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# THE "WHERE?" IN PARTICIPATORY LOCAL LAND USE PLANNING - A WEB MAPPING APPROACH IN SOUTH-WEST CAMEROON

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**Abstract**

Transparent public access to accurate and comprehensive spatial datasets serve as an effective basis for transparent and accountable land governance and development planning by public, private and civil society stakeholders.

Since 2014, a multidisciplinary, multi-partner team in Cameroon has worked with a diverse set of government, civil society, and research institutions to develop a set of protocols to collect high quality data and prepare maps on social, environmental and economic themes that are needed to inform the land use planning process. As much as possible data holders are supported with tools and capacity building to collect, manage, analyze and share their own up-to-date data.

Thematic maps are shared via a Common Mapping Platform built using WRI's MapBuilder technology. A growing number of institutions are willing to share data. This collaborative mapping will help in democratizing new tools for landscape management. In the medium term, legal and institutional frameworks are required to formalize, structure and sustain this collaboration for clearly defined public purposes.

**KEYWORDS (5)**:

Land Use Planning, protocols, spatial data, sharing, Web-Mapping,

## 1. Introduction – Informed land use planning

In Cameroon, as in other developing and emerging economies, there are many challenges involved in balancing the sometimes conflicting or competing needs for space or investment.

Fomete et al (2018, submission to this conference) have presented the context and rationale for a Council-level land use planning method in Cameroon that harmonizes top-down and bottom-up approaches into responsive, transparent, inclusive, and interactive process to try to rationalize the future use of land, as well as secure tenure, as a foundation for sustainable rural development, REDD+ and turning the high-level commitments being made to 'zero-deforestation' commodity production and to reduce some of the growing conflicts over land in Cameroon.

Spatial data, often viewed in the form of maps, are an essential part of land use planning, in terms of presenting the situation in the past and currently and what is possible in the future. This document therefore provides guidance on the use of spatial data in land use planning.

A challenge in the operationalization of Cameroon's 2011 law on Land Use Planning is that the information to guide land use decisions is either missing, out of date, or too coarse (for example existing global data sets) to be useful at the micro level – where decisions about land allocation and management are taken and will finally have their impact. Further, where such data does exist, access to it is asymmetric – government officials, project staff, researchers and the private sector have better access to data than local communities or the civil society organizations that work with them.

Over the past 2 years Phase 1 of an EFI-funded project has set out to a) develop and test standard protocols for collecting spatial data that can inform land use planning; b) design, build and test a common mapping platform to improve the transparency of spatial data in Cameroon.

Phase 2 builds on this preliminary work to:

- Improve the tools and spatial information for supporting decision making during the preparation of land use plans (with initial focus on Council Land Use Planning process); and
- Development and testing of a method for preparing Council Land Use Plans).

## 2. Case Study of data collection and testing of the platform - The Experience of Nguti:

The project is inspired by the ambition and experiences of "OneMap" initiatives being promoted in Indonesia (WRI, 2018) and OneMap Myanmar (CDE, 2015) to compile national datasets considered essential for more rational and sustainable land management.

But with considerably smaller resources (€450,000 compared to over €10 million for the One Map projects), the Cameroon Project team has tried to do this at the level of one municipality as a way of testing what spatial data is required during local land use planning *before* scaling up, rather than trying to compile national data sets all at once.

The rationale is that the accuracy and usefulness of spatial data can only be appreciated at a local scale, with real stakeholders in real decision-making processes. Tests at this scale can help understand what sort of decisions might be made during local land use planning, and the information that stakeholders needed to guide such decision-making. This has helped prioritize what data is really needed, improve data collection protocols to improve thematic map accuracy. Tests in the pilot area can also inform the design of useful functions that support local land use planning before scaling up to regional or national levels.

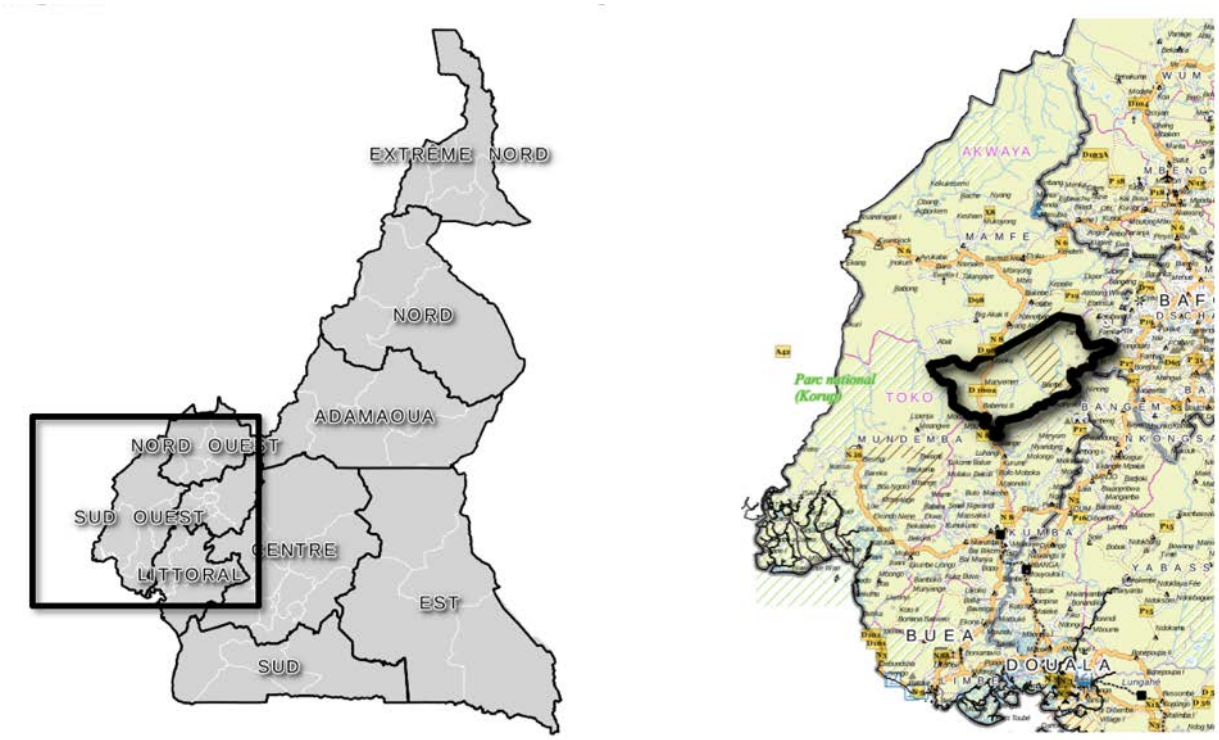
It is therefore a learning process, that can generate valuable lessons on protocols, tools and agreements for data collection, management and sharing.

The simultaneous development and testing of spatial data management tools to support a real land use planning exercise has significant advantages in terms of guiding a) choices of what data is really needed to inform land use planning and b) how spatial data can be used during land use planning. This has been a two-way learning process.

*Nguti – A real case study to test the Land Use Planning Guidelines*

Nguti Municipality in Cameroon's South West Region was selected in consultation with municipal, regional and national level stakeholders as the first testing ground for the Council LUP method, being a representative microcosm of land management challenges in the forested zone. Nguti council has been the subject of large scale land allocations for agroindustry like SGSOC (Nguiffo, 2013; Ndi, 2017). The development and testing of the land use planning guidelines is therefore guided by the experiences from Nguti. This paper uses some illustrations from the process in Nguti so far. Data collection and consultation have started, scenarios have been identified and analyzed in a participatory process at village levels, led by AJESH. However, the preparation of an actual Council Land Use Plan still lies ahead.

*Figure 1: Nguti Pilot Site for Local Council Land Use Planning*




*<u>A set of protocols for data collection to identify constraints and opportunities at the local level</u>*

A wide range of data is needed to inform the Land Use Planning process – first to determine the current land cover and land uses, then to estimate future land demands and decide where best to allocate land to different purposes to meet objectives.

At the start of the project, data for most of these factors did not exist, so we set out to develop a set of protocols for compiling new data layers where stakeholders indicated they were needed. Our approach has been to:

- assess and agree what information is needed at the local, regional and national levels with the relevant stakeholders;
- identify and engage the institutions and experts best placed to design and test the data collection protocols where possible, training local data collectors to collect data;
- test the usefulness of the resulting dataset to inform the Land Use Planning process by presenting to stakeholders for feedback, where necessary, refining the protocol.
- complete the data collection and analysis and share the resulting data or map layer.

