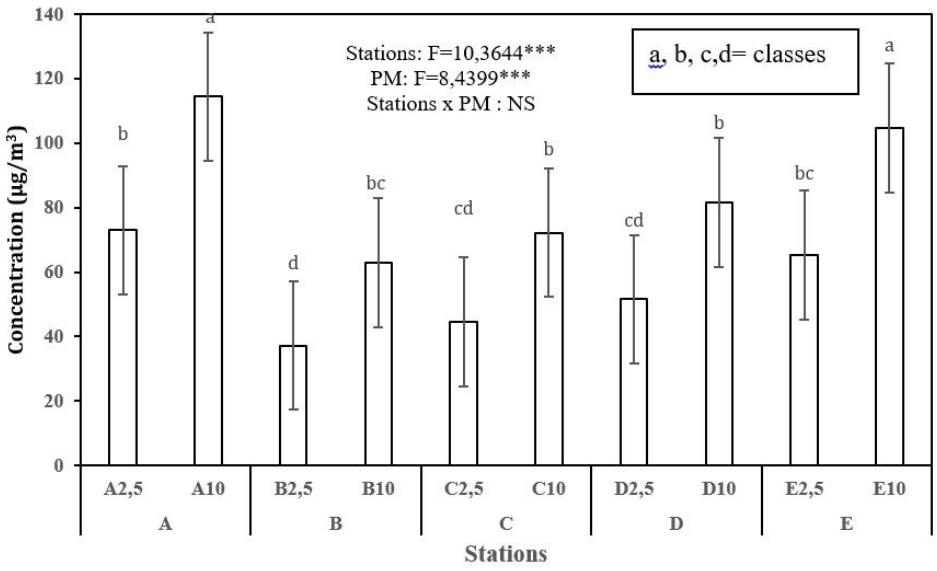
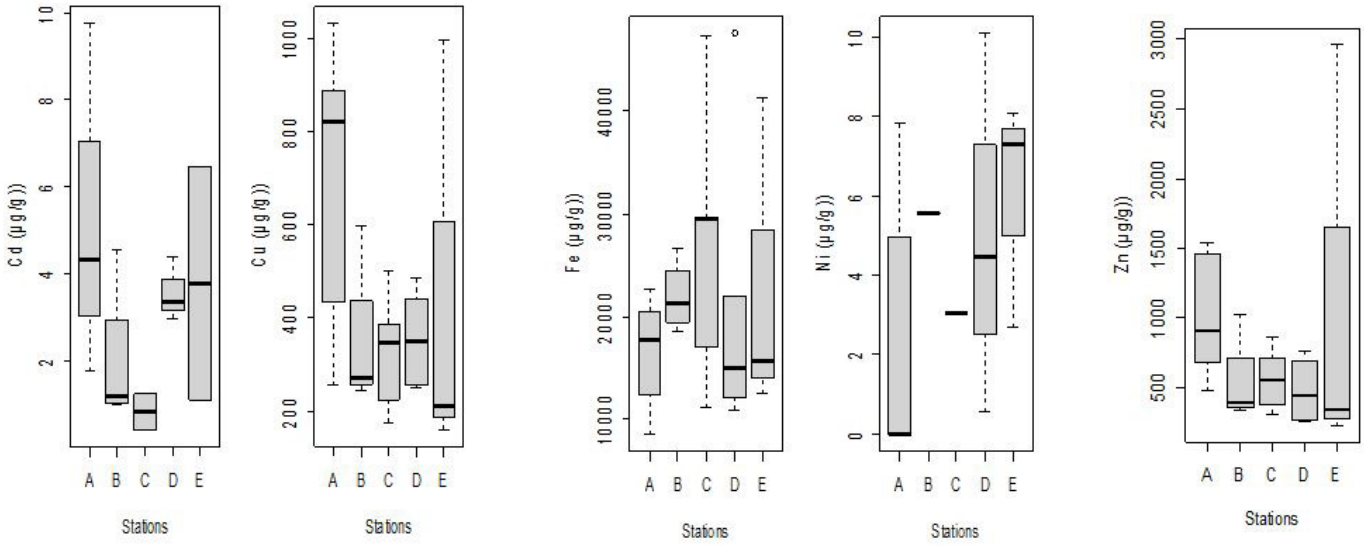
Les valeurs de concentrations élévées en PM et la présence remarquable des ETM sur toutes les 5 stations seraient dues essentiellement aux émissions des véhicules au niveau des échappements, à l'abrasion des pneus et à l'usure des plaquettes de freins,… bien que les incinérations des dechets ménagers puissent egalement y contribuer. Ces résultats soulignent la pertinence de la problématique de la pollution atmosphérique à Lubumbashi, et la nécessité de mener prochainement des études afin de parvenir à élucider en profondeur leur origine spécifique dans le cadre de nos prochains travaux.



Graphique 1. — Moyennes des Concentrations des PM2,5 et PM10 sur différentes stations exprimées en µg /m³.



Graphiques 2. — Moyennes des Concentrations de chaque ETM sur differentes stations exprimées en mg /g.

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Citizen-driven monitoring of freshwater snails that transmit the tropical disease schistosomiasis in Uganda

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KEYWORDS. — Biogeography; Citizen Science; Sub-Saharan Africa.

SUMMARY. — Schistosomiasis is a neglected tropical disease caused by parasitic worms, with common symptoms including stunted growth, anaemia, cognitive impairment, decreased physical fitness and organ-specific pathological effects. Ranking second only to malaria in terms of morbidity and prevalence, an estimated 230 million people are affected by some form of schistosomiasis worldwide, with the vast majority living in sub-Saharan Africa (COLLEY *et al.* 2014). Recently, the World Health Organization recommended to complement existing mass drug administration campaigns with targeted control of the freshwater snails acting as intermediate hosts for the parasite. However, due to a shortage of trained experts and resources in the Global South, detailed information on the spatiotemporal snail distribution, which is needed for targeted snail control, is missing (WHO 2017).

In this study, we set up and trained a network of 25 citizen scientists (CS) to report weekly on schistosome-competent snail abundances in a highly endemic area in Uganda. This data, together with marked GPS locations, key parameters on water chemistry and photographs of the identified snails are recorded using a mobile phone application. Validation and analysis of the submissions is done remotely by trained researchers, after which targeted feedback to the citizen scientists can be provided when necessary. Preliminary results show the potential of citizen participation to upscale snail sampling in remote regions and serve as a proof of concept to address the pressing need for low resource yet spatiotemporally dense information on snail host abundance.

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Phytochemical profiling and anthelmintic activity of root barks of *Oldfieldia dactylophylla* (Welw.ex Oliv.) J. Léon, an Euphorbiaceae used in traditional Congolese medicine

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Keywords. — *Oldfieldia Dactylophylla*; Root Barks; Anthelmintic; *Caenorhabditis Elegans*; HPTLC.

Summary. — *Oldfieldia dactylophylla* (Welw.ex Oliv.) J. Léon (Euphorbiaceae) is a traditional Congolese medicinal plant, often confused with a lookalike *Vitex* species. Root barks are used to treat human and animal gastrointestinal parasites, verminosis, diarrhoea, wounds… As the problem of disponibility of antihemintic drugs and the emergence of parasites resistance remain a huge challenge, the quest for new antihelminthic drugs is a necessity.

The present work aims to investigate the phytochemical profiles and anthelmintic activities of heptane, dichloromethane, ethyl acetate and methanol extracts of *O. dactylophylla* root barks.

A bioassay for the anthelmintic activity was performed with a *Caenorhabditis elegans* (*C. elegans*) test model using a WMicrotracker instrument to monitor worm mobility. Sensitive high-performance thin-layer chromatography (HPTLC) methods were developed using CAMAG instruments. HPTLC fingerprints of the extracts were obtained using HPTLC silica gel F254 plates with petroleum benzine (40-60°C)-acetone-ethyl acetate (80:15:5, v/v/v) as mobile phase. After treating with natural products and vanillin-sulfuric acid reagents (Eur. Ph.), plates were evaluated under visible and $UV_{366\ nm}$ lights. The bioassays of heptane extract showed the highest mobility inhibition activity (85 % inhibition) followed by methanolic extract (58 % inhibition). The two extracts were fractionated and anthelmintic activity against nematodes was found for one fraction (F11) of the heptane extract and two fractions (n-butanol and aqueous) partitioned from the methanol extract. Experimental evidence confirms the validity of the traditional use of *O. dactylophylla* root barks for the treatment of gastrointestinal parasites. The next step of this study will be to purify and characterize the compound(s) responsible for this activity.

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Young Researchers' Overseas Day
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Police reform through the lens of human rights: The case of Ethiopia

Abera Gebrehiwot[1], Parmentier Stephan[2*] & Teklu Asmelash[3]

Keywords. — Police Reform; Human Rights; Police Custody; Protections.

Summary. — The context of police reform varies among countries depending on the economic, social, cultural and political environment in which motive for police reform is shaped. Although police reform has been well known to Western democracies long time ago, it has gained considerable scholarly attention in the 1990's where many countries in Africa, Latin America, Asia, and Central and Eastern Europe saw major political shift from authoritarian past (1). During this period and until recently, the UN, Western governments including the US and Australia, NGO's and INGO's have administered huge police assistance programs in war torn and post dictatorship regimes in Africa, Latin America, and former post-communist countries of Central and Eastern Europe (2). Not surprisingly, Ethiopia has adopted police policy and implemented community policing following the end of military government in 1991. This development was paralleled by the adoption of constitution, and ratification of major international human rights treaty instruments such as the International Covenant on Civil and Political Rights(ICCPR), International Covenant on Economic, Social and Cultural Rights(ICESCR), and Convention against Torture and other Cruel, Inhuman or Degrading Treatment or Punishment(CAT). However, reports by NGO's, and international organizations indicate that serious human rights violations have persisted despite police reform measures. These reports indicate that serious human rights violation relate to ill treatment of suspects under police custody. This paper argues that serious challenges exist in streamlining human rights both in the formulation and implementation of police reform measures in respect to the protection of suspects under police custody in Ethiopia. First, the paper discusses post 1991 police reform measures in respect to the protection of suspects under police custody in Ethiopia. Then, the paper examines the role police reform has played and could further play in enhancing the of protection of suspects in police custody in Ethiopia. The findings and conclusion aims to provide different solutions in furthering the protection of suspects by the government and stakeholders.

