WWF

REPORT

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COMMUNITY-BASED MONITORING, REPORTING AND VERIFICATION KNOW-HOW:

Sharing knowledge from practice

FOREST AND CLIMATE PROGRAMME

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INTRODUCTION

Reducing Emissions from Deforestation and forest Degradation (REDD+) has emerged as one of the biggest global opportunities for the conservation of tropical forests. More than US$8 billion has been committed for REDD+, the largest single commitment to forests in history. With 20% of global carbon emissions caused by deforestation and forest degradation, REDD+ has the capacity to fight climate change by producing real and verifiable emissions reductions, while benefiting biodiversity and people's well-being.

WWF supports the development of REDD+ by taking a two-pronged approach. WWF's global Forest and Climate Programme (FCP) is working at the field level to build REDD+ at scale, and at the global level to ensure the policies and financial support are in place for REDD+ to succeed. Our work is currently focused on threatened and valuable forest landscapes around the world in Colombia, Democratic Republic of Congo, Guyana, Indonesia and Peru.

One of the vital components of successful REDD+ focuses on monitoring, reporting and verification (MRV), which is the work related to both the remote sensing and ground based data that is needed to monitor forest carbon emissions.

As REDD+ continues to develop, so does the capacity of REDD+ practitioners when it comes to forest monitoring. Every day, these experts are exploring new ways to define REDD+ readiness and implementation through their project and program work. They are, in effect, "learning while doing." For this reason, it is crucial that lessons learned about what works and what does not work are captured, shared and used to inform others' REDD+ efforts, whether at the local project level or global policy level. Learning also helps to minimize redundancies while maximizing the effectiveness of REDD+ practitioners. WWF-FCP recognizes the importance of learning and knowledge sharing, and believes these are vital for global REDD+ success.

It can be daunting to identify, collect and share information on REDD+ monitoring, reporting and verification processes and the challenges and rewards of working in and with local communities. These responsibilities often fall to project managers, who are overloaded and do not have the time to reflect on their work. The result is that this information is sometimes only shared during small workshops and does not reach potential beneficiaries facing the same challenges around the world.

In order for these project managers and others to effectively reflect on their work, we present this report on community-based monitoring reporting and verification as a resource that can help provide innovative and strategic approaches through a review of tools and technologies, overall lessons learned, and suggested next steps.

EXECUTIVE SUMMARY

Community-based monitoring, reporting and verification (CMRV), is the involvement of local people in the monitoring, reporting and verification of carbon stocks and other forest data. CMRV can potentially provide cost-effective and locally collected biomass data, promote equality in benefit sharing, and maximize the social and environmental co-benefits of work around reducing emissions from deforestation and degradation, known as REDD+. The involvement of local people, who may have diverse skills, expertise, societal roles and interests, can bring important information on forest management to the REDD+ discussion, and can also help address key issues such as biodiversity conservation and social safeguards.

Because of the importance of CMRV and its potential for improving REDD+ work related to biodiversity and social safeguards, it is paramount to learn about CMRV experiences globally. This was the aim of the 'south/south' (the exchange of resources, technology, and knowledge between developing countries) training workshop in community-based MRV systems that took place from the 22nd to the 29th of August 2014 in Guyana. Participants came from 15 different countries and represented governments, communities and technical experts. The workshop was organized through a collaboration of World Wildlife Fund Guianas (WWF-Guianas), the WWF Forest and Climate Programme, the Global Canopy Programme, and the U.S. Geological Survey SilvaCarbon Program.

Different technologies and approaches for CMRV were tested during the workshop in real world situations. Technologies consisted of mobile phone applications for literate and illiterate users that were developed on open source platforms and approaches included participatory mapping and sound recording. These technologies and approaches were analyzed in detail to understand their strengths and weaknesses.

Participants also discussed challenges and the enabling conditions needed to implement CMRV and to use the information collected by communities for national-level MRV reporting. The primary challenges identified were related to communication flow, the importance of simplifying messages and the need to promote transparency between communities and governments. Participants described the challenges around differing government and community priorities about what information needs to be recorded and integrating MRV at the community level with the national efforts.

Discussions also focused on the importance of establishing linkages between the local and the national MRV system. These links can help ensure that CMRV can develop adequate institutional frameworks, improve transparency related to data-sharing issues, and secure enough funding so money can flow down from the international, national and local levels. Participants talked about the importance of continuous capacity building, as communities need to receive adequate training in the many aspects of MRV.

During this workshop, more than 30 participants from Asia, Europe, America and Africa agreed on these key lessons from their experiences:

1. Community forest monitoring cannot be a part of the national MRV system if there is no political will to incorporate these vital stakeholders into REDD+ implementation.
2. To achieve effective CMRV, it is vital to first reach consensus with all stakeholders on the basics of the work.
3. Information gathered should be relevant to both communities and the government.
4. The data collection method should be appropriate and relevant for communities.
5. There must be a clear end use for the data that was collected and an agreed-upon understanding of how the communities benefit from gathering this data.

These tools, approaches, and lessons learned are presented here for consideration by REDD+ practitioners, community organizations, civil society and other key stakeholders involved in REDD+ initiatives, as a working resource for facilitating community-based monitoring processes and supporting the development of similar initiatives.

1 WHAT IS COMMUNITY-BASED MONITORING, REPORTING AND VERIFICATION?

WHAT IS CMRV?

Community-based monitoring, reporting and verification (CMRV) can be defined as the involvement of local people in the measurement, reporting and verification of carbon stocks and other data (e.g. biodiversity, ecosystem services, drivers of deforestation or degradation) that are required to assess the impact and co-benefits of REDD+.

Hawthorne SD and Boissière M. 2014. Literature review of participatory measurement, reporting and verification (PMRV). Working Paper 152. Bogor, Indonesia: CIFOR.

To measure the effectiveness of a REDD+ scheme and receive the financial incentives associated with emission reduction of greenhouse gas (GHG), it is crucial to monitor, report and verify (MRV) those emission reductions. To ensure that emission reduction is permanent and additional, the MRV must estimate carbon emissions at the national level while assessing the effectiveness of REDD+ demonstration activities (projects) and improving the accuracy of the GHG accounting at the subnational level. Thus, the MRV system needs to integrate and manage data across geographical scales and multiple government levels.[1]

In this context, community-based MRV can provide cost-effective and locally collected biomass data, promote equality in benefit sharing, and maximize the social and environmental co-benefits of REDD+. The involvement of local people, who may have diverse skills, expertise, societal roles and interests, can bring important local information on forest management to the REDD+ discussion. CMRV can also be an appropriate way to assess the safeguards in the Cancun Agreements defined in 2010, especially (a) the full and effective participation of relevant stakeholders, in particular, indigenous peoples and local communities; (b) conservation of natural forests and biological diversity and enhancement of other social and environmental benefits; and (c) the building of a transparent and effective national forest governance structure. According to the Durban outcomes, countries need to develop a safeguards information system to report how they are addressing and respecting the Cancun safeguards (Decision 12/CP.17).