This has paid dividends – errors identified at the fine local scale have guided correction of the protocols, before substantial investment in collecting and analyzing large datasets, or trying to use them. Protocols that have proven to work at the local level can then be used to generate useful data at the wider scale.

The resulting protocols and datasets developed, or under development are presented in the following sections:

*Historical and ongoing Land allocation*

Much land has already been committed to one or another use by different Ministries. Compilation of historical data, documentation and accurate maps are essential to know the starting point for future land use planning. Each of the following ministries unilaterally allocates land to specific uses and manage their own data. With no unified cadaster, we have relied on the Forest Atlas map database (MINFOF and WRI, 2017). The data for Agro-industrial plantations is also derived from MINFOF WRI sources.

- Ministry of Forestry and Wildlife (MINFOF)
- Ministry of Economy, Plan and Land Management (MINEPAT)
- Ministry of S, Cadaster and Land Affairs (MINDCAF)

The EFI project has experienced some challenges with accessing data on land allocations from the Ministry of State, Property, Surveys and Land Tenure (MINDCAF). Allocations appear less transparent and documentation is poor. At present there are no village level records of customary land allocations, but the team is exploring the potential and possible additional sources of funding to test the Social Tenure Domain Model (STDM)[1] in Nguti to document customary land allocations;

*Harmonized participatory mapping protocol:*

As explained by Fomete et al. (2018), land tenure in Cameroon is highly insecure, but is seen as a foundational prerequisite for sustainable rural development, for achieving the Sustainable Development Goals, implementing REDD+, and for operationalizing the high-level global commitments to the production of zero-deforestation agricultural commodity production.

But first and foremost, the purpose is to map the rights of local communities.

[1] Social Tenure Domain Model: https://stdm.gltn.net/

Participatory mapping is a powerful tool for visualizing, defending, securing and managing community lands and territories. It has been successfully deployed in many different ways, from countering destructive infrastructure projects to helping to establish community forests. The role it can play in land-use planning and tenure reform or a basis for FPIC and benefit distribution in relation to avoided deforestation projects is also increasingly understood by policy makers (RFUK, 2015).

A protocol was introduced and tested in the field in phase 1 by Rainforest Foundation UK (2015). With the support of a project funded by the Tenure Facility (2017), a harmonized participatory mapping methodology has been developed and adopted by stakeholders at the National level through a series of meetings of a Strategic Advisory Group. The method has been endorsed for use by all relevant Government Ministries but needs now to be integrated into the legal texts and operational norms of Land Use Planning, Environmental and Social Impact Assessment, etc.

- Two years of data collection (2015-2017) using a participatory mapping method (RFUK, 2015), implemented by local NGO Ajemalebu Self Help (AJESH), with RFUK support, has resulted in the mapping of 54 of the 55 villages in Nguti Subdivision.
- The participatory mapping exercise identified and mapped customary boundaries between villages, which could be used as a basis for registering village lands. The maps are a vital tool for negotiations between each other and with outsiders over access to resources.
- Participatory mapping also identified extensive farming areas and other resource use including hunting and gathering, fishing, camping. Trained village cartographers use GPS enabled tablets to collect data – primarily in the form of points – about the land uses and features they identify in the field at specific points. These are transferred to a map, which is verified and if need be completed or corrected in a community meeting. The resulting maps of farmland do not capture all farms but are indicative of their distribution. Remote sensing has been used to capture additional information about land cover using different methods. Comparisons of the remote sensing datasets and the data collected during participatory mapping is on-going to determine its accuracy.
- In future, there is an opportunity to focus participatory mapping efforts in areas that appear in remote sensing imagery to be farming areas and to use the field data collection as a source of data to run much improved supervised classifications of remote sensed images. This will save time during participatory mapping and greatly increase the spatial accuracy of the estimated extent of farmlands – which will have a positive impact on securing community rights to land.

*Figure 2: Village Boundary Maps transferred to the Common Mapping Platform*

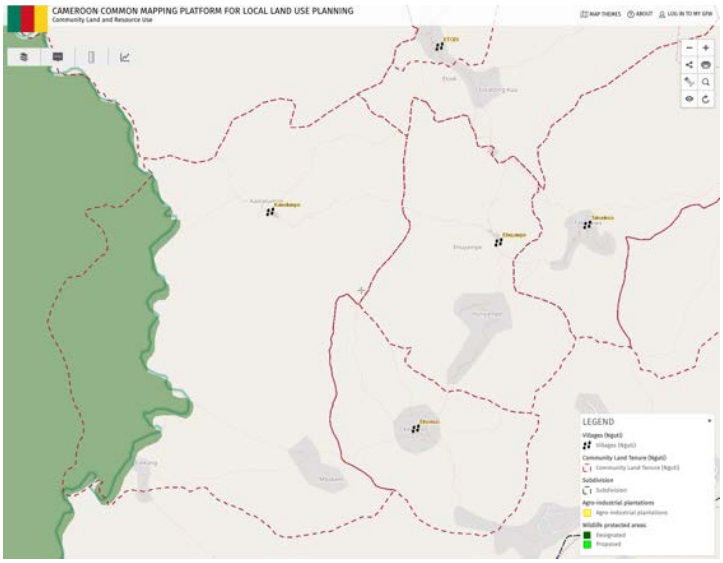
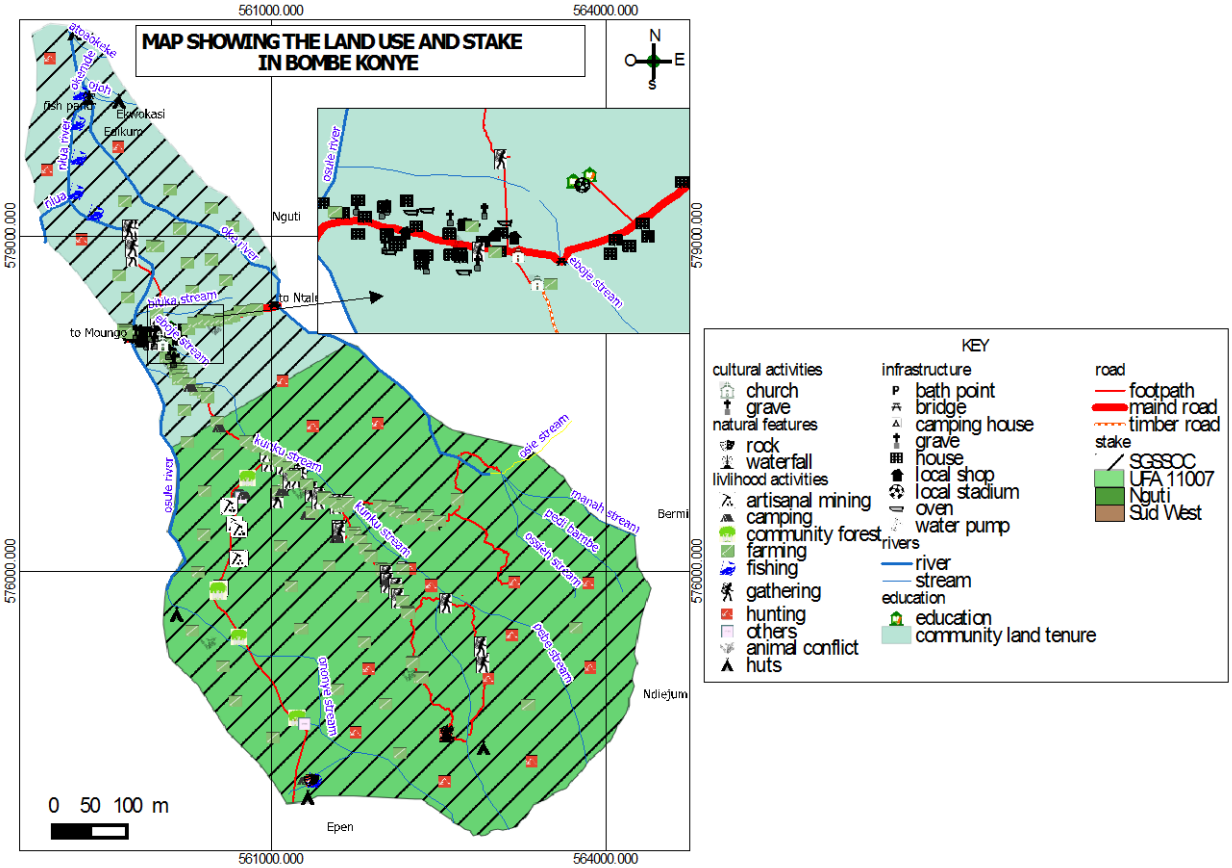