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Pygmies Return to their Eden? From slow violence to open conflict in DRCongo's Kahuzi-Biega National Park

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Keywords. — Coercive Conservation; Everyday Resistance; Slow Violence; Ethnographic Research; Democratic Republic of Congo.

Summary. — In this paper I make a contribution to the literature on conservation and environmental conflict. Specifically, I explore how the 'slow' violence (Nixon 2013) of top-down conservation causes communities to develop clandestine forms of resistance, which can – ostensibly out of nowhere – unleash 'sudden' outbursts of violence from the bottom-up. I use a recent conflict between indigenous 'Pygmy' communities and eastern Democratic Republic of Congo's (DRC) Kahuzi-Biega National Park as an illustrative example. I gathered ethnographic data for the case study between August 2019 and February 2020 with a team of local researchers. The conflict goes back to the 1970s, when conservation authorities first displaced Pygmies from the Park. The Park was territorialised in several stages, which led to the marginalisation and impoverishment of Pygmies (slow violence). Pygmies tended to conceal much of their opposition from Park authorities, confining their struggle to 'hidden transcripts' and 'everyday' forms of resistance (Scott 1990, 1985). They also engaged in non-confrontational 'rights-based' forms of resistance (O'Brien 1996). However, all that changed in October 2018 when thousands of Pygmies returned to the Park by force, generating a wave open conflict with Park authorities (sudden violence). Once inside the Park, they formed strategic alliances with armed groups, traders and Bantu communities. I argue that the decision to take their covert struggle to the centre stage was due to factors internal and external to the Pygmy resistance. In the final section, I describe how manipulation 'from above' and internecine struggles 'from below' have caused the Pygmy resistance movement to fragment. By engaging in open violent action against Park authorities, Pygmies effectively 'used up' some of the latent energy stored within their hidden transcript. Although this did affect some positive changes, it now appears the recent conflict may reproduce the very power relations Pygmies sought to overturn. My findings reinforce the significance of the relationship between slow/sudden violence, covert/overt resistance and hidden/public transcripts for the study of environmental conflict in the Global South.

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Impact of Rohingyas on the vegetation cover at Kutupalong Camp in Ukhiya, Cox's bazar, Bangladesh

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Keywords. — NDVI; Anthropogenic Change; Deforestation; Ecosystem Service.

Summary. — Bangladesh has been dealing with one of the world's largest refugee emergencies along its border with Myanmar (especially in the rough wooded zone of Ukhiya subdistrict, Cox's Bazar) due to a massive influx of Rohingya refugees, particularly since 25 August 2017, whose impacts threaten the viability of local plantations as well as natural forests (societal and ecological assets). This research aims to evaluate the impact of this influx on the physical landscape in the Ukhiya sub-district as well as on the socio-cultural landscape. The study was based on both geo-spatial data and survey data analysis. We state that the Rohingya refugee influx has a significant impact on the physical and socio-cultural landscape of the area in and around the Rohingya camps. Analysis of the normalized difference vegetation index (NDVI) showed that between 2015 and 2018 the forested areas adjacent to the Kutupalong camps (Ukhiya sub-district) declined by 11.23 km². Forest cover fell from approximately 68.9% down to 2.72%; the decline represented about 15.2% of the entire forested area. Furthermore, the highest elevated area of Kutupalong camps (estimated to be 41m) is likewise affected by anthropogenic activities, for instance, wholesale cutting into the slope, and street and stair construction gradually increase the probability of landslides and inland floods in several camps. The settlement accounts for 27.6% of the total area in the Kutupalong RC and Kutupalnog extension campsite in 2019. Out of which 0.35% and 9.61% settlements are at risk of landslide and flood respectively. A large proportion of Rohingyas also uses wood for fuel; fuel wood consumption is the primary cause of forest degradation in Ukhiya sub-district. Its forests and elevation will never return to their original condition if the consumption of forestry assets proceeds unabated. The research findings are intended to inspire local, national, and global aid agencies to develop local strategies for forest management and environmental protection.

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Session III

Young Researchers' Overseas Day
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Contracts and certification in local value chains: Safe vegetables in Vietnam

Enthoven Laura[1*] & Van den Broeck Goedele[1]

Keywords. — Agricultural Economics; Econometrics; Choice Experiment; Southeast Asia (Vietnam).

Summary. — Food quality and safety concerns in low- and middle-income countries are often addressed using stringent standards and formal contracts between farmers and buyers that stipulate requirements on quantity, quality and price. However, such standards – and certification of compliance therewith – are generally complex and entail high costs related to conformity assessment. Many studies have investigated the welfare implications of these control mechanisms for small-scale farmers in modern value chains, including exports and supermarkets. Opposed to this, only a few studies have focused on the potential of certification and contracts to tackle food safety issues within local, traditional value chains. Understanding farmers' preferences for contracts with local buyers that involve safe production requirements is key to optimising their design, stimulating inclusive value chains, and ensuring access to safe food for all.

This study uses a choice experiment to explore the preferences of vegetable farmers in northern Vietnam for different types of certification schemes and contracts. Results evidence that farmers are willing to participate in safe vegetable contracts, provided that requirements are feasible and buyers fully committed and trustworthy. However, they are strongly averse to organic farming and selling to unknown buyers. They do not necessarily demand higher prices but highly value contracts that entail large purchase quantities, long duration and pesticide provision. Our results are particularly informative when one would like to encourage the establishment of new contracts between farmers and buyers, in turn fostering inclusive and safe local value chains.

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Unravelling an Ancient Near Eastern archival mystery: The provenance of the *Elamite Nineveh Letters* revised

Gorris Elynn[1*]

Keywords. — Assyriology; Elamology; Comparative Linguistics; Archival Studies; Ancient Iraq & Iran.

Summary. — Over the last century, scholars have intensively discussed the provenance of the *Elamite Nineveh Letters*. According to the inventory numbers of the British Museum, this archive of twenty-three late Elamite cuneiform tablets was allegedly excavated between 1850-1891 in the Neo-Assyrian capital Nineveh (Iraq). As these letters are the only Elamite tablets in the so-called Library of Assurbanipal, their Nineveh provenance was already questioned as early as the late 19th century (Sayce 1885: 756). Eager to solve this archival mystery, some scholars suggested that the letters ended up in the (K)uyunjik-collection by a 19th century mix-up of transport cases in either Bagdad before shipment to London or during the registration in the British Museum (Reade 1986: 213); some attribute a Malamir (Iran) provenance to the tablets (Charpin 1988), brought to Nineveh by British diplomats-explorers (Vallat 1988, 1998); others browsed the old Nineveh excavation reports, trying to reconstruct meticulously the archaeological context of the *Elamite Nineveh Letters* (Reade 1992).

Due to the lack of an academic text edition and a proper grammatical analysis of the *Elamite Nineveh Letters*, none of the above hypotheses takes into account the possibility that they might have been added in antiquity to the Library of Assurbanipal as *e.g.* war booty, or physical evidence of international communication. Recent studies (Gorris 2018) on Elamite writing traditions and the linguistic particularities of the *Elamite Nineveh Letters* have revealed the geographical scope and timeframe in which these tablets were written. This improved understanding of the *Elamite Nineveh Letters* combined with a study of the Elamite and Assyrian archival methods might bring us a step closer to unravel one of the Ancient Near Eastern archival mysteries. With a historical-linguistic approach, this paper aims to re-evaluate the plausibility of the already existing hypotheses, but will equally explore the options for a historical explanation in order to retrace the provenance of the *Elamite Nineveh Letters*.

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The State of Katanga in the International World: Reassessing Tshombe's Agency

Hendrickx Colin[1*]

Keywords. — Katanga; Tshombe; Congo; Agency; Congo Crisis.

Summary. — The Katangese secession from Congo-Léopoldville (1960-63) happened during a particularly tense moment during the Cold War in the Third World. Several scholars have started to broaden their scope away from the restrictions of a neo-colonial framework, without obscuring the role of external involvement (Larmer & Kennes 2014, Brownell 2014, Passemiers 2016). This presentation will look at the international dimension of the Katangese state and argue in favour of a reassessment of the agency of Katangese political elites. Based on the consultation of the Moïse Tshombe Papers, a hitherto neglected archival resource kept at the AfricaMuseum in Tervuren, this presentation focuses on the workings of the three most important 'pseudo-diplomatic' representations of Katanga, namely in Paris (Dominique Diur), New York (Michel Struelens), and Brussels (Jacques Masangu). The regime of Katanga's president Tshombe survived for a relatively long period of time, not in the least because it succeeded in establishing an international network which mobilised mercenaries to work for the state, and reached out to extensive lobby structures in France, Belgium, and the United States. Although the Katangese political elites faced a considerable amount of constraints, ranging from (at least *de jure*) non-recognition by every UN member state, to conflicts with Northern Katangese population groups and the UN mission in Congo (ONUC), they succeeded in instrumentalising international actors for domestic purposes. Thus, this presentation dialogues with the literature that emphasises African agency in international relations, and literature reconsidering the Katangese secession.