Because of the importance of CMRV and its potential for REDD+ and biodiversity and social safeguards, it is paramount to learn about CMRV experiences globally. This was the aim of the workshop in community-based MRV systems that took place in August, 2014 in Guyana. This workshop was organized through a collaboration of World Wildlife Fund Guianas (WWF-Guianas), the WWF Forest and Climate Programme, the Global Canopy Programme, and the U.S. Geological Survey SilvaCarbon Program.

The main objectives of this workshop were to (a) test different technologies and approaches used for CMRV globally; (b) exchange ideas between users and developers in a context as similar as possible to “real world” conditions; (c) understand the challenges and enabling

conditions needed to put CMRV into practice; and (d) use this information for national MRV reporting. Through a series of presentations, activities and exercises, organizers worked with the participants to gauge their views and opinion and to have them interact and test different tools used for CMRV. Participants came from more than a dozen different countries and represented governments, communities and technical experts. All shared knowledge and learned about tools, methods and CMRV experiences in other countries. Throughout the report you will read brief 'workshop observations' highlighting interesting topics, anecdotes or questions about working with CMRV that came up during the sessions.

The workshop was held in Guyana because it is the first country in the world with a functioning national-scale MRV system. The country also has an important indigenous population that owns 13.9 per cent of the total forest in Guyana. In this context, CMRV is key to making REDD+ work at the national level.

The lead workshop organizer was Naikoa Aguilar-Amuchastegui of the WWF Forest and Climate Programme. Co-organizers included Jon Parsons, Lucy Goodman and Helen Bellfield of the Global Canopy Programme, along with Sylvia Wilson, Coral Roig-Silva and the U.S. Geological Survey SilvaCarbon Program.

COMMUNITY-BASED MONITORING, REPORTING AND VERIFICATION CAN HELP US HAVE A BETTER UNDERSTANDING OF DEFORESTATION FOR:

1. Developing national MRV systems

- Identifying, assessing and understanding the drivers of deforestation
- Providing historical background and context that is related to how drivers operate and interact in the area (e.g. regional conflicts, disputes, cultural elements)
- Validating data produced by national MRV that is used to design national and regional policies
- Designing mitigation measures depending on local needs
- Assessing leakage risks by helping to understand the displacements of activities and the reasons behind these
- Helping measuring carbon (above- and below-ground biomass), measuring land cover, verifying remote-sensing imagery and providing information on safeguards

2. Monitoring and safeguards information systems

- Providing a global-to-local approach as it helps to identify those conditions that enable global drivers of deforestation and forest degradation and defining the reasons for occurrence in some places and not in others
- Allowing for sound design of the monitoring system itself by identifying the right indicators (e.g. understanding the rationale for local decision-making such as when to use shifting cultivation practices and understanding how community members decide where to put the next crop)
- Identifying pressure areas that are likely to be converted in the future
- Developing alternative land-use scenarios in those areas that are under pressure to be deforested

3. Supporting local decision-making

- Providing baseline information to make joint decisions between community and government on land use
- Promoting education and awareness of communities and policymakers
- Generating good activity data of the local area, zoning and planning land use, and developing future alternative scenarios
- Incorporating a decision-making process in the analysis of the overall data to enhance the accuracy of the data and to tailor mitigation actions

4. Securing broader transparency and effectiveness of forest policies

- Monitoring forest governance, effectiveness of policies and communication flow
- Monitoring local economic, social and environmental impacts of green economy policies

Workshop Observations: "We need to ask ourselves, who is this information for and why is it useful?

"Communities are not interested in biodiversity and safeguards, but about species they eat, pollinators, pest controllers, and other species that have sacred value. It is exactly the same when we ask them to collect information about carbon."

Michael K. McCall, Universidad Nacional Autonoma de Mexico (UNAM)

1 Hawthorne SD and Boissière M. 2014. Literature review of participatory measurement, reporting and verification (PMRV). Working Paper 152. Bogor, Indonesia: CIFOR.

2 TOOLS AND APPROACHES

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The tools and approaches presented here can help REDD+ practitioners tackle community-based monitoring, reporting and verification around the globe. These selected resources and methods were reviewed during the August 2014 capacity building workshop and are shared as a starting point for exploration and discussion.

First, each tool is briefly introduced, including an overview of primary functionality. This information was collected from expert presentations during the workshop and further research after the session. When available, case studies are presented along with additional reflections and questions or comments about the tools from participants.

An analysis of each tool is also included. It is important to mention that the tools were assessed in a context as close as possible to the real-world conditions of a forest community: (a) in the forest or close to the forest, (b) with no access to the Internet or a cellular network, (c) under the forest canopy, and (d) subject to different weather conditions (e.g. rain or no rain).

Key points for each tool or approach include:

1. Why the specific tool was developed
2. The stakeholders involved in its development
3. Strengths
4. Challenges
5. Key requirements to use that tool in a community context

A summary is presented to help readers understand to what extent each tool can be used in an MRV system for:

- Measuring carbon (above- and below-ground biomass)
- Measuring land cover
- Verifying remote-sensing imagery
- Providing information on safeguards

Discussing how these tools are used differently around the globe led to some interesting lessons learned. These are considered recommendations to give to others interested in using these technologies. The lessons were collected in a participatory way during specially designed learning sessions during the workshop.

It was clear from the participants that technology is a tool for CMRV, but it is not the only way of achieving good data and results. The technology needs to adapt to the community needs, not vice versa, and we should never disregard paper and pencil.

OPEN DATA KIT

opendatakit.org

OVERVIEW

Open Data Kit (ODK) is a free and open-source set of tools that help organizations design, implement and manage mobile data collection solutions. ODK is not one program, but rather an umbrella term that includes a series of different technologies. ODK provides an out-of-the-box solution for users to:

- Build a data collection form or survey
- Collect the data on a mobile device and send it to a server
- Aggregate the collected data on a server and extract it in useful formats.

ODK is free to use and is open source, which means that nobody owns it and there is a large community of developers around the world who are improving it to serve people's needs.

Originally these technologies were not designed for MRV, but rather for health monitoring. ODK is a data-collection system that was developed by the University of Washington and adapted for forest monitoring. The basic steps of using ODK are as follows:

a. Form creation: In order to ask questions about the forest, the user must first build a questionnaire. This is done through a technical process called form creation. ODK has ODK Collect, a form builder that can be based online or on a computer and allows the user to build the form in an easy and intuitive way. The cloud-based (Internet-based) program is easier to use but is limited in that it only allows the user to create simple forms, which may not be suitable for the local needs. If Internet access is not available, the user can create the form in MS Excel using simple codes. ODK Collect[2] is the program that runs the form that was created, turns it into a questionnaire, and manages the transfer of data between the phone and the cloud or computer.