*Figure 3: Example of one of the 54 detailed participatory maps of a village*




Source: AJESH (2016)

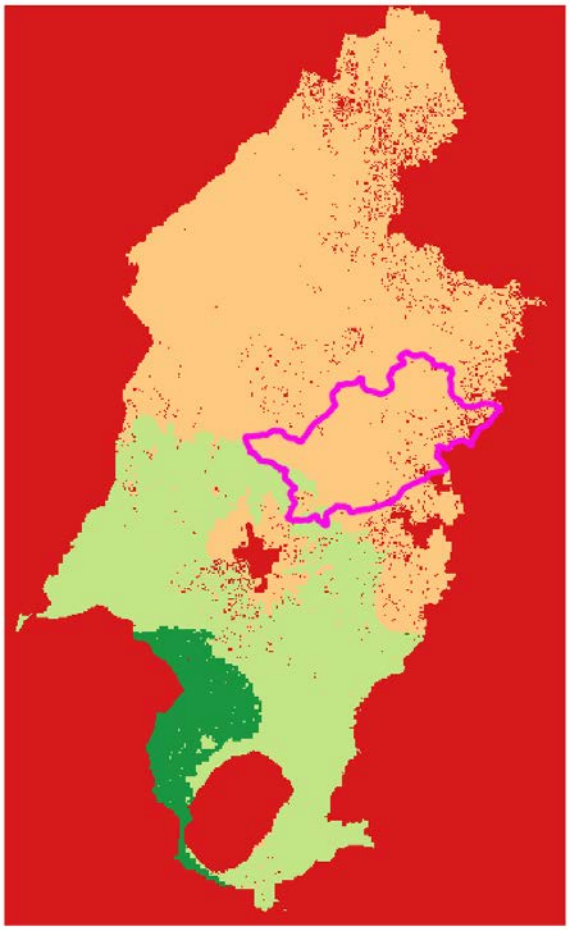
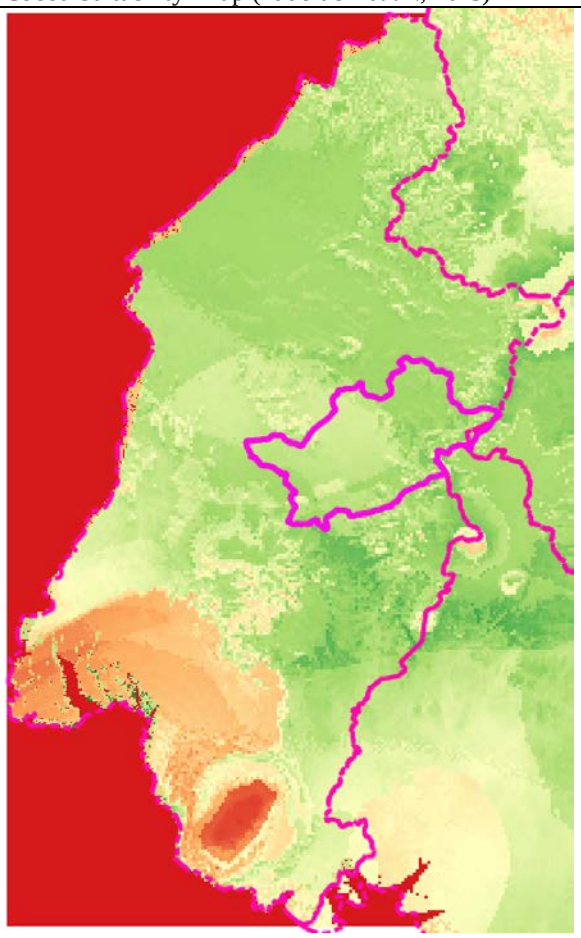
*Crop suitability Maps*

- Oil Palm, (Pirker, J., Mosnier, A., March, 2015). Global oil palm suitability assessment. Interim Report. This map has been substantially improved through collaboration with EFI Project team and a revised protocol for mapping suitability has been prepared (Pirker, 2016).
- Cocoa (Läderach *et al.*, 2013) have produced a map of cocoa suitability for West and Central Africa. The data was made accessible to the EFI project, and will be added to the mapping portal

In some parts of the south West region industrial Oil Palm is competing with cocoa production and displacing farmers from existing farms, and/or taking land that may be more suitable for cocoa.

The economic analysis using Land Use Planner (Douard et al. 2018) will help to compare these options from a social, economic and environmental perspective.

*Figure 4: Crop Suitability Maps.*

| Oil Palm Suitability Map (Pirker, 2016) | Cocoa Suitability Map (Läderach *et al.*, 2013) |
|---|---|
|  |  |

In phase 1 of the project, it was noted that the absence of soil maps resulted in crop suitability maps with relatively low spatial resolution that is not useful at the fine local scale. In Phase 2, the team is therefore working with partners (BGR) to improve the availability of soil and Geophysical maps – after which some of the crop suitability maps will be re-run, and perhaps new ones prepared.

*Soils, Water and geophysical features:*

The study area is particularly poorly covered by soil and geophysical information to guide crop suitability mapping and areas that need protection (watersheds, erodible soils, geohazards, etc).

The team has engaged with the German Federal Institute for Geo-Sciences (BGR[2]) that have funding from BMZ for a parallel project to prepare geophysical datasets that can inform the development of Land Use Schemas at the Regional level. BGR has started by compiling and digitizing all historical soil maps for Cameroon (see Zocpé et al (2018) and Figure 6). BGR has drafted a simple soil survey protocol (BGR, 2018) based on the Muenchenberg Soil Quality Rating (SQR) method (Mueller et al, 2007), which will be tested in the field during the next stage of the participatory land use planning process.

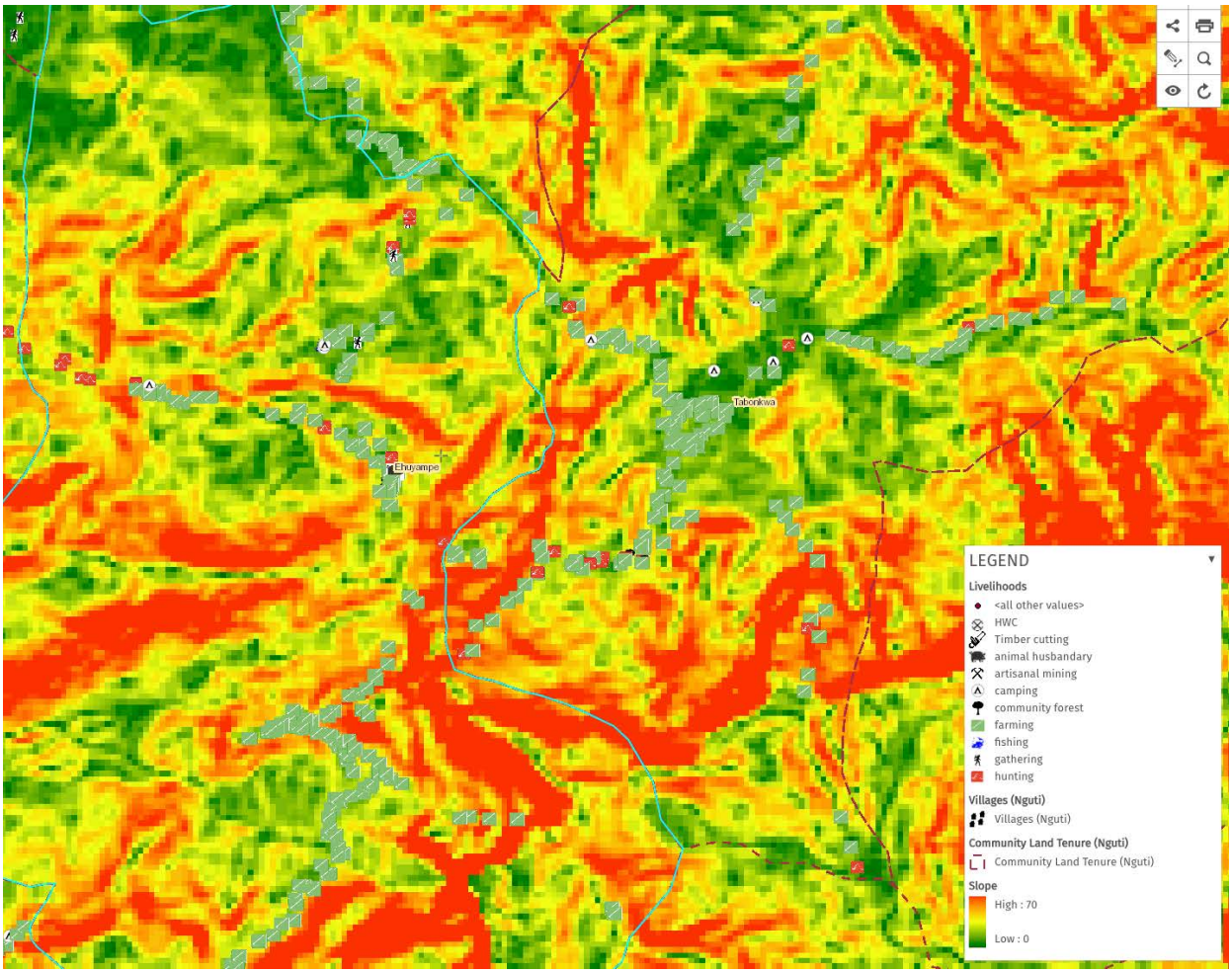
BGR is looking to develop a list of easily identifiable 'markers' (i.e. plant types, soil colors) that can be used to identify soil type based on their comprehensive soil analysis. Once developed the markers would provide an easily replicable approach for other regions in Cameroon.