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Could *Bacillus* and *Paenibacillus* be used to control fungal pathogens on Peanut crop without altering symbiosis bacteria?

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Keywords. — PGPR; Fungal Pathogen; Rhizobia; *Arachis Hypogaea* L.

Summary. — More than 55 pathogens, mainly fungi, have been reported to affect Peanut yields and quality of the groundnut produced under tropical climate. To control these pathogens without using synthetic pesticides, some Bacillaceae may be used as biocontrol. The aim of the present study was to select

Bacillus or *Paenibacillus* strains which can efficiently fight fungal pathogens of this crop without affecting Rhizobia growth involved in nitrogen symbiotic fixation.

Bacillus velezensis GA1, B. v. S499, B. v. QST713, B. v. FZB42 and *Paenibacillus polymya* 56 were tested as *Arachis hypogea* L. growth promoting rhizobacteria. The potential growth of these bacteria and Cyclic Lipopeptides production were tested using *A. hypogaea* root exudates as the main source of nutrient. These tested strains were also confronted against six fungal pathogens as well as against three Rhizobia.

All *Bacillus velezensis* were able to growth in environment containing *A. hypogaea* root exudates (0.3-0.4 OD) and to produce Surfactins and Iturins. It has been demonstrated, in previous research, that these Lipopeptides produced are involved in microbe colonization of rhizoplane, in the induction of systemic resistance in the host plant and can antagonize the growth of soil-borne pathogens. Antifungal activity was equally for GA1, S499, FZB42 and QST713 while less for Pp56. *Bacillus velezensis* GA1 and S499 were compatible in co-cultivation with *Bradyrhizobium arachidis*.

The use of *Bacillus velezensis* GA1 and S499 as PGPR is proving, *in vitro*, to be an effective means to fight against fungal pathogens on Peanut crop without altering the potential of symbiotic nitrogen fixation in Rhizobia-*A. hypogaea* system.

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Poster session

E

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Tectonic style during the Archean in the Ntem Complex (NW Congo Craton, southern Cameroon): Case of the "Nyabizan-greenstone belt (NGB)" and "Sangmelima granite-greenstone belt (SGB)"

Akame Joseph Martial[1*] & Debaille Vinciane

Keywords. — Tectonic Crustal Shortening; EPMA Monazite Dating; Anatexis.

Summary. — The present contribution examines the tectonic style during Archean in the "Nyabizan-greenstone belt (NGB)" and the "Sangmelima-granite-greenstone belt (SGB)", two major Archean deformation zones in the Ntem Complex, northwestern part of the Congo Craton (southern Cameroon). Based on the available aeromagnetic maps coupled with our field measurements, we have drawn maps of the foliation trajectories and performed a detailed structural analysis along both belts. The time constraints of magmatism, metamorphism and deformation were obtained by U–Pb laser ablation-inductively coupled plasma-mass spectrometry (LA-ICP-MS) dating on zircon and electron microprobe analysis (EPMA) U–Th–Pb dating on monazite.

The NGB area is a narrow belt trending NE-SW, surrounded by tonalite-trondhjemite-granodiorite (TTG) gneisses and granitoids, and consists of Mesoarchean metavolcanic and metasedimentary rocks. It is marked by a strong steeply dipping regional foliation associated with a dome-shaped fold structure, and steeply plunging stretching lineation that trend dominantly NW to N, sub-parallel to the fold axes. The well-preserved flat-laying fabrics alternate with steeply dipping mylonitic deformation zones. Shear indicators are poorly expressed but suggest a dominant sinistral strike slip component. The analyses of the maps of foliation trajectories and associated shear zone networks, suggest that the regional strain pattern results from transpression. There are vertical regional fabric domains with sub-horizontal foliation domains suggesting a strain partitioning at a regional scale. Numerous syn-kinematic intrusions and low-temperature mineral recrystallizations observed along the shear zones point to a long-lasting tectonic history in the NGB.

In the Sangmelima granite-greenstone belt (SGB), charnockites and TTG suites formed between ~ 3155 and 2850 Ma. The gabbro intrusion was dated at 2866 ± 6 Ma. Migmatization of the TTG-gneiss, coeval with a sub-horizontal shortening syn-metamorphic D1 event, is dated around 2843–2820 Ma using U–Pb LA–ICP–MS on zircon and U–Th–Pb EPMA dating on monazite. Syn-kinematic monzogranites were emplaced 2838±6 Ma ago. D2 is associated with F2 folds and C2 shear zones coeval with a second anatexis period between ~2788–2722 Ma marked by the emplacement of high-K granites that peaked at ~2750 Ma. Ages of migmatisation and syn-kinematic granites (2843 –2722 Ma) suggest a long-lasting tectonic process in the SGB. Late Neoarchean granitic pegmatite/aplite dikes and/or veins were emplaced during brittle deformation D3 and the Ntem Complex protracted cooling between ~2670–2550 Ma.

A synthesis of all results leads to the reconstruction of the general structure for the Ntem Complex, from the Paleo- and Neoproterozoic to the Archean domains. In addition, a new model of Archean geodynamic evolution in the NW Congo Craton from 3.32 Ga to 2.55 Ga is proposed.

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Salt tectonics and Cu-Co mineralization in the Katanga Copperbelt

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Keywords. — Copper; Cobalt; Breccia; Lufilian Orogeny; Central African Copperbelt.

Summary. — The Central African Copper Belt (CACB) Neoproterozoic orogenic belt is located in the south-eastern part of the Democratic Republic of Congo (DRC), northern Zambia and eastern Angola. It hosts Cu-Co (U, Ni) and Zn-Cu-Pb (Ag, Ge, …) ore deposits (Cailteux *et al.* 2005, Kampunzu *et al.* 2009). Cu-Co (U, Ni) mineralization is hosted within large sheets (megafragments, 1-10km in length) of rocks belonging to the Roan Group which form part of tectonic megabreccias. Several kinds of breccias such as resulting from hydrofracturing; dissolution of carbonates, faulting and collapse breccias due to dissolution of evaporites occur in these megafragments (Cailteux *et al.*2018). The present tectonic configuration of the Katangan basin (*e.g.* at Tenke-Fungurume, Kakanda,) show complex geometries of the megabreccia like diapiric structures (Selley *et al.* 2018) suggesting salt tectonics (halokinesis) during the Pan-African orogeny. Different Cu-Co (U, Ni) mineralization phases, including a diagenetic, hydrothermal phase, were identified in the CACB (Dewaele *et al.* 2006), interpreted to be partly associated with the salt tectonics (Selley *et al.* 2018). The salt sheets that probably occurred in the Roan Group were halokinetically modified during the rifting stage and the Pan-African orogeny. Their dissolution increased the salinity of both the residual brines, which contributed to transportation of the metals, followed by precipitation of the Cu-Co hypogene minerals (*e.g.* bornite, chalcopyrite, carrollite, …) during the different mineralization phases.

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Tephrostratigraphy of the Bora-Baricha-Tullu Moye (BBTM) volcanic system in the Central Main Ethiopian Rift

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KEYWORDS. — Volcanology; Tephrostratigraphy; Silicic Volcanoes; Main Ethiopian Rift.

SUMMARY. — The Main Ethiopian Rift (MER) is a tectonically and magmatically active rift in the northern portion of the East African Rift System. The MER contains more than 60 volcanoes with some evidence of activity on their geologically recent past. Large caldera-hosting silicic volcanoes are dotted along the rift floor, with Corbetti and Aluto probably some of the more frequently active ones, showing evidence of explosive eruptions every few hundred years. Currently few of the volcanoes are monitored and for many of them no information exists on the frequency and magnitude of past volcanic eruptions.

The Bora-Baricha-Tullu Moye (BBTM) volcanic field is situated in the Central Main Ethiopian Rift. During the last ~100 kyr, after a major eruption that deposited a regional marker horizon, the region was blanketed by thick successions of widespread tephra fall and localized pyroclastic density current deposits. A historical eruption around 1900 CE, recent seismic activity and deformation, and an active geothermal system, highlights the volcanic system is still active and may erupt in the near future. We present a tephrostratigraphic framework for the region, based on field surveys and major-trace element glass analysis of the pyroclastic deposits.

The BBTM volcanic field comprises several Late Quaternary edifices. The major ones are Tullu Moye, Bora and Baricha. The overall chemical composition of Tullu Moye pyroclastic products is comenditic rhyolite; Bora and Baricha both erupt pantellerite magmas. In total, we find at least 28 individual units in the last 100 ky sourced from Bora-Baricha. Correlations between sections are especially complicated by 1) thick (even up to >10 m tephra fall deposits) yet seemingly limited lateral distribution of individual pyroclastic deposits; 2) repeated and homogenous glass compositions.

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Gold mineralization in the Karagwe-Ankole belt: Auriferous quartz veins from the Byumba deposit (Rwanda)

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Keywords. — Gold; Ore Geology; Petrography; µXRF; Rwanda.

Summary. — The Central African Karagwe-Ankole belt (KAB) hosts many important mineral resources, including the metals Ta, Nb, Sn, W, Li and Au, which have been the subject of several geological studies in the last few years (Fernandez-Alonso *et al.* 2012). Despite this effort, many unanswered questions remain regarding the formation conditions and mineralization style of the gold deposits. The aim of this study is to determine the controlling factors on the gold distribution and the feasibility for further exploration and possible extraction of gold ore within the Byumba deposit in northern Rwanda.