Because it is easy to introduce mistakes when developing the form, it is a good practice to use form-checking technologies. These technologies will read the code that was developed, give feedback on potential errors and show the user what the form looks like. Once the user checks the form and confirms that it is free of errors, he or she can upload it from a locally-based computer or Wi-Fi to the phone. The form-checking technologies that were used in the Forest COMPASS project are Smap and ODK Aggregate. Smap is a technology similar to ODK for mobile-based data collection that can be useful for data management and visualization offline.

b. Data collection: Forms need to be stored somewhere so that they can be downloaded later to phones. ODK Aggregate is a storage solution that was originally cloud-based. The user can create a form anywhere in the world and submit it to the cloud, and the people in a forest community can have it within minutes. Because Internet access is not available in most of the forest communities, ODK developed a non-cloud version that uses a locally based network on local computers.

c. Data processing: ODK Aggregate allows quick visualization, in graphs and basic charts, of the data that has been collected. Smap[3] is another technology that can be used to store the form and download it from a mobile device, which also allows users to do shapefiles of the polygons they created in the field, work offline and perform simple data visualization.

The Global Canopy Programme developed a process for CMRV using the ODK and Smap tools, which are form creation and checking technologies, to ease the ability of communities to monitor, report and verify. The process for using the ODK and Smap tools is explained in Figure 1. These tools were developed to ensure that users are able to access the information with or without an Internet connection.

2 ODK Collect renders forms into a sequence of input prompts that apply form logic, entry constraints and repeating substructures. Users work through the prompts and can save the submission at any point. Finalized submissions can be sent to (and new forms downloaded from) a server. Currently, ODK Collect uses the Android platform, supports a wide variety of prompts (text, number, location, multimedia, barcodes) and works well without network connectivity.

3 For more information about Smap, visit: http://blog.smap.com.au.

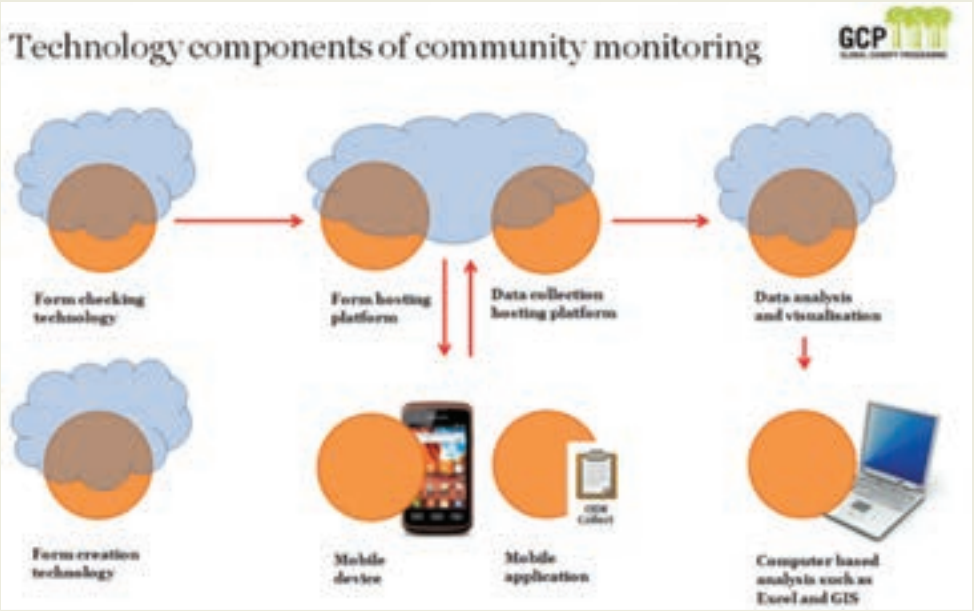

Figure 1: The ODK tool allows for the creation of a form for field collections. This form is stored in the cloud and can be pulled down by a mobile device with the use of the ODK Collect tool. The data can then be collected with the use of the Smap tool and placed back into the cloud before being downloaded for analysis through programs such as Excel and GIS.

FOREST COMPASS

Forest COMPASS is a Global Canopy Programme (GCP) project to scale up adoption of community-collected information to report on international and national undertakings relating to forests. The scale of Forest COMPASS work is from global to local:

- Advocacy and resources to support communities to have an enhanced monitoring role in REDD+, FLEGT and CBD to make these processes more transparent;
- Support communities to access governments and be aware of the national context and enable governments to connect with a network of community data collectors to enhance engagement;
- Support communities to collect data in the field by providing technical resources and training.

forestcompass.org

COMMUNITY-BASED MONITORING EXPERIENCES IN GUYANA AND BRAZIL

The Global Canopy Programme started working in CMRV in Guyana and, after implementing the project for several years, took the lessons learned from work in Guyana to Acre, Brazil, where they could scale the adoption and impact of community-based monitoring.

In Acre, GCP staff and crew are using minimal equipment: they use only phones, a laptop computer to store the data acquired with the phones, and a Wi-Fi router that allows the phones to broadcast the data to the laptop as if the laptop were a web server. This is necessary because ODK Collect encrypts the data and needs to push it into a web address. It is like copy-and-paste but more complex. Once the team is back in a location with Internet access, the data is uploaded to the cloud for storage and sharing.

Data is collected once a month when community members meet to download the questionnaires and to upload new forms from the data collector's laptop. At that time, the crews can visualize the data they collected and give one another feedback. In the next recording phase, they can correct any mistakes. The disadvantage is that the laptop contains all the information, and if it were to break down or get stolen, all the data could be lost. As a precaution, the team in Brazil makes several backups to USB sticks or memory cards that they keep in separate places.

GEOODK

geoodk.com

OVERVIEW

GeoODK (Geographical Open Data Kit) provides a way to collect and store geo-referenced information, along with a suite of tools to visualize, analyse and manipulate ground data for specific needs. It can be used without Internet, as the data collected in the field can be uploaded later when Internet access is available. GeoODK works with ODK, Aggregate and Formhub. It enables an understanding of the data for decision-making, research, business, disaster management, agriculture and more. As a multidimensional application, GeoODK's goal is to provide an open-source platform that can be expanded to address current and future needs of data collection.

GeoODK has three components:

1. Mobile Data Collection

The mobile app (Collect) was derived from the Open Data Kit developed by the University of Washington. Creators then added both an online and offline mapping component and some addition spatial widgets, as well as a developer option for deploying surveys with the app.

2. Database and Web Management

A custom-built "Formhub" has also been created for server-side aggregation of data. This web application is heavily supported by its community and is a useful tool to branch.

3. Geospatial Data Display

The Mobile Data Conversion Kit is a desktop application for downloading ESRI shapefiles and Google Earth KML files of data collected via mobile devices.