Slope and terrain ruggedness are factors that can severely constrain agro-industrial plantation development but can also render areas unsuitable for small scale agriculture – in particular in areas with erodible soils where cultivation of steep slopes can result in heavy erosion. Figure 5 shows that farmers are avoiding steep slopes in the communities to the eastern side of Nguti, which is characterized by steep slopes. The actual area of land that is cultivable for each village may therefore be much less than the area that lies within their village boundary.

The protocol will aim to determine which crops farmers prefer to grow where, and the criteria (terrain, soil type, distance from village) they use to select sites. This should greatly improve crop suitability maps.

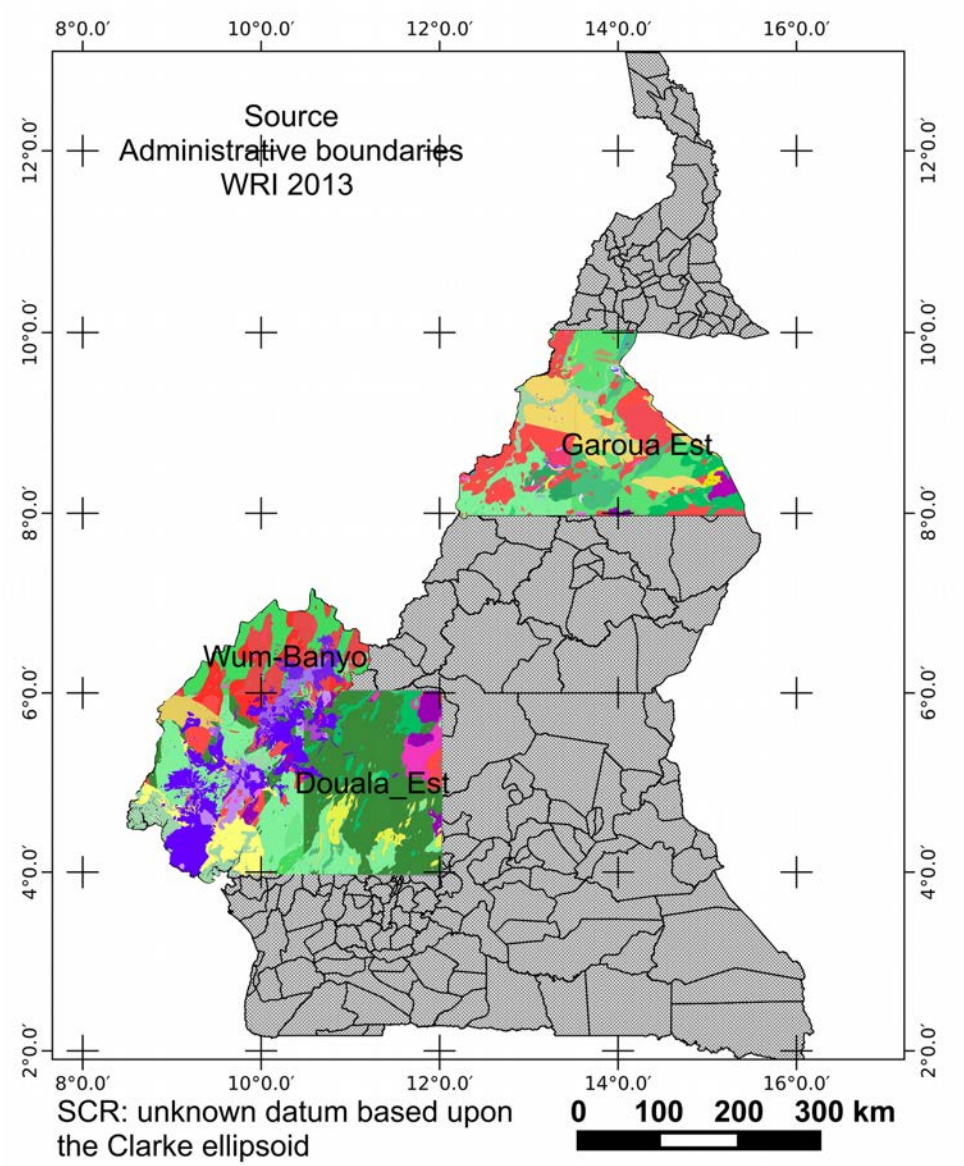
[2] *Bundesanstalt für Geowissenschaften und Rohstoffe* (BGR), the German Federal Institute for Geosciences and Natural Resources.

*Figure 5: Slope map showing that farmers prefer to remain in the valleys.*




**Source:** Slope Map Derived from the SRTM Digital Elevation Model 30m resolution. Green square icons are farmer's plots, that clearly follow the valleys.