Explorative drillings (8 drill cores, ±1800 m in total) from the Byumba deposit were logged and sampled for further petrographic investigation and Micro X-ray fluorescence (µXRF) based major and trace element mapping (a rapid, high-resolution and non-destructive geochemical screening tool). The rocks from the Byumba deposit show distinct phases of folding and shear deformation. Three main quartz vein phases were identified (pre-, syn-, post-folding) (Wouters *et al.* 2020). A generation of post-folding (V3) massive or sigmoidal quartz veins, crosscut the folds and cleavage. Geochemical characterization by µXRF element mapping identifies the shear-related chlorite-rich quartz veins (V3), as host of the primary gold mineralization (Wouters *et al.* 2020). Within these veins, a dark grey quartz phase, hosts the gold mineralization that occurs in the form of sub-micron gold patches and of small disseminated blebs. In addition, µXRF mapping shows a correlation between the gold-enriched quartz veins and the arsenic content of the analyzed mapping areas, expressed by the presence of arsenopyrite (FeAsS) and As-rich pyrite (FeS2), but no detectable amount of gold is present within the sulfides themselves (Wouters *et al.* 2020). A supergene enrichment phase of gold is identified at reduction zone boundaries through logging of the gold grade.

The occurrence of sub-micron free gold within the quartz phase poses problems for processing of the ore, as concentration of gold through gravity-based techniques is not feasible. Hence, heavy processing and environmental unfriendly leaching techniques would have to be applied. Furthermore, the absence of significant amounts of refractory gold within sulfides inhibits the use of roasting and other techniques frequently used in gold extraction that rely on a significant presence of gold within sulfides (Marsden & House 2006).

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By-products binders from industrial and agricultural process for improving the physico-mechanical properties and durability of compressed earth blocks

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Keywords. — Lime Residue; Compressive Strength; Durability; Pozzolanic Reaction; Rice Husk Ash.

Summary. — Although, earthen materials have been and remain the most used building materials, their hygrothermal and durability performances are still problematic. The present study investigated the physico-mechanical and durability performances of compressed earth blocks (CEBs) produced from kaolinite-rich earthen material stabilized with by-products such as calcium carbide residue (lime-rich residue) and rice husk ash (silica-rich ash), locally available in the vicinity of Ouagadougou, Burkina Faso. Dry mixtures were prepared using earthen material and 0 to 25 % lime or 20:0 to 12:8 % lime:ash of the weight of earthen material. Moistened mixtures were manually compressed to produce stabilized CEBs (295x140x95 mm).

Stabilized CEBs were cured at 30±5 °C and wrapped in plastic bags for 45 days. The cured CEBs were dried and tested for thermal, mechanical and indicators of their durability. While unstabilized CEBs immediately degraded in water, the stabilized CEBs were stable against water erodability (non-erodable) and their other durability indicators were excellent. They resisted erosion at standard water pressure (50 kPa) and at an extreme pressure of 500 kPa. This improvement accompanied the increase of the compressive strength of stabilized CEBs (from 1 MPa to 4 7 MPa). It was due to the formation of cementitious products resulting from the pozzolanic reaction between the lime and aluminosilicates in earthen materials and ash. The stabilization also decreased the thermal conductivity (1-0.5 W/m.K) and diffusivity ($6x10^{-7}$ - $4.5x10^{-7}$ m^2/s).

CEBs stabilized with by-product binders essentially reached comparable or even better performances than CEBs stabilized with common industrial binders such as cement. This suggests that the value can be added to by-product materials for improving the structural efficiency of CEBs to bear load in the wall in two or three-storey buildings, and possibly improve the thermal comfort and energy efficiency of CEBs-based buildings.

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Poster session

F

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Dietary diversity as a hematological status determinant during pregnancy in Ethiopia: Community-based cross-sectional study

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Keywords. — Pregnant Women; Anemia.

Summary. — Background: Studies indicate that there is a high prevalence of anemia among pregnant women in Ethiopia. To contribute to solve this problem, more information on determinants of anemia during pregnancy in Ethiopia is crucial.

Method: A community-based cross-sectional study was conducted and data were collected from pregnant women living in four regions of Ethiopia from February to April 2017. A total sample of 1,174 eligible pregnant women was selected using systematic random sampling. Data were collected through an interviewer-administered questionnaire. A blood sample was obtained by finger prick and hemoglobin test was done to determine hematologic status of pregnant mothers. Multiple regression was used to identify determinants of the hematological status of pregnant women at a 5 % level of significance. Bivariate analysis was also used to examine the association between hematological status and its determinants.

Result: The overall prevalence of anemia among pregnant women across all the four regions of Ethiopia was 33.4 %. The highest prevalence of 50.0 % was seen in Kombolcha district whereas the least (9.5 %) was in Offa district. The mean hemoglobin level across all regions was 11.56 (SD=1.59) g/dl which is a bit higher than anemic cut-off value of pregnant women (<11 g/dl). About one-third of mothers were undernourished in all study districts measured by Mid Upper Arm Circumference (MUAC). Only 46 % of pregnant women took iron /Folate supplementation and out of this 91.4 % took supplements every day. Among the variables considered in the multivariate analysis, gestational age, ANC attendance, MUAC, educational status, family size, minimum dietary diversity, and healthseeking behavior showed a significant association with the hematological status of pregnant women in their respective order of prediction.

Conclusion: The prevalence of anemia among pregnant women is unacceptably high. Minimum dietary diversity, maternal educational status, gestational age, ANC attendance, family size, healthseeking behavior, and mid-upper arm circumference showed an association with the hematological status of pregnant women. Integrated multisectoral nutrition sensitive interventions focusing on diversifying diet through nutrition education should be done as well as improving ANC uptake by pregnant women.

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Estimation of Lead exposure of Peulh cheese consumers from southern Benin

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Keywords. — Chemical Contaminant; Risk Assessment; Lead; Cheese; Benin.

Summary. — Most Beninese markets are spaces where food products, often unpacked, are exposed to ambient air (Ekaneme 1998). In such environments, dust is source of lead (Pb) contamination of foodstuffs (Mama *et al.* 2013). The main objective of this work is to carry out a preliminary assessment of the exposure of Beninese adult consumers to Pb, through the consumption of traditional Peulh cheese named Wagashi Gassire (WG) sold on the markets in southern Benin. For this purpose, 15 samples of WG, including 9 red Wagashi Gassire (RWG) and 6 white Wagashi Gassire (WWG), were collected from three markets in Abomey-Calavi. Lead levels were determined by ICP-MS (Amoussou *et al.* 2019). A deterministic approach was used to calculate the Pb exposure corresponding to an average daily consumption of 200 g of WG. The results revealed the presence of Pb in all samples with median values of 0.048 and 0.133 mg/kg wet weight (ww) for RWG and WWG respectively. For an adult of 60 kg body weight (bw), the exposure would be 0.16 and 0.44 µg/kg.bw/day for RWG and WWG, respectively. According to EFSA (2010), the risk linked to the intake of Pb from food should be assessed using the approach of the margin of exposure (MOE), based on benchmark doses (BMDL) determined for cardiovascular and nephrotoxic effects in humans. These BMDL have been set to 1.5 and 0.63 µg/kg.bw/day, respectively, for adults (EFSA 2010). The MOE (*i.e.*, the ratio between the Pb BMDL and the Pb intake) were 9.4 (RWG) and 3.4 (WWG) for cardiovascular effects, and 3.9 (RWG) and 1.4 (WWG) for nephrotoxic effects, showing that the Pb intake was lower than the BMDL. These MOE above 1 indicate an absence of concern about the Pb intake from WG consumption. However, these estimations should be extended to all dietary sources of Pb. This work was funded by ARES-CCD (PRD WALAC project) and the results presented in this paper have not yet been published.

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La revalorisation des produits de terroir au Maroc: reconstruction d'un patrimoine alimentaire et émancipation des productrices

M'barki Rayyane[1*]

Mots-clés. — Terroir, genre; Justice sociale et spatiale; Méthodes qualitatives; Nord du Maroc.

Summary. — Au Maroc comme ailleurs, les femmes subissent encore des discriminations liées à leur sexe. Ces injustices sont particulièrement importantes en milieu rural malgré la contribution effective des femmes au développement local. Les femmes rurales marocaines sont considérées comme des gardiennes du patrimoine local, car, elles perpétuent les savoir-faire ancestraux nécessaires à la fabrication des produits de terroir. Elles répondent ainsi à une demande nationale et internationale croissante. Toutefois, le travail des femmes n'est que rarement valorisé et les inégalités de genre persistent. Dans ce contexte, notre recherche propose une analyse du lien entre le terroir et la justice sociale et spatiale d'un point de vue genre. Autrement dit, elle permettra d'appréhender la manière dont l'organisation spatiale de la filière des produits de territoire influe sur et est influencée par la justice sociale de genre.

Notre recherche s'appuie sur une étude comparative de trois projets de valorisation des produits de terroir (le miel d'arbousier, le fromage de Chefchaouen et le sirop de raisin appelé samet) pour couvrir des situations variées. Le recueil des données repose sur des entretiens d'explicitation auprès des productrices pour les inciter à mettre en mot leur vécu et exprimer ce qui reste spontanément tacite, des entretiens semi-directifs auprès des acteurs régionaux de l'agriculture et des acteurs locaux capables de favoriser ou d'empêcher l'émancipation des femmes (ex. les maris des productrices et les imams) ainsi que des questionnaires destinés aux consommateurs urbains. Afin de favoriser la reconnaissance sociale, culturelle et économique des femmes rurales, notre projet s'adresse à un public divers et large grâce à des ateliers d'information et de sensibilisation. Au moment d'écrire ce résumé, nous n'avons que des résultats partiels de notre recherche mais nous pouvons mettre en avant certaines réussites comme celles des projets de valorisation du fromage de chèvre de Chefchaouen. Ce produit a reçu une IGP en 2011, il a connu un succès soutenu par la fromagerie "Ajbane Chefchaouen" qui garantit la qualité et l'innovation (ex. féta Chefchaouen, gouda de chèvre, yaourt). Ce produit patrimonial a contribué à l'amélioration des conditions de vie et de travail de nombreux acteurs comme les éleveurs qui ont bénéficié d'un travail d'encadrement et de sélection ayant amélioré la performance de la production laitière. Si le lait produit ne permettait que l'allaitement des chevreaux, certains éleveurs ont commencé à vendre 30 litres par jour avec un troupeau de 30 chèvres. Cependant, la situation des femmes qui conservent les savoir-faire reste discutable dans une société patriarcale où les opportunités d'évolution sont inégales et où les stéréotypes sexistes persistent.