Brief summary:

- Form/survey-based data collection
- Edit saved forms/surveys
- Works offline
- ODK Aggregate/Formhub server submission
- Offline/online mapping with OpenStreetMap (OSM)
- Offline tiles (Mapbox)
- Support for different offline tile service
- GeoShape (polygon) Collection data type
- GeoTrace (walk around area)
- GeoTriggers
- Attach GeoPoint/GeoShape/GeoTrace data types to survey/form (just like images)

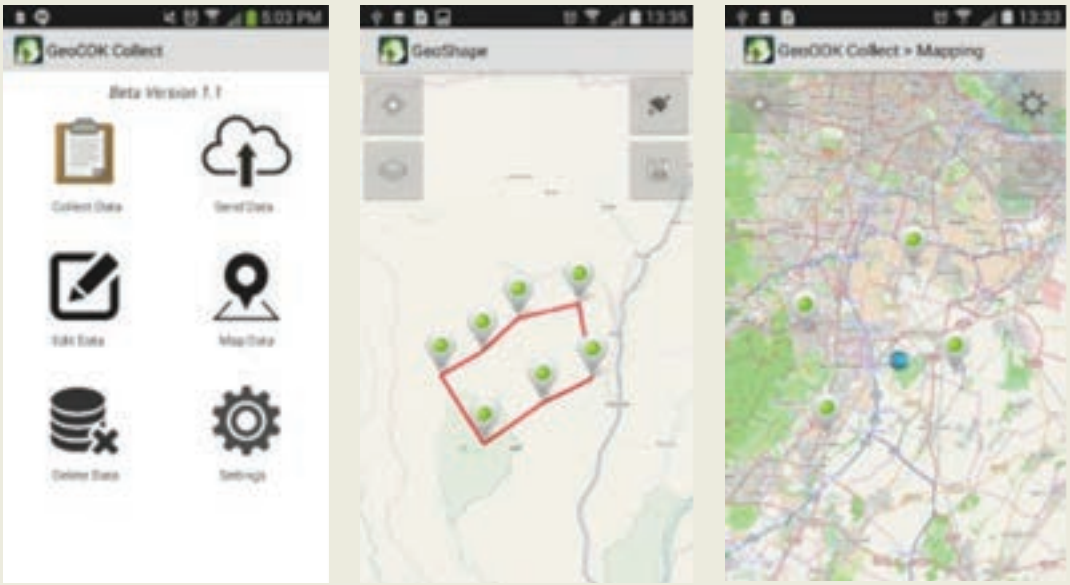

Figure 2: The GeoODK Collect application is displayed in this figure, showing how information can be collected, edited, shared and shown on a map interface.

GEO-WIKI

geo-wiki.org

OVERVIEW

Geo-Wiki.org is a community of volunteers that are helping to validate global land-cover maps derived from satellites. Global land-cover maps are used to inform decisions in a number of important areas such as climate change, deforestation and biodiversity. User photographs can help improve the quality and validity of these maps. Since large differences occur between existing global land-cover maps, current ecosystem and land-use science lacks crucial accurate data (e.g. to determine the potential of additional agricultural land available to grow crops in Africa). Volunteers are asked to review hotspot maps of global land-cover disagreement and to determine, based on what they actually see in Google Earth along with their local knowledge, if the land-cover maps are correct or incorrect. Their input is recorded in a database, along with uploaded photos, to be used in the future for the creation of a new and improved global land-cover map. To provide a sense of scale, there are currently:

- 5,000 users
- 100 different countries
- 500,000 validations
- 3,000 uploaded pics

Incentives to contributors:

- Best validator – €35 Amazon voucher
- 2nd and 3rd best validator – €20
- Top 10 validators – co-authorship on a scientific paper to validate the map of land availability for biofuels

Within the Geo-Wiki Project there is a special app called Geo-Wiki pictures that participants can use to photograph landscapes and share them with friends and colleagues through Geo-Wiki.org using the visualization capacity of Google Earth. Your photographs will be automatically geo-referenced and tagged with information such as compass direction and the angle of tilt.

Features:

1. Take photographs of landscapes while on holiday or while out with your friends, and the Geo-Wiki pictures application automatically provides a geographic coordinate, the compass direction and the angle of tilt.

2. Tag the photographs with any additional comments or text.

3. Tag the photographs with a land-cover type based on a simple-to-use drop-down menu. These land-cover types are used to help us validate global land-cover maps.

4. Upload these photos to Geo-Wiki.org, a site that allows you to visualize your photographs on Google Earth. The images can be uploaded via mobile connection or stored until you have Wi-Fi access.

Figure 3: The Geo-Wiki pictures application is shown in this figure, demonstrating how the application can give certain information such as latitude, longitude and tilt.

MOABI DRC

rdc.moabi.org

OVERVIEW

Moabi Democratic Republic of Congo (DRC) is a collaborative mapping initiative that aims to increase transparency and accountability on resource issues in DRC. It is part of Improving Forest Governance through Independent Monitoring in the Democratic Republic of Congo, a multi-partner project building the institutions and tools necessary to independently monitor natural resources across DRC. The project's current focus is developing an independently monitoring approach for REDD+.

Objectives:

- Strengthen DRC civil society and local communities to conduct independent forest monitoring, particularly REDD+
- Conduct continuous and regular field monitoring in REDD+ project areas
- Increase civil society participation in monitoring REDD+ and broader natural resource issues

About the platform:

- This is the second version of Moabi DRC. The original Moabi DRC and its technical consortium was launched in June 2011 by WWF and Observatoire Satellital des Forêts d'Afrique Centrale (OSFAC). In 2013, management of Moabi DRC was handed over to the International Institute for Applied Systems Analysis (IIASA). The first version supported only mapping; now the app supports reporting and networking of local observers in the capital of each province wherever there is power and Internet access. A local observer can link Moabi with civil society, as it can be the link between the data gathered in Moabi that might be useful to the communities or elements of civil society in general that the observer interacts with and vice versa.
- Creators have completely rebuilt the site using the open-source OpenStreetMap (OSM), the world's largest collaborative mapping project. The new collaborative features are currently in the beta testing phase.
- Two key features are maps and reports. Maps refer to geographic data and have different information layers: (1) indigenous lands, (2) logging concessions, (3) agriculture concessions, (4) road projects, (5) UMD Forest Loss (2000-2012), (6) UMD

Figure 4: Moabi DRC platform home page.

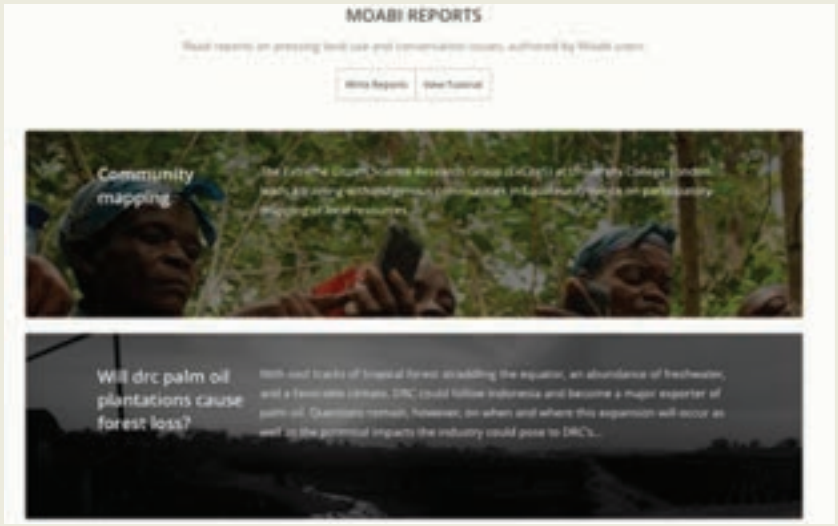

Figure 5: Moabi DRC reports site showing different online discussions.