*Figure 6: Area of interest for digitizing historical soil Maps*



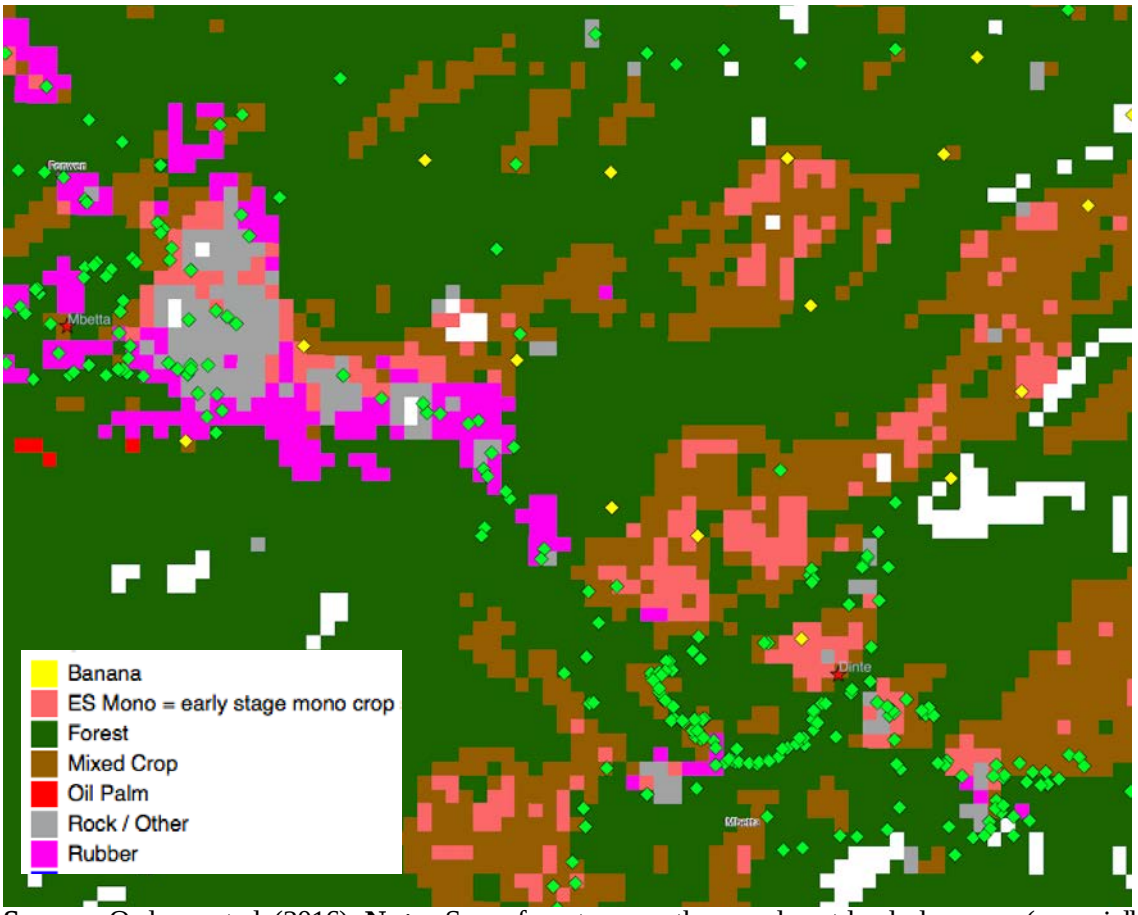

**Source:** Zocpé et al (2018).

***Land cover mapping***

Various sources of remote sensed data have been tested.

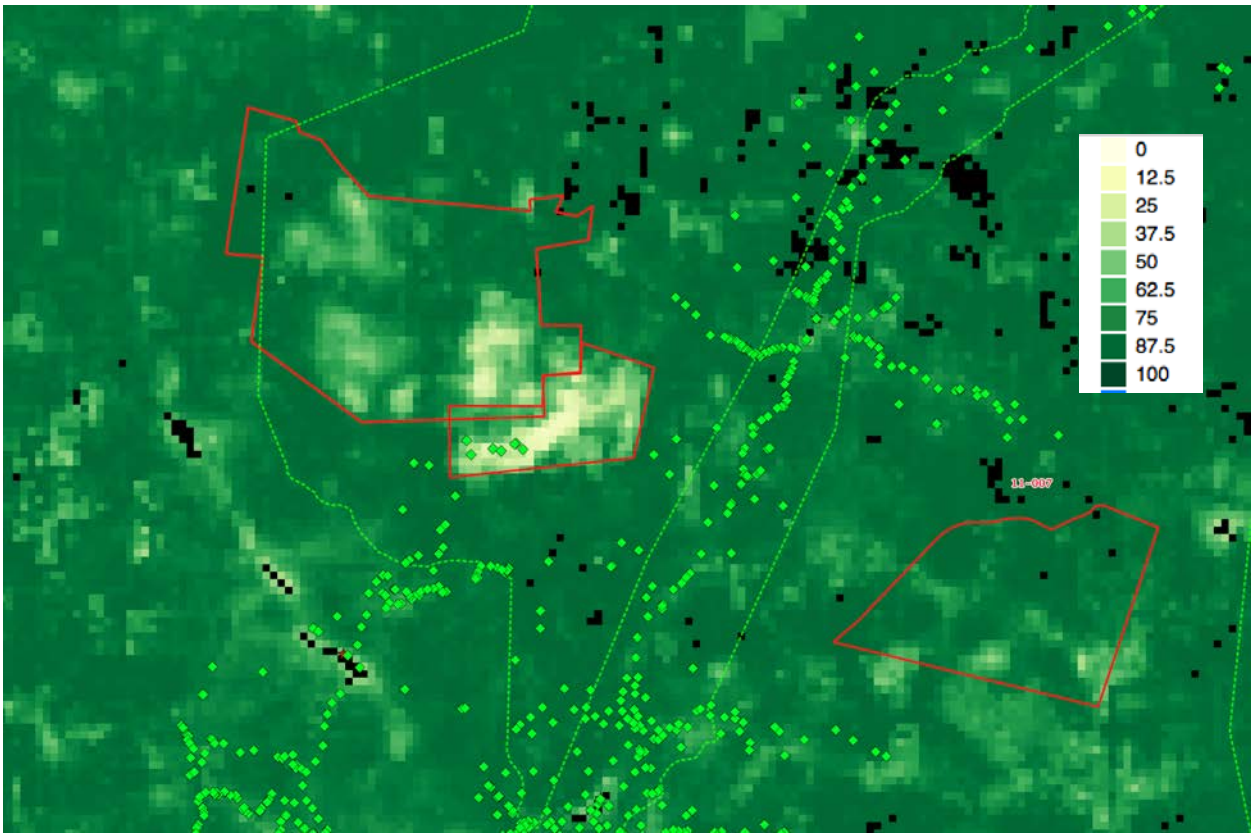
- Ordway *et al. (2017)* produced a high-quality land cover map and are open to working with the project to refine the map based on project-led ground-truthing (see Figure 7).
- The Sentinel Hub Agriculture layer (Sentinel, 2018) looks promising even in its raw form but has not yet been processed (see Figure 8);
- The European Space Agency (ESA) Climate Change Initiative (CCI) data layer showed poor correlation with the community Farmland data from Participatory mapping. However, the Copernicus Land Cover LC100 forest layer shows strong visible correlation with farming areas identified during participatory mapping agriculture, also in areas where other supervised classifications have not always detected signs of farming (see Figure 8).
- The free 25-meter resolution Annual Mosaic produced by the Japan Aerospace Exploration Agency (JAXA) with the radar Advanced Land Observing Satellites (ALOS-1 and ALOS-2) do not work well in densely forested areas because the radar sensor saturates in high density forests, so even agroforestry cannot be mapped. Some open areas / canopy gaps in correspondence of farms are detected, but other farms are not (likely because they're hidden by the canopy). Many more open areas / canopy gaps from the radar analysis are identified – which may be other farms that have not been mapped on the ground?
- ALOS Mosaic: http://www.eorc.jaxa.jp/ALOS/en/palsar_fnf/fnf_index.htm#description
- GAF-AG (The leading European providers for earth observation and geo-information solutions, which has been undertaking pilot project in Cameroon since 2007, with the support of the German Development Bank (KfW) and the European Space Agency (ESA) has expressed openness to re-running its algorithm for cocoa agroforests with Radar data.

*Figure 7: Land cover map (Ordway et al. 2017) overlaid with Participatory Mapping data of farmland Ordway*




**Source:** Ordway et al. (2016). **Note:** Some forest regrowth around past land clearance (especially along roadsides) is currently misclassified as Rubber. The participatory mapping only captured a small fraction of the farmland (light green diamonds)

*Figure 8: ESA Copernicus Forest Cover overlaid with farms from participatory mapping*