Si le terroir est un vecteur de développement local qui pourrait favoriser l'émancipation des productrices, les changements positifs du statut social et économique ne bénéficient pas à toutes les collaboratrices, car, les projets de développement rural ne transforment pas les normes sociales et culturelles qui perpétuent les disparités entre les sexes et maintiennent la domination masculine et la subordination féminine. Par ailleurs, la fabrication de certains produits de terroir labellisés comme le fromage de chèvre de Chefchaouen requiert des compétences techniques développées dans le cadre des formations, ce qui interroge la répartition des ressources et des opportunités de développement entre les hommes et les femmes. Notre projet vise à identifier les mécanismes de sujétion des productrices et à co-construire des propositions d'actions qui peuvent améliorer la justice sociale et spatiale d'un point de vue genre, sur la base d'une analyse des représentations sociales et de la répartition des ressources productives.

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Isolation, antagonistic activity, chemical characterization of soil-borne and plant-beneficial bacteria from Burundi

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Keywords. — Burundi; Antibacterial Activity; Plant Beneficial Bacteria; Plant Diseases.

Summary. — Food production is worldwide threatened by plant diseases and pests, which are responsible of about 10 % of loss of the global food production (Strange & Scott 2005). Chemical pesticides have been for long utilized for fighting those pests and increment crop harvests. However, the adverse effects of the conventional pesticides on environment and human kind appealed the international community to search for alternative solutions. Plant Beneficial microorganisms with pathogen antagonistic and plant resistance inducing activities could be an ecofriendly option to boost crop yields and limit those deleterious effects (Adedeji *et al.* 2020). In our work, nineteen bacterial strains were isolated from arable soils samples collected from two different agro-ecological locations in Burundi (Murwi-Cibitoke province and Isale-Bujumbura province). Six bacterial isolates exhibited great antibacterial activity against five of the six selected plant pathogenic bacteria (Two gram positive and four gram negative). One particular bacterial isolate was however active against all the six plant pathogens to an extent comparable or greater than the reference bacteria's activity. For instance, that isolate inhibited cereals' brown sheath rot (*Pseudomonas fuscovaginae*) at a rate of 150 % compared to *Bacillus velezensis* GA1 activity. The 16S rRNA sequencing revealed that five isolates belong to *Bacillus pumilus* strains and the best candidate belong to *Bacillus nakamurai* strains. Culture supernatants analyses by LC/Q-TOF mass spectrometry showed that the *B. pumilus* strains produce pumilacidin among other unknown compounds, while the *B. nakamurai* strain produce cyclic lipopeptides (surfactins and iturins), polyketides and siderophores. One important peak on the mass spectrum seem to be an unknown fengycin (research ongoing). Further analyses including pattern fragmentation are required to determine the nature of that compound. Green house and *in planta* experiments with that promising candidate (belonging to *B. nakamurai* strains) constitute the forefront activities to be carried out for efficacy assessment. These findings suggest that Burundi soils are a reservoir of plant beneficial bacteria that may be utilized in plant diseases management

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Session IV

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Severe acute malnutrition in childhood, chronic diseases and human capital in adulthood in the Democratic Republic of Congo: the Lwiro Cohort Study

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Keywords. — Malnutrition; Follow-up; Democratic Republic of Congo; Long-term; Chronic Diseases.

Summary. — **Introduction:** Low- and middle-income countries are undergoing a phase of nutrition transition with a rapid increase in cardiometabolic diseases and their risk factors, such as obesity in adults, whereas undernutrition still largely predominates among children in these regions. According to the developmental origins of chronic non-communicable diseases (NCD) theory, these two burdens could be closely causally linked. We therefore sought to explore the long-term effects of severe acute malnutrition (SAM) during childhood on health and human capital in adulthood.

Methodology: We identified 524 adults (with a median age of 22 years) in the Eastern part of the Democratic Republic of Congo, who were treated for SAM during childhood at Lwiro paediatric hospital between 1988 and 2007. They were compared with 407 community controls of comparable age and sex. The variables of interest were primarily cardiometabolic risk markers for NCD, and secondarily, human capital [education, occupation and socioeconomic status (SES)]. For the comparison, we used linear and logistic regression to estimate the effect of SAM on the risk of NCD, and ordinal logistic regression for the human capital.

Results: Compared with the community controls, malnutrition survivors had a higher mean waist circumference (+1.42 cm, $p = 0.015$), and a larger waist-to-hip ratio (WHR) and waist-to-height ratio (WHtR) [(WHR) +0.03; $p < 0.001$ and (WHtR) +0.01; $p < 0.001$)]. On the other hand, they had a smaller hip circumference (-1.25 cm; $p = 0.021$), and lower muscle strength (-2.2 kg; $p < 0.001$) measured with a Takei Grip-D device. As regards cardiometabolic markers for NCD, apart from a higher HbA1c (+0.4 %; $p < 0.001$), no difference was observed in blood pressure, lipid profile, fasting glycaemia, creatinine or albumin between the subjects and the controls. Compared to the controls, the subjects had a higher risk of metabolic syndrome [adjusted Odds Ratio (OR) 2.14; $p = 0.045$], visceral obesity (OR 1.88; $p = 0.001$) and thinness (adjusted OR 2.14; $p = 0.045$). The risk of metabolic syndrome, however, was reduced by food diversity. The prevalence of hypertension, diabetes, overweight and dyslipidaemia was similar in both groups. Lastly, the proportion of malnutrition survivors with a high level of education and SES was lower ($p < 0.001$ and $p = 0.006$).

Conclusion: SAM during childhood exposes survivors to a high risk of NCD and low human capital in adulthood, even in the absence of subsequent nutrition transition. Policy-makers and funders seeking to fight the global spread of NCD in adults should consider the long-term benefit of reducing childhood SAM as a preventive measure to reduce the socioeconomic burden attributable to NCDs.

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The transformation of farm production systems in the West Bank (Palestinian Territory): a path towards enhanced livelihood conditions for small-scale farmers?

Panosetti Fadia[1*]

Keywords. — Rural Development; Sustainable Livelihood Approach; Agrarian system analysis framework; Ethnography; Israel/Palestine.

Summary. — The precarious livelihood conditions of millions of small-scale farmers remain amongst the world's biggest challenges. Despite increased attention to the importance of small-scale farming activities for sustaining the livelihoods of rural communities, the body of research exploring this topic in the Israeli/Palestinian context often rests on a set of binaries: on the one hand, it provides detailed analysis of how prolonged military occupation and territorial dispossession along with neoliberal restructuring have worked to turn the agrarian and self-sufficient Palestinian economy into a dependent and "de-developed" one and to curtail livelihood options for rural Palestinian communities; whereas on the other hand, it offers accounts of small-scale agriculture as a model of community resistance, solidarity and autonomy.

Finding this approach unsatisfactory for the purpose of exploring the conditions that render small-scale farming a viable – or not – livelihood activity, this work brings these two levels of analysis together and studies how small-scale farmers in the rural village of Wadi Fukin – located in the southern outskirts of Jerusalem – have adapted their farm production systems in response to reduced access to livelihood's natural assets, price fluctuations and policy interventions that downplay small-scale agricultural sector in favour of an agribusiness-model of agricultural development. In so doing, it uses an adapted version of the Sustainable Livelihood Framework coupled with the agrarian system analysis framework. Based on seven months of ethnographic fieldwork carried out between 2018 and 2019 during which I conducted over thirty interviews with farmers, lawyers and civil society actors, carried out field observation in the village and collected archival materials, this work shows how farmers have adapted their cropping and livestock rearing practices, the varieties of cultivated species and the size of their animal flocks as well as their equipment and the division of family labour on the farm to render small-scale agriculture a viable activity.

Based on preliminary data analysis, results indicate that overall transformation of farm production systems is leading to a gradual loss of local varieties of heirloom seeds, agricultural practices and associated forms of knowledge. In fact, farm production systems are increasingly entrenched in the market and depend on the flow of development benefits that are conditional to the adoption of sets of blanket practices for change. Drawing attention to some of the agricultural practices that are getting lost in the adaptation process, this work concludes that the only ground for a substantial improvement of rural communities' livelihoods is the one that engages rural communities on their agro-ecological and historical specific terms.

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Techno-economic assessment of an off-grid energy solution for use in informal settlements of Western Africa - Case study of the settlement of Old Fadama, Accra, Ghana

Pasquet Thibaut[1], under the supervision of Ackom Emmanuel[2], PhD, & Per Sieverts Nielsen, PhD[3]

KEYWORDS. — Institutional Development; Urban Planning; Mini-grids; Hybrid Systems; Solar Power; Community Empowerment.