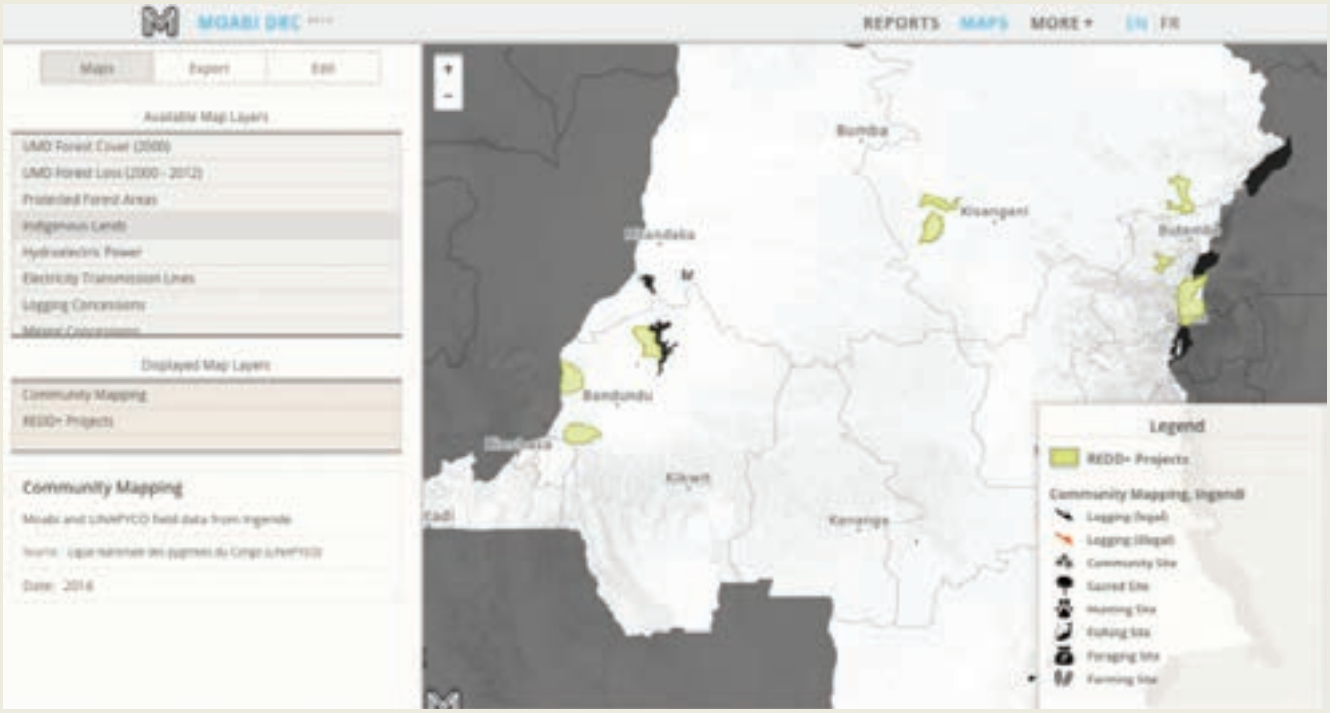

Figure 6: Moabi DRC maps showing the location of REDD+ projects and community mapping activities.

Forest Cover (2000) and (7) community mapping. The maps can be exported as a JPG file or using the OSM or GeoOSM extension in a zip file. Everybody can publish reports of some issues and complaints in the field. Users can export and print reports that are related to the maps.

- Users are allowed to edit data, and the application keeps a history of the edits (metadata). Creators follow the editing, and every three months creators have a working group that includes the private sector, government and communities to discuss all the editing in the platform. For instance, if there is data about mining, the mining ministry needs to check it.
- The site also includes social networking elements. Communities or organizations can tell interactive stories and add layers and mapping information to them. This is another level of participatory mapping. As part of a broader community, people can upload data and discuss it with others. Users can report an event, an error or a polygon and then discuss it with stakeholders. This interactive process allows for editing, and a history of the edits is viewable. Users can share participatory mapping. If a community finds that something is happening that shouldn't, it can be reported there. It is a platform for dialogue.

SOUND RECORDINGS

OVERVIEW

The use of sound recorders is an easy and inexpensive way to collect biodiversity data. To do this, recorders are placed in relevant locations along survey transects in the forests to capture sounds coming from the selected sites.

The sound information is later analyzed by experts or community members to define a species' presence or infer the number of species and other data in the area (such as species richness, diversity, and similarity metrics).

Recorders provide general biodiversity information and indices that can help community members and governments better understand the flora and fauna makeup of different areas.

These recordings can also help safeguard forests. Communities can monitor the species that are most relevant to them, or can check for anthropic sounds such as logging, hunting or illegal activities.

Sound recordings can be collected by non-specialists to do initial assessments of a forested area. The information can then be shared via Internet to specialists located in other parts of the world who can analyze the recordings, provide feedback, and verify data. However, in many cases, specialists are not needed to identify the sounds, as communities are often experts in recognizing species that are relevant to them. This information from sound recorders can also be used in the creation of management plans in communities.

Courtesy Adriana Tovar Martinez

Figure 7: Sealed digital recorders are placed in the forest for sound recording; information is then collected from the site using an ODK form.

© WWF / Staffan Widstrand

SAPELLI

ucl.ac.uk/excites/software/sapelli

OVERVIEW

Sapelli is a mobile data collection and sharing platform designed with a particular focus on non-literate and illiterate users with little or no prior information technology experience. It was developed by University College London's Extreme Citizen Science (ExCiteS) research group with the aim to provide indigenous people with tools that empower them to take action to protect their local environment and way of life.

The platform plays a central role in ExCiteS' mission – to develop theories, tools and methodologies to enable any community, anywhere, to engage in citizen science – and will soon be made broadly available.

Sapelli software is a suite of tools for data collection and analysis that includes:

- Sapelli Launcher, a text-free app launcher
- Sapelli Collector, which offers pictorial decision trees and icon-driven interfaces
- Sapelli Data Sender to forward SMS messages
- Sapelli Maps
- Decision Tree Authoring Tool
- A cloud-hosted server component to receive and store data

Sapelli can be understood as participatory software development embedded within a wider participatory methodology that encompasses:

- A detailed process of free, prior and informed consent (FPIC)
- Participatory problem framing
- Building community protocols for engagement with:
  - the project itself
  - other stakeholders in the problems local people have identified (NGOs, companies, government)

It is also tailor-made software that is developed based on particular situations, case studies and community needs. The ExCiteS team works with communities through decision trees to define the software requirements. Some of the questions the communities were asked prior to the development of the software are:

- What type of data is relevant to you?
- How can you create data categories to make a simple tree (with consistent levels)?
  - Significant for the community
  - Up to six images per screen
- Is it easy to navigate?
- Are the images easy to understand?
- Does it contain the most important aspects the community wants to register?
- What has been left out?