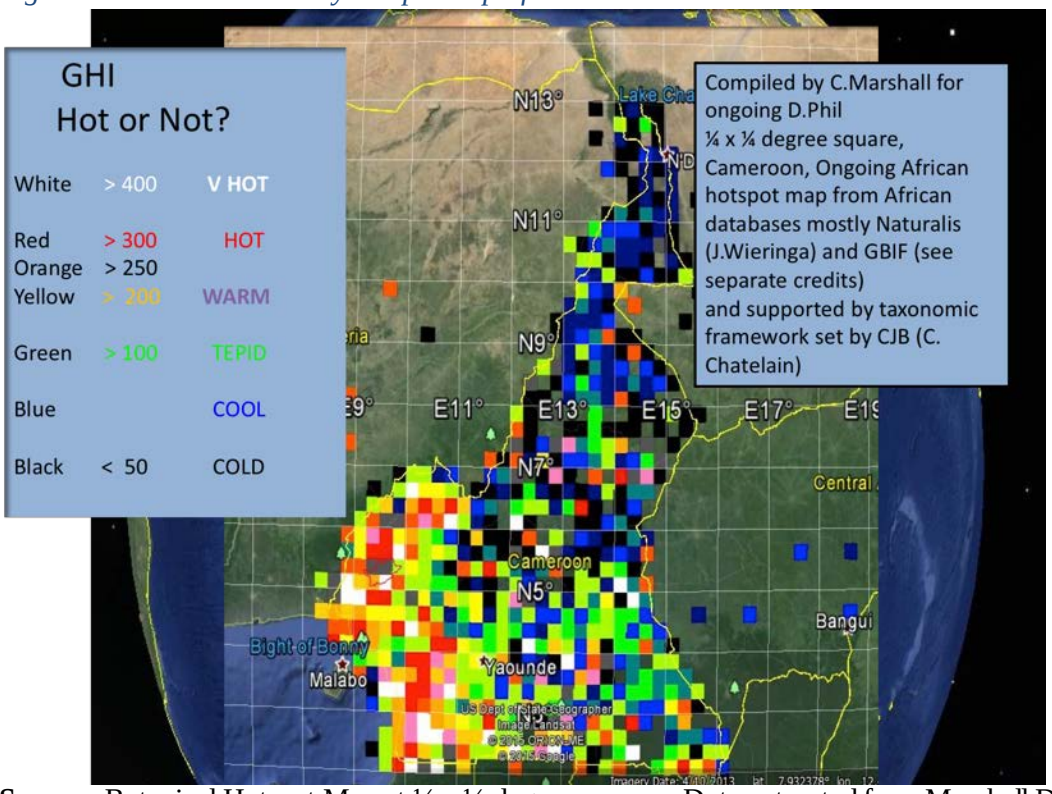



**Source:** ESA Copernicus Forest cover %, overlaid with position of farmland (green diamonds) collected from GPS points from participatory mapping on the ground collected by AJESH and RFUK. Red polygons are the Herakles / SGSoc Concession, the western one showing their recent land clearing.

*Biodiversity Mapping:*

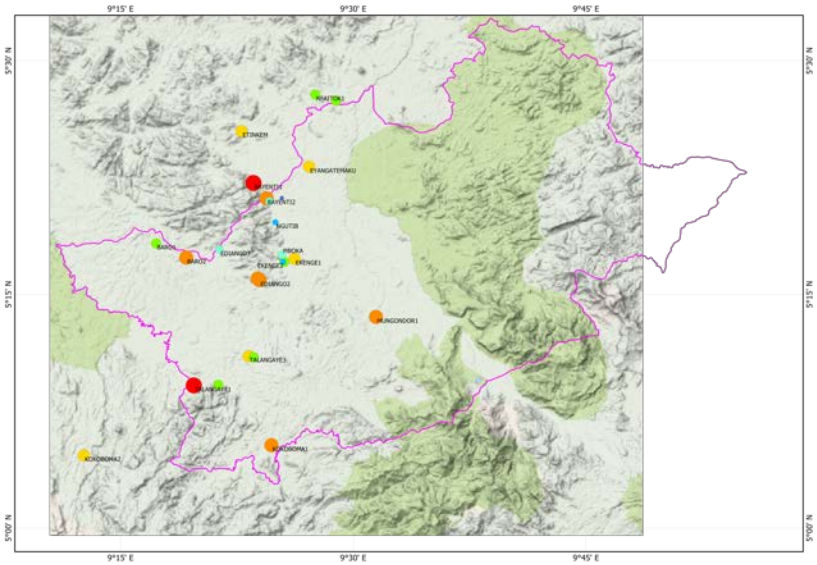
Botanical diversity and hotspots using Rapid Botanical Surveys (RBS), (Hawthorne and Marshall, 2016). The RBS method was tested in Nguti and a first set of results uploaded to the mapping portal. Marshall (2017) has compiled a botanical hotspot map for all of Africa which gives a very valuable first indication of the risk for future investors of finding High Conservation Values (HCVs) that would restrict operations that want to meet global voluntary standards such as the RoundTable on Sustainable Palm Oil (RSPO).

*Figure 9: Botanical diversity hotspot map of Cameroon*




**Source:** Botanical Hotspot Map at ¼ x ¼ degree squares. Data extracted from Marshall D.Phil. see publication (Marshall et al. 2016). Map for the whole of Africa is available on the Oxford Plant Observatory (TOPO) Web Map Portal at lower resolution (1 degree grid square
- http://herbaria.plants.ox.ac.uk/bol/topo/explore

*Figure 10: rapid Botanical survey points for Nguti*




Note: – High scores (red) to low scores, green.

*Wildlife corridors*

A preliminary protocol has been drafted based on the methodology prepared by MINFOF Programme for the Sustainable Management of Natural Resources (PSMNR)

*Population estimates:*

Exact population and house counts are available from house to house surveys conducted by AJESH during the participatory mapping exercise. However, such methods are time consuming and expensive and therefore not replicable at scale. The team is consulting with International Institute for Applied Systems Analysis (IIASA) to develop a simplified methodology based on counts of buildings form OpenStreetMap data (100% of buildings in Nguti have been digitized on OpenStreetMap (OSM) during phase 1), household surveys in a sample of households to estimate average occupants per house and estimates of population trends. Such a method will be more replicable than having 100% household census data (which is expensive to collect).

Innovative techniques such as machine learning to automate the identification of buildings (Lokshin, 2018) look to hold great promise to accelerate the process of mapping buildings across whole countries. However, in the meantime, Cameroon is one of the countries in the world best covered by OpenStreetMap data (though less so for rural areas) and therefore we will start by using this data.

*Transport cost mapping*

Transport costs in Cameroon are among the highest worldwide (Teravaninthorn and Raballand 2008). The "first mile problem" refers to the fact that the initial movements of products represent an over-proportionally high share of total transport costs (Njenga et al., 2014; Pedersen 2001). For Land Use Planning, this raises the question: "Where in my council should I give preference to which crops?". The objectives of this map payer are therefore to:

- Plan allocation of crops to fit community needs
- Find out how far away from the market cropping can be viable

The steps of the transport cost mapping process:

- **build a map of the transport network** (on and off-road) – a combination of data from the Ministry of Public Works, with additional farm to market roads mapped using OpenStreetMap tools and finally, adding tracks and paths that are not visible on satellite imagery from tracks recorded during the participatory mapping fieldwork.
- This data was all uploaded to and combined on OpenStreetMap (the most comprehensive dataset available so far), and then downloaded for the whole of the South West Region, and used to prepare a friction surface.
- Add a Per-km Transport Costs (t-costs) for different roads and transport modes
- Make t-costs specific for main crops (wet, dry staple, export, oil, salad)
- Insert data in GIS model which finds the cheapest path through a cost landscape.

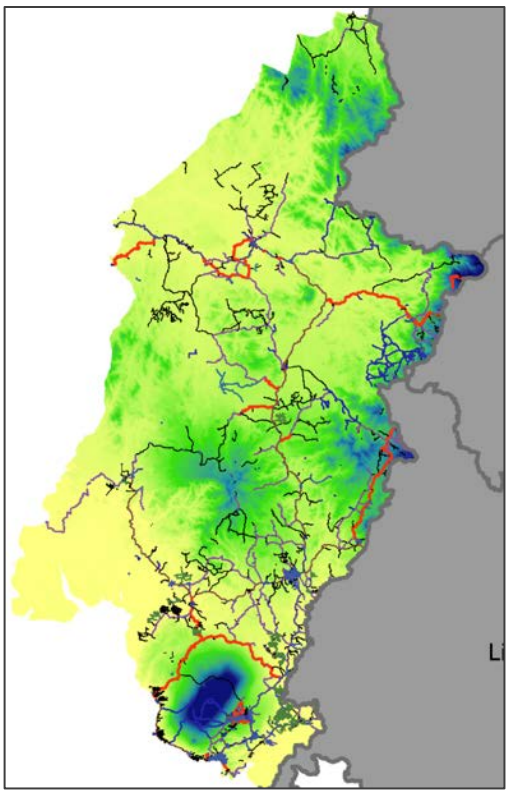
The resulting map can then show what proportion of the value of the different crops is consumed by transport costs to get them to market, giving a good indication of where it is, or is not viable to cultivate crops.