SUMMARY. — Energy access has been identified as a crucial factor for several development goals, such as education, health, equality or poverty reduction. However close to one billion people still lack an electricity connection, concentrated in developing countries of sub Saharan Africa and south-east Asia. This share is expected to grow in sub Saharan Africa, where population growth outpaces electrification. This issue is worsened in informal settlements, or slums, which concentrate more than half of the urban population in sub Saharan Africa, and experience rapid growth due to rural urban migrations. In these unauthorized settlements, occupation of the land is frequently illegal. As a consequence, utilities companies do not operate there, resulting in an deprivation from basic services. Electricity access is lackluster, often achieved through unsafe illegal connections which plague the main grid. This research therefore explores how electricity access in informal settlements could be improved by relying on off-grid hybrid energy systems, to bypass the need for a sanctioned connection to the grid. The study focuses on the case of the informal settlement of Old Fadama in Accra, Ghana. It relies on a literature review, interviews and the mini-grid optimization tool HOMER. The structure of the Old Fadama settlement was studied, revealing an organised community able to support cooperative projects. A renewable energy resources assessment was then carried out using online tools, highlighting interesting solar resources in the Accra region. An economically viable diesel-solar hybrid energy system was then tailored to meet the needs of the community, suggesting stand-alone systems could be a viable option to electrify informal settlements. Practical guidelines to implement the system in an informal environment are presented, emphasizing the importance of relying on local cooperatives. Finally the study provides a set of policy recommendations, to promote the development of off-grid energy systems in Ghana through local initiatives and private investment facilitated by the state.

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Negative effects of cattle on soil carbon and nutrient pools reversed by megaherbivores

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Keywords. — Savanna Ecology; Soil-plant-herbivore Interactions; Experimental Field Data; Kenyan Savanna.

Summary. — Wild herbivore populations are declining in many African savannas, which is related to replacement by livestock (mainly cattle) and the loss of megaherbivores. Although some livestock management practices may be compatible with the conservation of native savanna biodiversity, the sustainability of these integrated wild herbivore/livestock management practices is unknown. For instance, how will these herbivore mixes influence key processes for the long-term functioning of savanna ecosystems, such as soil carbon, nitrogen and phosphorus pools and cycling? The Kenya Long-term Exclosure Experiment studies the ecosystem consequences of manipulating the presence and absence of wild herbivores and cattle at moderate densities in a 'black cotton' savanna. Here we show that after 20 years, cattle presence decreased total soil carbon and nitrogen pools, while the presence of megaherbivores (mainly elephants) increased these pools and even reversed the negative effects of cattle. Our results suggest that a mix of cattle at moderate densities and wild herbivores can be sustainable, provided that the assemblage of wild herbivores includes the largest species.

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Poster session

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Runoff response to land management in small catchments near Lake Tana, Ethiopia

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Keywords. — Sub-catchment; Quick Flow; Stone Bunds; Curve Number; Lake Tana Basin.

Summary. — The highlands of Ethiopia are severely affected by soil erosion by water. Consequently land management practices such as stone bunds have been widely implemented in recent years. Here, we investigate the effect of stone bunds and vegetation on steep slopes on quick flow (direct flow due to rain storm) in six small catchments (20 – 80 ha), which are dominantly agriculture and have seasonal streams. Hydrological monitoring stations were installed at the outlet of each catchment, and discharge and rainfall were recorded every five minutes during the rainy seasons of 2018 and 2019. Event-based quick flows (Qd) were analyzed against rainfall (P) and catchment characteristics. Quick flow was also predicted with the Natural Resources Conservation Service "Curve Number" (NRCS-CN) method, which is an empirical model used to predict runoff based on hydrologic soil group, land use and antecedent moisture condition. Calibration of the NRCS-CN runoff model based on observed Qd and P resulted in an Summaryion coefficient (λ) (which is a ratio of the initial Summaryion to maximum potential retention) value of 0.014, much less than the commonly used 0.05. CNs in July and August are higher than June and September due to high antecedent moisture condition and showed declining trend with increasing stone bund densities. In catchments with high density of stone bunds and vegetation on steep slopes the quick flow was reduced by 43 % compared to catchments without conservation structures; implying that stone bunds and vegetation rehabilitation implemented so far have been effective in reducing quick flow and enhancing soil infiltration and ground water recharge. Based on our results, a value of $\lambda = 0.01$ is recommended for runoff prediction using the NRCS-CN method in the sub-humid Ethiopian highlands, rather than the commonly accepted 0.05. Besides, ongoing efforts of soil and water conservation in the highlands of Ethiopia should be promoted in catchments where quick flow is high due to land degradation.

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Assessing the impacts of urban gullying in the Democratic Republic of Congo

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Keywords. — Physical Geography; Satellite Data; Impact Analysis; D.R. Congo.

Summary. — Urban gullies cause major infrastructural damages and often claim casualties in many tropical cities of the Global South. Nonetheless, our understanding of this hazard is currently limited to some case studies while the overall impacts remain poorly quantified. Here, we aim to bridge this gap by making a first quantification of the number of persons and buildings affected by urban gullies at the scale of the Democratic Republic of Congo (DRC). We used Google Earth imagery in combination with local news sources and earlier research to identify 25 cities in DRC where urban gullies occur. This list is likely exhaustive. Next, for each of these cities, we used Google Earth imagery to map all visible urban gullies and evaluate their expansion rate and the resulting damages where possible. In total, more than one thousand urban gullies were mapped across the 25 affected cities. Overall, the problem of urban gullies in DRC is especially acute in the cities of Kinshasa, Mbujimayi, Tshikapa, Kananga, Kabinda, and Kikwit. Over 80 % of these gullies were active and, by analyzing their expansion in the period of 2004 to 2020, we identified 4257 houses and 998 roads were destroyed. Nonetheless, the actual impacts are likely much larger since the limited amount of imagery available does not allow to quantify all impacts. For example, in most cases, a large urban gully was already present on the first image available.

We therefore also made an estimate of the total number of persons directly affected by urban gullies (*i.e.* displaced due to the destruction of their house). For this, we calculated the areal fraction of urban gullies in affected cities (which ranged from 0.12 % to 5.66 %) and combined these fractions with the urban population density. From this, we estimate that a total of 245 000 people have been affected. Given that these gullies are linked to recent urban growth and typically less than 30 years old, we estimate that at least 8000 people/year lose their house as a result of urban gullies in DRC. This is almost an order of magnitude more than the estimated impacted population based on the total number of observed destroyed houses (which is only around 25000 people). However, this later estimate is most likely a severe underestimation, since many urban gullies are older than the first image available and have unknown and unconsidered impacts. Furthermore, also the estimate based on population density may be an underestimation because: (*i*) urban gullies may disappear and reappear over time; and (*ii*) many of these gullies are likely more recent than 30 years. Furthermore, this assessment does not take into account numerous other indirect impacts of urban gullies (*e.g.* impacts on traffic and sanitation, increased flood risks, real estate value loss and intangible impacts like fear or stress).
Overall, this research shows that urban gullying is a serious problem in DRC, but likely also in many other tropical countries. More research is needed to better understand this processes and, ultimately, to prevent and mitigate its impacts. The results and the database of this study provide an important first step in this direction.

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Understanding the effectiveness of measures aiming to stabilize urban mega gullies in Kinshasa

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Keywords. — Phyiscal Geography; Environmental Management; Terrain Surveys; D.R. Congo; Soil and Water Conservation.

Summary. — Kinshasa, the capital of the D.R. Congo, is strongly affected by urban mega gullies, *i.e.* large channels that are incised into the soil by concentrated runoff water, which may easily be tens of meters wide, several meters deep and hundreds of meters long. There are currently hundreds of such gullies, having a total length of >100 km. Many of these gullies continue to expand, causing major damage to houses and other infrastructure and often claiming human casualties. To mitigate these impacts numerous efforts are being implemented. The type and scale of these measures varies widely: from large structural measures like retention ponds to local initiatives of stabilizing gully heads with waste material. Nonetheless, earlier work indicates that an estimated 50 % of the existing urban gullies continue to expand, despite the implementation of such measures. As such, we currently have very limited insight into the effectiveness of these measures and the overall best strategies to prevent and mitigate urban gullies. One reason for this is that gully erosion is typically very episodic with long periods of stability, followed by sudden expansion events. As a result, understanding the dynamics of gully expansion in urban environments requires observations over sufficiently long time periods. However, most current initiatives to stabilize urban gullies happen on a rather isolated basis and are rarely evaluated afterwards.

This work aims to improve our understanding of this issue by constructing a large inventory of measures implemented to stabilize urban gullies in Kinshasa and statistically confronting these measures with observed vegetation recovery and long-term gully expansion rates (derived from high-resolution imagery over a period of >10 years). Our preliminary results (based on a dataset of > 140 urban gullies) shows that the most commonly applied measures are revegetation and reinforcement of gully heads with sandbags or household waste material (implemented in around 50 % of the cases). Also retention ponds and water storage tanks are frequently implemented (around 30 % of the cases). Surprisingly, our results indicate that urban gullies with higher expansion rates tend to have more measures implemented in their upstream catchment. While this seems counterintuitive, it may point to the fact that more actively retreating gullies create a larger sense of urgency and therefore instigates a higher number of (often ineffective) initiatives. More research is needed to confirm this. Furthermore, the stability of gullies seems to be strongly linked to vegetation cover in the gully. Nonetheless, it is not always clear if vegetation is the cause or the result of this stability. Overall, this study provides one of the first large scale attempts to evaluate the effectiveness of gully control measures in urban tropical environments. With this study, we hope to contribute to a better prevention and mitigation of this problem that affects many cities of the tropical Global South.

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Characterization of Landscape Change in Rusizi National Park in Burundi

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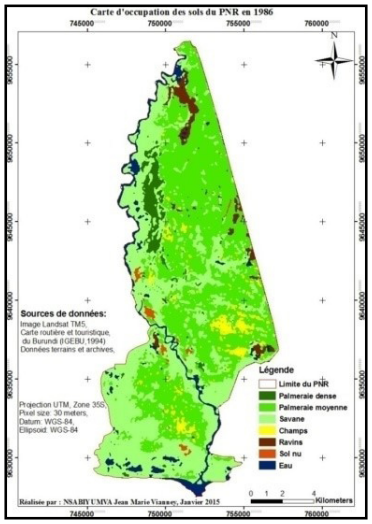
KEYWORDS. — Landscape Ecology; Satellite Data; GIS; Protected Areas of Burundi; Rusizi National Park.