Figure 8: Process that users go through for data collection using Sapelli.

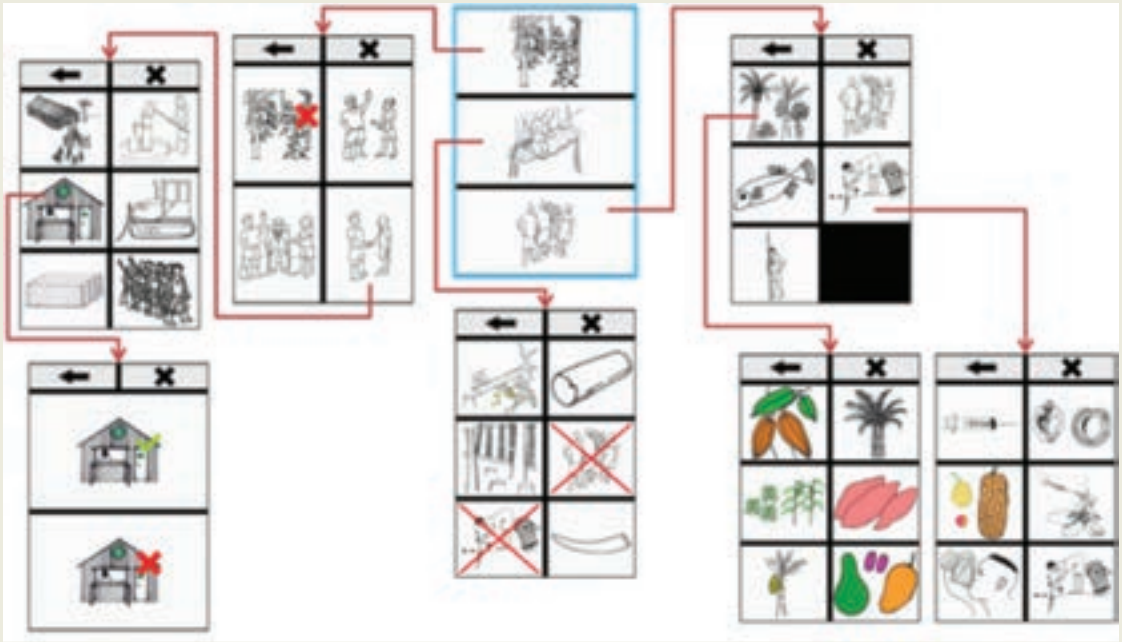

Figure 9: Sapelli user interface using decision trees and images for the non-literate.

CYBERTRACKER

cybertracker.org

OVERVIEW

CyberTracker (CT) is a method of geo-referenced field data collection and visualization that was developed by Louis Liebenberg with Justin Steventon in South Africa in the late 1990s, initially designed to record the highly developed skills of San game trackers in the Kalahari. It was developed as a primary component of a non-profit organization to improve environmental monitoring for conservation globally. CyberTracker is used by indigenous communities, scientific researchers, citizen scientists, and environmental planners and managers.

CyberTracker has evolved further into applications for environmental education, forestry, social and health surveys, crime management, community-based disaster risk reduction and relief, and biomass carbon mapping and monitoring toward REDD+.

This tool has a user-friendly interface developed for smartphones, tablets, or Pocket PCs (PDAs) with GPS tracking displays icons and text, and speeds up and improves data collection.

The icon image interface is particularly significant, making field data collection easier for non-literate users or children.

CyberTracker desktop runs on most versions of Microsoft Windows and on Apple Mac OS X and supports Android smartphones, Samsung Galaxy Camera, tablets and Windows Mobile PDAs. CyberTracker is open source. It has been downloaded for free 50,000 times in more than 150 countries. The field application of CyberTracker (for biomass carbon) requires no programming skills and the data collection can be customized.

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CyberTracker is not a GIS program, but the output results are exported to GIS (reports and data tables.)

MEASURING BIOMASS CARBON

The Measuring Biomass Carbon with CT application is for communities to engage in MRV for forest carbon (e.g. sequestration, conservation, reduced emissions). The core is the focus on measurements required for carbon MRV: to provide reliable, accurate, high-precision measurements to satisfy carbon payment mechanisms. Communities have the specific local knowledge, the capacity for acceptable measurements and the required skills, and community measurement is economical.

The CyberTracker software allows users who have no programming skills to use the Measuring Biomass Carbon with CT app to:

- Design and edit a database
- Customize screen sequences using the Sequence Designer feature
- Create field guides for forest management types, degradation types and species identification, and also for indicators of biodiversity and social indicators
- Add photos, videos and sound recordings
- Display map options, which include Microsoft Virtual Earth, Google Earth, ESRI shapefiles and images (JPEG, bitmap, etc.)

- Gather geo-referenced data with handheld device or smartphone with GPS
- Navigate with GPS Moving Map
- Export data to Excel, CT export file, XML, Google Earth KML, web page (HTML), ESRI shapefile, JPEG, etc.
- Query and view data on desktop PC with maps, tables and photo views
- Use CyberTracker import and export system to share data
- Change database structure without losing existing data

The Measuring Biomass Carbon with CT app is described in the *Manual for Community Technicians* (http://redd.ciga.unam.mx/files/CommunityManual.pdf). The manual and the app itself are in English and Spanish.

Figure 10: The above are examples of the CyberTracker application and how data is collected.

INTERACTIVE FOREST MONITORING

wageningenur.nl/en

OVERVIEW

Remote sensing is the backbone of national forest monitoring systems. For REDD+ MRV, it is important to engage local communities in monitoring and validating information provided by remote sensing. To this aim, there is a need for a systematically designed tool that can work, in an integrated nature, with remote sensing and community-based monitoring. In this context, the Laboratory of Geo-Information Science and Remote Sensing (GRS) at Wageningen University is currently developing and testing an interactive mobile-based forest monitoring tool in different parts of the world (e.g. Ethiopia, Vietnam and Peru). The developed interactive forest monitoring (IFM) tool incorporates user-friendly design; has the potential to facilitate near-real-time forest change alerts based on remote sensing analysis; and can provide data collection, storage and processing in partnership with local communities.

Figure 11: Tool for near-real-time forest monitoring showing screen shots indicating when to collect REDD+ data.

- This open-source tool allows for near-real-time forest monitoring.
- It aims to bridge the gap between remote sensing and community-based monitoring in an interactive fashion.
- The tool allows monitoring of forest cover guided by a database and allows for the verification or reporting of what is happening in a particular area. The mobile phone connects with the GPS and constantly reads the position of the surveyor. When the tool senses that it is in the proximity of a polygon in need of validation, a figure will pop up in the mobile screen to tell the surveyor to collect and share relevant information for that area. After receiving this alert, the surveyor can start to answer questions from the ODK form. The tool also allows the user to take pictures.
- The added value is that the tool connects with the database from time to time to download local information. In the future the tool will have different plug-ins. This will be particularly useful when users are in the same area on a regular basis and do not need to actively check national deforestation data or other information.