*Table 1: Cost of transport assumptions for different road and transport modes*

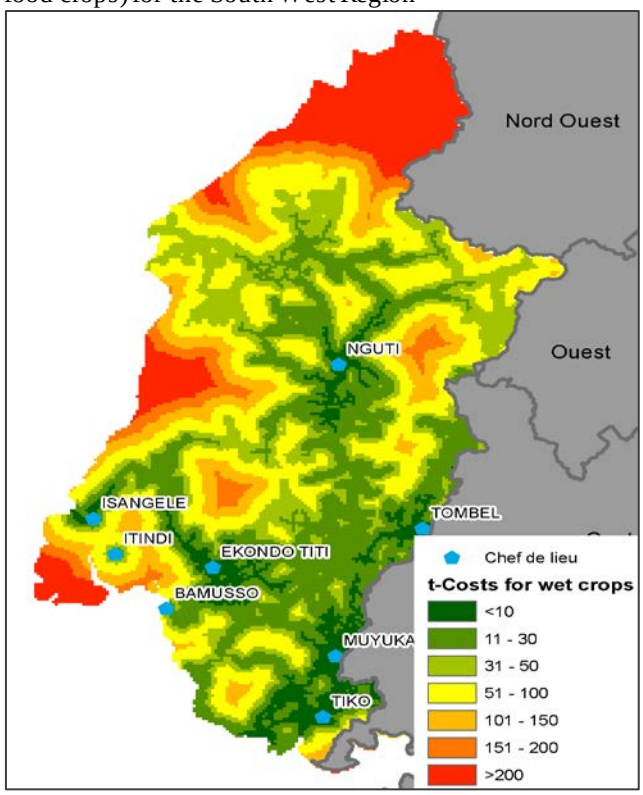
| **Transport modes** | **Hypotheses made** | **Resulting t-costs (USD per ton*kilometer)** | **Source** |
|---|---|---|---|
| Head loading | -Average remuneration in rural areas<br>Transport of 20kg<br>-Off-road | 7.5 | Pedersen (2001) |
| Unimog | -Max load of 3,3 tonnes<br>-On secondary roads | 0.4 | Interview with TELCAR |
| Truck | -Max load of 20 tonnes<br>-Drives on main roads only | 0.2 | SCET Tunisie (2013) |

*Figure 11:; Mapping the cost of transport for the South West Region*

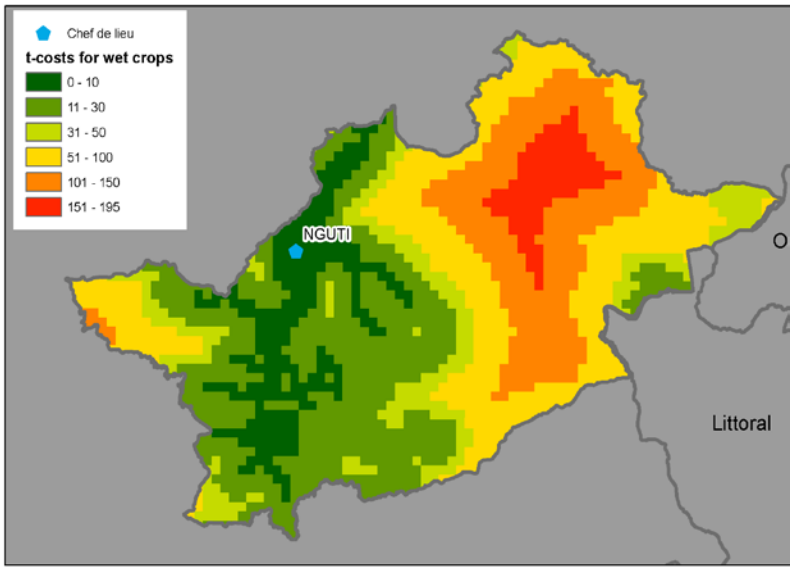
a) Map of transport network with digital elevation model used to create the friction surface

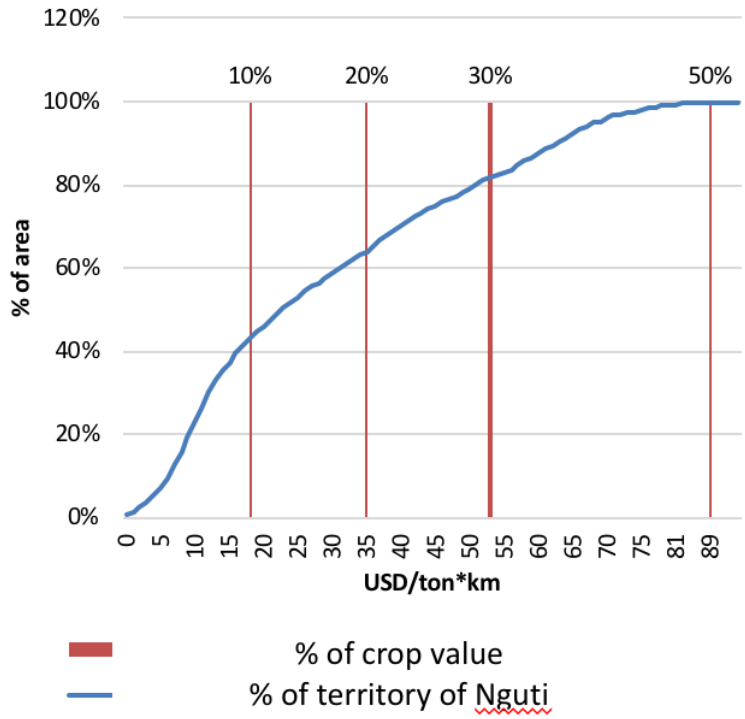


Map (b) cost of transport for wet crops (unprocessed staple food crops) for the South West Region




The map shows that for bulky, wet and heavy staple crops, a large proportion of the value of the crop would be consumed by transport costs if they were transported to market. This makes it clear that without constructing new rural roads, the area of Nguti that is economically viable for food crop production is perhaps only 50% of the total area, before taking into account other constraints such as legal status of the land (protected forests, etc)




*Estimates of current and future farmland used / needed per household and crop:*

The team engaged IIASA experts to adapt the GLOBIOM models to estimate future demand for land to the sub-national and local scales (Pirker et al, 2018). However, better estimates of current farm sizes and yields in complex multi-cropping farming systems are needed. The team has reached out to IITA, CIRAD

and the Cameroon national agricultural research institute (IRAD) to compile better baseline data on farming systems from existing research or new field research where existing data is not available.

Estimates have been made using a simplified Excel version of IIASA's Global Biosphere Management Model (GLOBIOM) http://www.globiom.org/). These will need to be updated with data from farming system analysis collected in the field;

Field data collection and integration tools

To achieve efficiencies in the field, multi-disciplinary data collection teams are being formed and furnished with the necessary training and tools to allow efficient and accurate data collection.

The team has researched a number of existing platforms that may help with consistent, georeferenced and efficient field data collection, such as FAO Open Foris, SEPA, OpenDataKit (ODK), KoboTools among others. These tools facilitate synchronized Remote Sensing, field inventory, data analysis and reporting.

It is hoped that the use of mobile devices with open access data collection and management tools will generate useful lessons about the efficacy of using of technology in remote village settings by trained field data collectors.

*Agronomic and socio-economic data:*

The International Institute of Tropical Agriculture (IITA), Institute of Agricultural Research for Development (IRAD), CIRAD (the French Agricultural Research Centre for International Development) and the Centre for International Forestry Research (CIFOR) have a lot of data on farm sizes and cost-benefit of different farming systems already available but these may need updating to be specific to South West and Nguti. The EFI consortium will identify gaps for additional data collection in the field by AJESH (subject to RFUK securing additional funding). Resulting data will be used to improve the economic analysis using tools such as the Land Use Planner being developed by EFI (Douard et al., 2018)

*Sharing map data via the Cameroon Common Mapping Platform for Local Land Use Planning*

Geospatial Information needed for Land-Use Planning is generated and held by dozens of different entities (communities, ministries, satellites, research institutes, etc.). This is the rationale behind EFI's initial interest to commission the development of a Common Mapping Platform, where data from multiple sources could be shared with the public and guide decision-making in a visually explicit manner.

The integration of these many map layers and spatial datasets into a comprehensive web-platform allows many users to access explore the data.