SUMMARY. — This work aims to analyze the threat of protected areas in Burundi and the proximity of the Rusizi National Park to the city of Bujumbura (PNR) and to characterize the part of the co-management policy for protected areas (NZIGIDAHERA 2012). The overall objective is to show the spatiotemporal dynamics between 1986 and 2013 and to propose a participatory and sustainable management system of the natural resources of PNR. A diachronic landscape analysis was performed by means of geomatics (remote sensing, GIS and GPS).

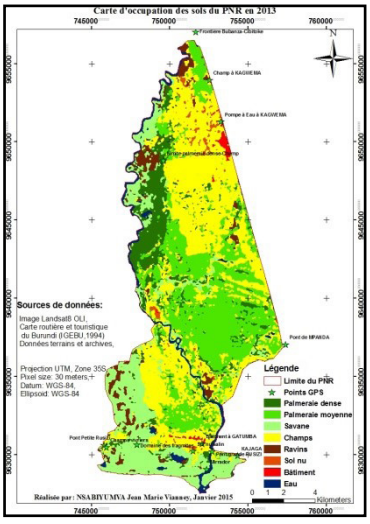
We have adopted a method of analysis based on the satellite images Landsat TM of 1986, July19th and the Landsat OLI of 2013, June 11 th. A supervised classification was executed, together with their visualization in several software programs in accordance with maps of Burundi.

The results include seven (7) land use classes illustrated by the image of 1986 and eight (8) classes visible on the image of 2013. And, through the transition matrix, we can observe that the land use has changed. In fact, the PNR was in 1986 occupied by 85 % with natural vegetation including savannah (40 %) and medium palm (45 %). However, a strong fragmentation was observed in 2013 with four (4) of the eight (8) classes covering each an area greater than 10 % of the the total area. Among those 4 classes, agricultural class was the most dominant and occupying 38 % of the PNR. So, from 1986 to 2013, the agricultural area increased by 35 % (6,500 ha) and the built-up area which was already visible in 2013 and occupies 0.66 % of the PNR (123.79 ha).

These changes are mainly due to human disturbance and uncoordinated management. The maps with the different land use/land cover types could guide the different actors involved in the PNR management.



Rusizi National parc in 1986



Rusizi National Park in 2013

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Poster session

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Multi-layered public spaces in informal settlements as an asset for neighborhood-upgrading: A case study in Lahore, Pakistan

Arif Mashhood M.[1*], Schoonjans Yves[1] & Devisch Oswald[2]

Keywords. — Urbanism; Sustainable Development; Socio-spatial Analysis; Slum Upgrading; Lahore (Pakistan).

Summary. — The understanding of informal settlements plays a pivotal role in attaining the Sustainable Development Goals (SDG) objectives in the global south. Informal settlements have spatially grown through self-build initiatives of inhabitants and by incremental production of space, with public spaces often being produced by self-managed processes. Literature on urban informality (Roy 2012, Dovey 2012) and on the importance of inclusive and public spaces in cities (Sennett 2019), demonstrates that public spaces possess symbolic meaning in terms of self-expression, culture and politics and can embody diversity of activities performed by collective urban life. In the context of Pakistan, reflections on the role and importance of public space in slum areas remain, however, extremely scarce. My research explores this issue for the case of Shamspura Colony which is an old, highly compacted and densified informal settlement in the city of Lahore. The selection of the case was made keeping in view the settlement's connection and interdependency with the adjacent urban fabric in terms of multiple factors *e.g.*, job & economic opportunities, labor pooling, etc. The research is chiefly supported by fieldwork and an in-depth quantitative and qualitative investigation, and includes mapping, photography, and documentary sources for analyzing the appropriation of public spaces within this settlement and gaining insight about their trajectories of production of spaces. It furthermore plans to use design scenarios to engage more directly with the local community and stakeholders on possible futures for this area. Drawing on a widely accepted conviction in circles of planners and urban policymakers that the informal settlement is not the problem to be removed, but rather an asset that can be incrementally transformed, and taking inspiration from a number of recent projects (d'Auria *et al.* 2010, Loeckx*et al.* 2004), this study aims to demonstrate that stimulating the multi-layered use of these public spaces can serve as a potential tool in this process towards urban sustainability of Lahore's informal settlements.

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Contribution of Livelihood opportunities to the growth of Collective Spaces in Informal Settlements: Learning from Dar es Salaam-Tanzania

Lutta Jacob[1*], Prof. Yves Schoonjans[1] & Prof. Aldo Lupala[2]

Keywords. — Livelihood; Collective Spaces; Informal Settlements.

Summary. — From architectural, urban and morphological perspectives, collective spaces seem to be spaces that provide flexibility for private and public users. Collective spaces are significant in many cities including Dar es Salaam as they provide opportunities for people to be more active participants socially and economically in the life of their communities. The expansion of cities in Sub-Saharan Africa is associated with an increasing demand for space for various activities. This research aims at exploring the livelihoods opportunities as potential elements for the growth of collective spaces at Mlalakuwa informal settlements in the city of Dar es Salaam.

A case study methodology, semi-structured interviews with key informants, field observations, mapping, sketches, and photographic registration were used in collecting data. Households survey and literature review were also adopted in this study. This research, therefore, focused on the study of the livelihoods activities, leading to the development of collective spaces at Mlalakuwa informal settlement.

The study showed a diversity of livelihood activities operating at Mlalakuwa area including trading goods in the market, shopkeeping, farming, street vendors, livestock keeping, as well as small-scale industrial activities like furniture making, steel processing and tailoring. This suggests that livelihoods activities play an important role in both middle and low-income earners at Mlalakuwa informal settlement neighbourhood.

This study shows that community-members at Mlalakuwa neighbourhood earn their living by integrating various assets as livelihoods strategies based on their experience and on the availability of resources to sustain their daily lives. The results should encourage all development actors, including local authorities, to facilitate smooth interventions to improve the collective spaces and to maximize the livelihood activities.

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Adaptive Reuse Of Colonial Built Heritage: The Case of the former Collège du Saint-Esprit, Bujumbura, Burundi

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Keywords. — Architecture; Adaptive Reuse; Colonial Built-Heritage; Central-Africa.

Summary. — In the last two decades, the world has witnessed a growing interest in colonial built heritage in Africa through both architectural historiographies from postcolonial perspectives (Hosagrahar) and scholarly literature re-thinking and re-positioning this legacy as a form of 'shared heritage'. Many questions remain unresolved, however, of how these physical remnants can be architecturally conserved by taking into consideration the 'contested or dissonant histories' that are embedded in them. Indeed, 'whose histories' should be addressed, and, more importantly, 'whose heritage' are we talking about (Lagae 2008)?

In my contribution, I want to engage with these new scholarly insights, by focusing on a particular case-study: the former Collège du Saint-Esprit in Bujumbura, Burundi. This complex in modernist architectural style, built between 1952 and 1961 according to a design of the Belgian architect Roger Bastin, was conceived as the first interracial institution for secondary education in Central-Africa that was to train the future elite of Belgium's Africa (Lagae 2012). The Collège, which became part of the University of Burundi after independence, holds a prominent place in the postcolonial history of the region as many prominent figures in the post-independence society of Central Africa graduated from this institution. Today, the impressive complex is still in use, but it is suffering from a lack of maintenance.

In order to stimulate the reflection on the Collège's future, I argue that the notion of adaptive reuse, which is gaining prominence in current debates on built heritage (Scott; Plevoets & van Cleempoel), as well as a research by design project-approach (EAAE), form useful points of departure. Because of the impossibility of conducting fieldwork locally, I draw on both existing historical scholarship on the complex (Lagae 2012) and an architectural analysis of the original complex based on archival research, to propose a future scenario that aims at re-programming the complex into a vibrant site for the meeting and education of highly cultivated minds, thereby targeting different stakeholders: through the introduction of on-site agricultural activities, the dissemination and production of new scientific knowledge can be stimulated while also providing a service to surrounding communities. The introduction of a convention centre, including a hotel, is meant to ensure financial sustainability of the complex by reaching out to, among others, the community of prominent alumni of this (former) elite institution. As such, I aim to demonstrate that adaptive reuse is not only a way of embedding the former Collège du Saint-Esprit in today's society of Bujumbura and Burundi, but can also be a means of preserving in a meaningful way a particular example of Belgium's architectural legacy from the colonial era, taking into account its complex, and, at times, dissonant history.

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Pour une architecture du *Care*: Repenser l'infrastructure hospitalière en République Démocratique du Congo; le cas de l'hôpital général de référence de Makala

Lumfuankenda Bungiena Trésor[1*]

Mots-clés. — Architecture hospitalière; Architecture du *Care*; Kinshasa.

Résumé. — La République démocratique du Congo, tout comme l'ensemble de l'Afrique subsaharienne, bénéficie de fonds de développement alloués aux nations pauvres par des projets de coopérations bilatérales et multilatérales. Une importante partie de ces fonds est affectée à des projets d'infrastructure de base dont la santé reste un des volets privilégiés. L'essentiel de l'aide est investi, avec un certain degré d'urgence dans les soins (médicaments, équipements…), tandis qu'une faible partie est réservée aux infrastructures : construction de nouveaux hôpitaux mais souvent également réhabilitation de bâtiments existants, qui datent pour la plupart encore de l'époque coloniale. Malheureusement, ce dernier volet se limite, dans la plupart des cas, à un ravalement pour repeindre les bâtiments ou à l'aménagement de locaux pour recevoir de nouveaux équipements. Notre étude vise à proposer une nouvelle approche architecturale qui cherche à intégrer le concept du Care dans le projet de réhabilitation. Au lieu de penser l'architecture de l'hôpital comme une problématique technocratique et exclusivement à partir de l'organisation fonctionnelle des pratiques médicales classiques (le Cure), le concept de Care attire à nouveau l'attention sur la dimension du confort physique et psychologique des usagers (Atelier Utrecht 2016, Visscher 2020, Nurock 2010).