PARTICIPATORY MAPPING AND GEOGRAPHIC INFORMATION SYSTEMS

OVERVIEW

Participatory mapping (PM) is an approach rather than a tool used for sharing knowledge with communities. PM investigates processes using spatial visual elements (symbols, pictures or similar) and discussion to understand communities and the use of local (natural) resources. It is not only related with creating a map; it is also a participatory process that slowly builds up from developing trust, knowing the local culture and understanding community needs. PM is a process of sharing stories and creating spatial plans through a map together with community members.

Participatory mapping can capitalize on the use of any of the tools mentioned thus far for CMRV. Additional elements include the possibility of developing several thematic maps as it allows for mapping anything relevant for community members. This is relevant when talking about CMRV as community-driven rather than MRV-driven as a means to assess and track changes relevant to the community as well as to negotiate and discuss what the community wants to do with its territory or the resources it has at hand.

However, it is often difficult to get relevant information about the use of the territory. Because of lack of trust, communities find it difficult to share their real needs.

PM is different in each region and country; there is no one way to do it. Every project and community has a different cultural background and, thus, a different approach.

Participatory mapping can be useful for:

- Empowering the community
- Identifying ecosystem services and indicators
- Identifying drivers of deforestation
- Defining territory and natural resource use

Workshop Observations: What is a map?

A map is a symbolic representation of a place. It can be anything: a drawing, a symbol, a song, a feeling, etc. It can also be an idea and a representation of a thought we have about the environment. It is a subjective representation that depends on individual perception. That is why participatory mapping is important to do in groups to develop the reality experienced by community members.

Workshop Observations: How do you know a community is ready for participatory mapping?

1. Communities need to have some kind of organization; communities that are clear about what the problems are and what they need are ideal for PM.
2. If communities ask for PM, they might be ready for it.
3. In general, communities require PM when there is a real problem that they are facing in their land. In Indonesia, communities started to understand the importance of PM when they had land tenure problems. They approached NGOs operating in a conflict zone when they needed a map to define their territory.

PROCESS OF PARTICIPATORY MAPPING IN KUTAI BARAT, INDONESIA

Yuyun Kurniawan

WWF-Indonesia

Participatory mapping in Indonesia was developed as an approach to protect community land from outsiders and private companies. Territorial maps had been produced in the country without knowledge of the situation at a local scale. As a result, the maps did not coincide with the reality on the ground. Communities wanted to have a map as a primary document delineating their lands in order to protect territory from potential encroachment by outsiders. If communities do not have these maps, there can be disputes over who legally owns which territories.

Currently, in addition to the territorial map, communities also need a natural resources plan for how they will use their land. Without both a territorial map and a resources plan, the government could potentially give the land to the private sector. In short, PM has become an important tool for defining territories and managing natural resources.

PM can also help resolve land tenure disputes. In Indonesia, there are many tribes with traditions that go back hundreds of years. Some are migrants from different places, there have even been tribal wars over land use. Each tribe has its own rules about how to use and manage its territory, making land tenure even more complicated. In addition, the government has its own approach to land use and management, so the context is very complicated.

The process starts in trying to understand the culture as the mapping draws information about the community's local wisdom. The way of representing this knowledge can be through a map. We must spend, on average, six months living in a community and collecting information about its history, tradition, social classes and natural resources, and only then can we have a community meeting to start sketching out the map. We first ask community members to trace the territory on paper and provide information on boundaries and land uses. We next run the map that was drawn by hand through a GIS system and give it back to the community during a village meeting.

After we make a map, the process is not finished. We still need to negotiate with all the key stakeholders. In community lands in Indonesia there are all types of companies (mining, logging, etc.) that may also have rights to the land. The key stakeholders must all be involved in the management of this area. This is a very long process, and patience is key.

Reflections on our experience:

- GIS is simply the tool to draw all this information, not the tool for gathering the information. Sometimes mappers bring computers and GPS devices with them to villages, and communities are very impressed by the equipment, but the communities may forget about digging for the information, and they believe that once the map is ready the process is finished.
- In 1998, I made a map with a community, and 10 years later the government took the community to trial over a land tenure dispute as the community had been accused of breaking the law and using a national park. I was a witness for the community in court. After the map had been created, the community claimed the national park was their territory, and they didn't care about the state border or the land-use system. They thought they were free to do whatever they wanted. So PM is not always as easy as one might think.
- Communities learn from the process. n the past, communities were sometimes taken advantage of, and they have learned from that experience. It's possible for communities to manipulate the information on the map. We need to be careful when we are drawing information from the community, as the map is a powerful tool for them to use when bargaining with the private sector and government.

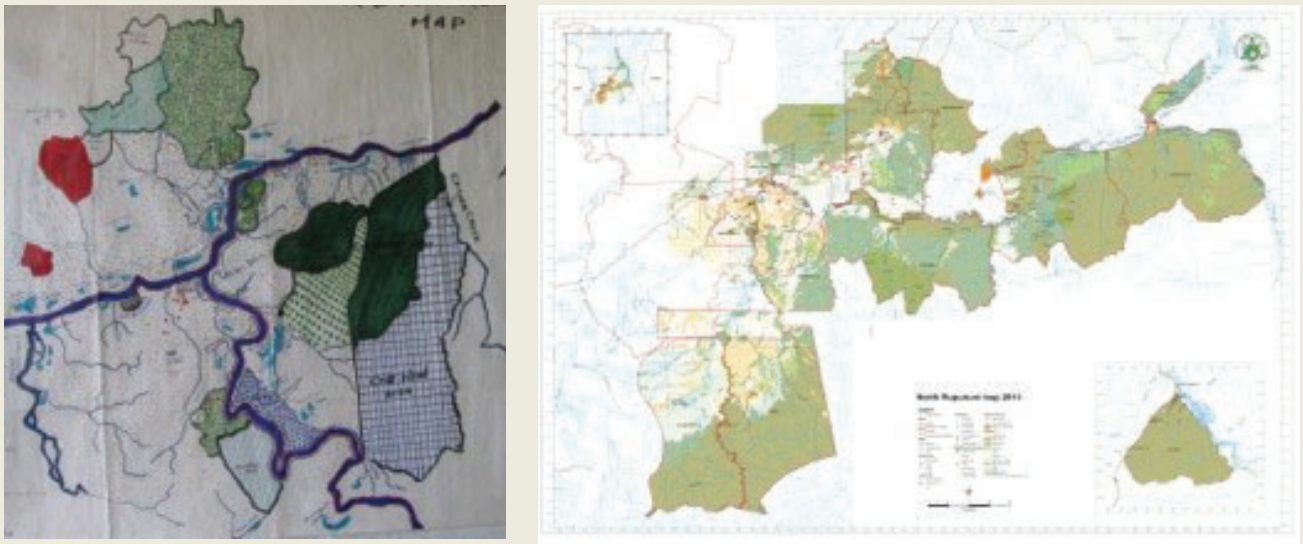

Figure 12: The image on the left shows the sketch map of one of the villages (Rewa), which is part of the North Rupununi area, made with the local community before being digitized and turned into the overall Rupununi map on the right. The whole step-by-step process is described in a manual.[4]

4 CMRV – GIS technical manual for south/south training workshop, August 2014.

PROCESS OF PARTICIPATORY MAPPING IN NORTH RUPUNUNI, GUYANA

Vivian "Rikki" Moses

North Rupunini Disctict Development Board (NRDDB)

Participatory mapping started in the North Rupununi District of Guyana out of the need to start working in CMRV and REDD+. The first task was to define the issues that communities wanted to monitor in their territory. For this the project management team sat down with the community leaders and created a list. Communities started to monitor natural resources, forests, traditional farming, well-being and other infrastructure. But we had no idea about the geographic features of our territory. The idea was to put these down on paper so everybody could see the geographic features on a map. We went to community meetings and asked communities for their consent for PM. Some agreed to participate in this process, and some didn't. If 75 per cent agreed, we would move forward.