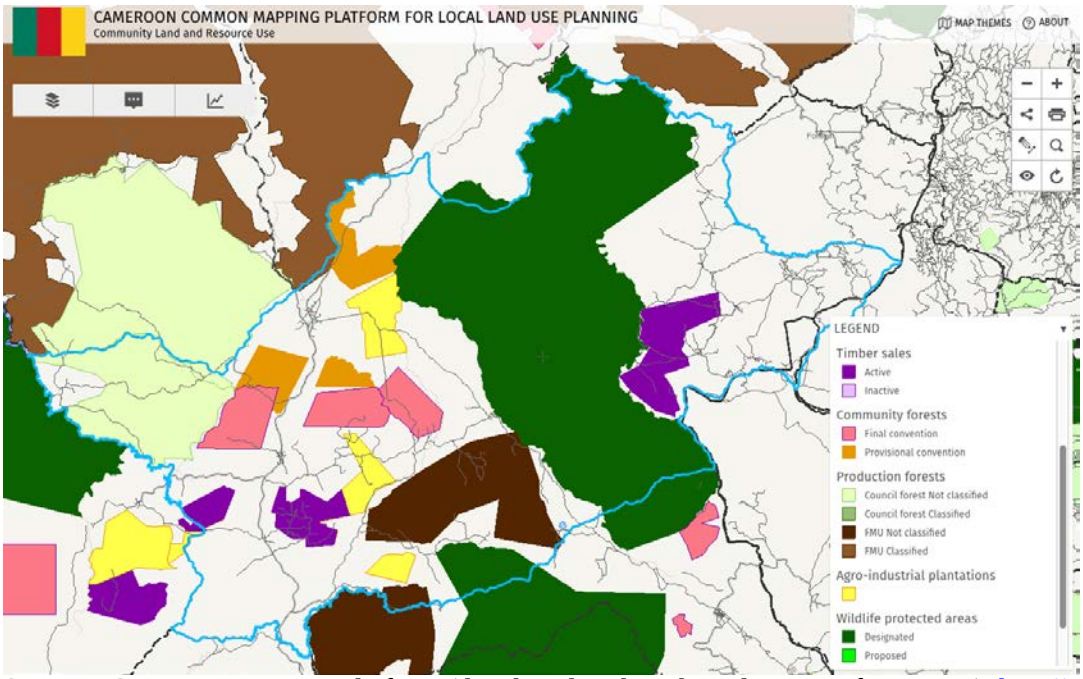
Under Phase 1 of the project (2014-2016), LTS and WRI prepared a beta-version of the Common Mapping Platform that adapted WRI's old Forest Atlas Platform with new layers and functionalities. Data from Phase 1, and new data layers from Phase 2 has now been integrated into v.2.0 of the Platform using WRI's new customizable MapBuilder[3] technology (Maschler and Strong, 2016), that runs on ArcGIS online. MapBuilder allows users to customize their maps to meet their own needs. MapBuilder makes use of many layers already compiled under the Forest Atlas project and Global Forest Watch (GFW), whose data layers are freely available via the WRI Open Data Portal).

We are adding the many thematic map layers being prepared by the project for land use planning. Any number of map layers can be arranged in a series of themes that are useful for specific audiences and purposes.

Most layers will be permanently integrated into the Platform to allow common analyses to be run by all users. Additional data layers that may be of interest only to specialist users, or for specific one-off purposes, can be uploaded to the Platform or online map library, for use as required. Once validated by MINEPAT, the Platform will be hosted under a MINEPAT domain name.

[3] MapBuilder: (http://wri.github.io/gfw-mapbuilder/ and http://www.globalforestwatch.org/howto/tutorial-videos/tutorial-map-builder-build-a-custom-web-app-in-arcgis-organisations.html

**Figure 1. Map of current land allocations in Nguti**




**Source:** Common Mapping Platform (developed with technical support from WRI): http://my.gfw-mapbuilder.org/v1.latest/?appid=96d68291863e4766a16ac66fa931a5f2&l=en

*Adding new online functionalities*

MapBuilder already integrates a number of standard functions to analyze e.g. land cover by class, and rates of forest loss per given area and period.

In the current phase of work the team is identifying useful functionalities that can analyze multiple layers to inform land use planning processes. For example – how much land in an area of interest is a) already allocated to different legal land categories; b) used by local communities for livelihood and cultural purposes; c) of high conservation value (biodiversity, ecosystem services) d) suitable terrain, soil and climate for one or more land use or crop type; e) economically accessible for commercial enterprise given current or future road infrastructure. The platform may also serve to share the outcome of the land use plan with relevant stakeholders.

These functions are first being built on desktop GIS applications to determine their usefulness and refine the analysis procedures. Where appropriate, some functions will be programmed into the web mapping platform to allow widespread, non-expert users to run standard analyses. Web-based and offline mapping platforms are seen as complementary tools to share and analyze spatial data during land use planning.

Where data is not already public, there is still a need to develop and negotiate data sharing protocols to define the ownership rights of data and define the necessary safeguards to ensure that they will be used appropriately – especially data from participatory mapping exercises, which include information on land and resource use patterns, and customary village boundaries that are not yet recognized by the State.

*Using visual tools during the participatory land use planning process*

During the participatory land use planning process, a combination of spatial data (maps printed from the Online Portal, and on desktop GIS) that integrate participatory maps and other data layers will be used to present the options in visual spatial format. Infographics from the Land Use Planner (on and offline versions available) will be used to illustrate the costs and benefits of different options for different stakeholder groups.

These visual tools are considered to serve as essential means of communicating complex information to guide the collective decision making of stakeholders at the Council level and the village or clan level.

## 3. Remaining challenges

The testing of protocols and data collection is on-going, with some delays in part due to political unrest insecurity in the pilot area.

- **Coordination of multiple partners** - Due to the scale of the data compilation and consultation required, the project is reliant on additional partners and financial resources. However, differences in timing of the partners and projects has made the timely integration of the top-down and bottom-up processes challenging.
- Challenges lie in achieving cross-sectoral consensus on data needed from the field, standard tools and coordinated multi-disciplinary field data collection campaigns in preparation for land use planning processes.

## 4. Conclusion

This project has focused at collecting data at the level of one municipality in preparation for Land Use Planning. However, the data collection protocols, some of the data layers, the common mapping platform, the population and consumption-based model, and the land use planner tools are all being designed with a view to serve data collection, analysis and results sharing at higher levels also levels.

Preliminary results will illustrate the efficacy and outputs from the methodology and tools.

The emerging council LUP methodology (see Fomete et al, 2018) demands a complex mix of participatory processes, technocratic tools, communication and negotiations towards agreements on the future direction of rural development, informed by the global and national priorities, values (natural and / or socio-cultural), trends (population, markets, climate change), agendas and funding opportunities (for example for rural development and REDD+).

Building a coalition of organizations around a vision of democratized mapping

The project implementers quickly realized that to succeed in the compilation of data from a wide variety of sources, it was necessary to build alliances with many partners – including other Ministries, international and national NGOs, research institutions and projects working on the ground. The project has evolved into a voluntary collaboration of many organizations, and a momentum has built to continue the work. The team has used the experience from this pilot phase to conceive a collaborative programme of work that continues to compile data and tools to support land use planning at this local level.

Pros and cons of technocratic and participatory approaches to land use planning

The council level land use planning method being developed by the project team entails a combination of participatory processes and technocratic analyses. The paper explores the appropriate balance of these two processes in terms of stakeholder engagement, accuracy of data collected and cost efficiency. The absence of good spatial data, or of adequate free prior informed consent about future land allocation can both result in serious mistakes in land governance and decision making.

Creating the institutional and legal framework for spatial data management

As in Myanmar and Indonesia, the process of data sharing in Cameroon has raised questions about intellectual property rights and potential confidentiality, sensitivity, or the commercial value of data. While most institutions involved have proactively shared data, there is not yet a legal or institutional framework to guide large scale spatial data sharing in Cameroon. The lack of a consolidated and modern digital cadaster, and the informal, sometimes non-legal nature of many land and claims and transactions mean that much land ownership remains invisible in the public data sets. Sharing community maps of customary land tenure and resource use via the same public platforms alongside government data is helping to open dialogue about the duality of the tenure system and long-term options for recognizing customary tenure, or at least take it into account during decision making.

In future, there is need for a legal and institutional framework and comprehensive programme of capacity building for all data holders to collect, analyze and share data on a regular basis, and for planners to be able to use the spatial data and tools that have been put at their disposal to inform and improve land governance.

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