Mon propos tentera d'illustrer cette approche nouvelle à travers un cas d'étude : l'hôpital général de référence de Makala, l'ancien Sanatorium de Kinshasa, construit dans une architecture moderniste dans les années 1950. Partant d'une analyse du projet architectural original et d'une grille de lecture qui permet d'étudier la fonctionnalité, le vécu et le perçu de l'hôpital actuel, je proposerai quelques interventions spécifiques possibles, aussi bien au niveau architectural qu'urbanistique, destinées à améliorer l'usage et le bien-être des usagers, patients aussi bien que personnel soignant.

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Young Researchers' Overseas Day
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Etude technique des maisons métalliques faisant partie du patrimoine du Kongo – Central

Mpemba Nkole Kabongo Aris[1*], Jaspart Jean-Pierre[1] & Demonceau Jean-François[1]

Mots-clés. — Ingénierie; Maison en acier; Structure métallique; Patrimoine ; Kongo-Central.

Résumé. — La sauvegarde des bâtis historiques a pour objectif la préservation pérenne d'un patrimoine, symbole de l'identification culturelle d'un peuple ou d'une nation. La conservation de ce patrimoine est d'une importance majeure pour un pays, une région, une ville ou un quartier dans le sens qu'il permet à une société de s'identifier à son histoire au travers de témoignages historiques tangibles et de créer ainsi son identité sociale (Groupe remmers).

C'est dans ce cadre que le Fonds de la Recherche Scientifique (FNRS) finance le projet de recherche intitulé «Les expérimentations de l'architecture au Kongo Central sous l'influence des acteurs et facteurs du pouvoir colonial et du contexte local. Tropicalisation de l'ingénierie et de l'architecture». Ce projet porte sur l'étude architecturale et technique des bâtiments en acier importés à l'époque de la colonisation, faisant maintenant partie intégrante du patrimoine bâti de la République Démocratique du Congo (RDC), mais présentant un état d'endommagement sérieux lié principalement mais pas uniquement au climat tropical de la RDC. Ce projet est mené conjointement par l'Université Libre de Bruxelles (en charge de la partie architecturale) et l'Université de Liège (en charge de la partie ingénierie).

Nous présenterons les premiers travaux réalisés à l'Université de Liège ayant pour objectif l'identification des caractéristiques techniques des solutions importées à l'époque coloniale, l'identification des différentes pathologies affectant ces structures, la proposition de solutions de réhabilitation en tenant compte des pathologies identifiées et la proposition de solutions de réaffectation de ces bâtiments.

En particulier, le parquet de Mbanza-Ngungu (Ancien hôtel ABC de Thysville à l'époque coloniale) sera pris comme cas d'étude afin d'illustrer les techniques utilisées et les pathologies identifiées.

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Session V

Young Researchers' Overseas Day
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Deconstructing Borders. Transnational Mobility Strategies of South Sudanese Refugees in Northern Uganda

Vancluysen Sarah[1*]

Keywords. — Development Studies; Forced Migration; Ethnography; Uganda; South Sudan.

Summary. — Transnational mobility of refugees between the host and 'home' country is an aspect that has been largely overlooked in the literature so far. Taking the current presence of South Sudanese refugees in northern Uganda as a case-study, this paper explores how different forms of mobility enable them to better cope with the harsh conditions caused by their displacement. Based on extensive field research, including life history interviews, the results of this article show how for South Sudanese refugees, crossing borders can actually be empowering, although these complex strategies do not fit within the mutually exclusive 'durable solutions' proposed by the international refugee regime.

A second contribution of the paper lies in the application of a transnational approach to study refugee mobilities. Looking through a transnational lens, it is illustrated how different forms of movement enable the refugees to hold on to certain aspects of 'normal life', such as being employed, enacting customs and visiting loved ones, blurring the distinction between 'voluntary' and 'forced' migration. This results in a deepening of transnational networks as the generally large South Sudanese families find their members dispersed across Ugandan and South Sudanese town centres, villages, refugee settlements and third countries in Africa and elsewhere.

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"Ethnic Minority Philosophy" in Contemporary China: History and Prospects

Van den Stock Ady[1*]

KEYWORDS. — Modern Chinese Philosophy; Religion; Ethnicity; Contemporary China.

SUMMARY. — The academic discipline of "ethnic minority philosophy", which emerged at the beginning of the 1980s in the People's Republic of China, has thus far remained virtually unstudied in the existing Western-language scholarship. The aim of this talk is to place the genesis and development of this little-known discipline against the wider background of modern Chinese scholarly and political discourses on the interrelated issues of national, ethnic, cultural, philosophical, and religious identity. In doing so, I analyze what I call the "hierarchical inclusion" of minority traditions into the history of Chinese philosophy, the perceived proximity between ethnic minority philosophies and "primitive religion", as well as the role of the problematic concept of "culture" in the reinvention of minoritarian traditions of thought as philosophy.

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Global-scale dispersal and connectivity in mangroves

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Keywords. — Biogeography; Climate Change; Ocean-Circulation Model; Lagrangian Particle Tracking; Global.

Summary. — Mangrove forests provide a broad range of ecosystem services and are among the most productive ecosystems on Earth. Various studies have demonstrated that these intertidal forests are shifting geographically in response to climate change, with important implications for human welfare, ecosystem functioning and the marine and global carbon cycles. Understanding the future of mangrove range dynamics is challenging and requires estimates of the way their hydrochorous (*i.e.*, water-buoyant) propagules disperse via tidal, near-shore, and open-ocean surface currents. Here we use a high-resolution (1/24° × 1/24°), eddy- and tide-resolving numerical ocean model to simulate mangrove propagule dispersal across the global ocean and generate connectivity matrices between mangrove habitats using a range of floating periods. We identify important dispersal routes, barriers, and stepping-stones and quantify the influence of minimum and maximum floating periods on simulated connectivity patterns. Our study provides a baseline to improve our understanding of observed mangrove species distributions and, in combination with climate data, the expected range shifts under climate change.

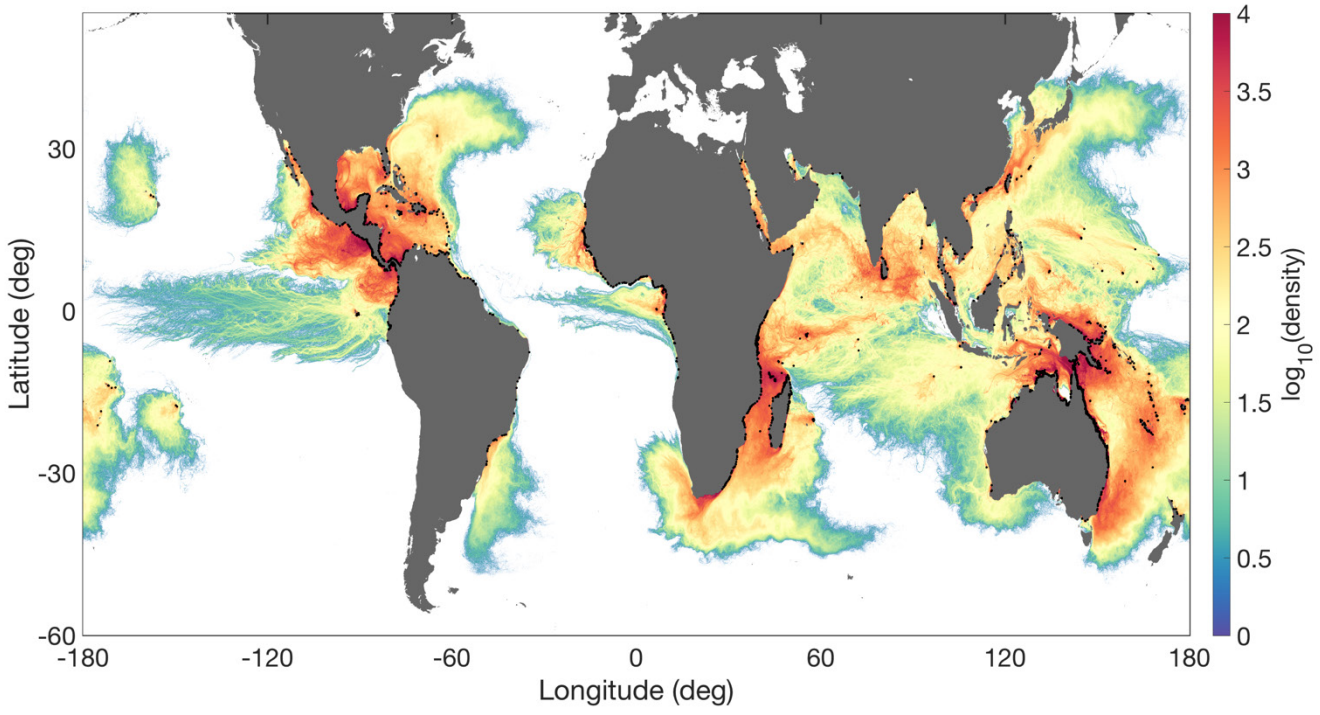

Fig. 1. — Density of simulated mangrove propagule dispersal trajectories across the global ocean. Dispersal trajectories were generated using velocity fields from the ECCO2 project (www.ecco2.org).

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