We had 32 crew members working on the project that were also members of the communities. Each of them visited the villages and asked what community members knew about mapping. Three days later they came back with a sketch map. While they were visiting each village, we got base maps from the government that showed roads and borders but didn't have information about farming and deforested areas, so the communities provided all that missing data. After all the data was collected, information was digitized, geo-referenced and transformed into a digital map. There was a period of revision, and we presented a draft to the communities and asked for their comments, additions and corrections. This was the basis for the final map of the communities. However, a final version was never completed because every time we went to the communities, there were new items in the community such as houses or roads. So it is important to remember that the map is a living tool that needs to be updated regularly.

HOW TO CREATE A GIS MAP

The trainings and steps to create a GIS-based map from the participatory mapping sketch maps were defined in a manual by Tjeerd Wits working for GCP during the CMRV project (2011-2014) and are related to the process of developing a GIS database for natural resources for the North Rupununi District Development Board in Guyana. The GIS database is based on the community resource maps produced by all 16 communities in the North Rupununi District and is imported into ArcGIS and finally uploaded to the Google Maps Engine:

- Create and collect sketch maps of communities
- Scan sketch maps of communities
- Import the sketch resource map into GIS and geo-reference
- Create layers to digitize the resource maps
- Create layout of the community maps and add grid
- Add field data from handheld into ArcGIS 10
- Import shapefiles into Google Maps Engine
- Change symbols in Google Maps Engine
- Create map with layers in Google Maps Engine
- Publish map in Google Maps Engine

TABLE 1: SUMMARY OF KEY ASPECTS OF TOOLS AND APPROACHES PRESENTED

	ODK	GEODK	MOABI DRC	SAPELLI	CYBERTRACKER	SOUND RECORDING	INTERACTIVE FOREST MONITORING	PARTICIPATORY MAPPING
1. Why was it developed? **What gap does it address?**	» To collect data from surveys taken in communities, using an easier format than paper forms. » By capturing data electronically in any device, the information is taken in digital form, which means there is higher accuracy, more data is collected, and it is easier and quicker to process and analyze.	» Because it has a mapping component, the app helps to visualize a point in the map where the surveyor is. » This brings another dimension to the community and provides immediate feedback to them.	» To strengthen the REDD+ process with communities, the government and the private sector. » To gather all REDD+ related data to increase transparency in the REDD+ process.	» To enhance participation of communities that are non-literate.	» Feasible and usable for communities.	» To gather good-quality data in the field in a short amount of time and in an efficient way that would eliminate surveyor and time-of-day bias. » Data is readily available for assessment and validation as recordings remain contrary to surveyors in the field.	» Interacts with the surveyor in real time indicating where it needs to collect data. » Helps validate whether a polygon is or is not a false alert.	» It is more a mechanism/ process for getting people to share their local knowledge and for capturing local spatial knowledge. » Drawing helps report knowledge that is usually transmitted verbally.
2. Who was involved in the development of these tools and what were their roles?	» University of Washington. » Technician developing specific tools. » Data entry people on the ground. » Discussion and development forums: hundreds of people that can help you solve a problem. » Local partners in Guyana: NRDDB.	» IIASA.	» WWF-US (first version). » OSFAC based in DRC. » OGF based in DRC. » IIASA based in Austria. » Cloud cover company building the system based in Washington, DC. » Donor: NORAD.	» ExCiteS team in University College London (UK).	» Louis Liebenberg with Justin Steventon. » The app for CMRV was developed by Alejandra Larrazábal, Michael K. McCall and Margaret Skutsch, from Centro de Investigaciones en Geografía Ambiental Universidad Nacional de México.	» More a methodology than a tool. With low-budget recorders and for REDD+ biodiversity safeguards assessment, it has been proposed by Adrian Tovar Martinez and Naikoa Aguilar-Amuchastegui from WWF's Forest and Climate Programme.	» Arun Pratihast, Brice Mora and Jim Biezen from Wageningen University, Netherlands.	(from Guyana project) » Communities and organizations within them (wildlife clubs, women's, farming, logging, political groups). » Project management group with GIS skills. (in Indonesia) » Communities.

						» Sound recording used for a long time as a means to assess and track bird communities and populations.		» GIS expert, socio-anthro-pology team.
3. Strengths	» As it is open source, there is a big global community involved in its development and improve-ment. They are great for prob-lem-solving. You are not working alone. » Tailored to user needs. The user can develop a form depending on the community needs and also train members on the basics of the tools. This helps communities take owner-ship and improve it for their own needs. » Forms can be created in Excel, and information can be collected easily by community members.	» Open source. » Can work offline and without phone signal. » Dynamic legend. » Comprehensive survey. » Can help define land-use conflicts (local communities, government and private sector). » Avoid private initiatives to overlap with the communities.	» Open source. » Multilingual (French and English). » Transparency element as users can upload and edit information. » Social networking element and story behind the maps. » Civil society can upload and edit data coming from different projects.	» The commu-nity itself. If you want to do forest monitoring, the best way to doing it is with the communities. » Participatory approach: the tool and icons are developed considering the community needs. » Get detailed and good-quality information gathered on the ground by the communities.	» Same as Sapelli. » Can be relatively easy to record information, as the icon system is fantastic. » Represent local spatial knowledge. » Agreements with the communities on data flow, cross-checking and ownership.	» Reduce bias in species identification: you can always play back recordings and ask some experts. » Enables cross-valida-tion. » Recordings are available for the future and for training of new surveyors. » Allows learning and interaction with specialist. » Low-cost tools. » Produce quality data. » Easy to use. » Automatic recording, and can record during the night or at peak activity times without interference of surveyors.	» Provides real-time interaction of the surveyor with the remote-sensing data from a particular area.	» Enhanced communica-tion. » Unexpected results (e.g. community in Guyana asked the govern-ment for extension of their territory as a result of PM). » Is a process that empowers communities and supports better resource management, well-being and development projects

	ODK	GEODK	MOABI DRC	SAPELLI	CYBERTRACKER	SOUND RECORDING	INTERACTIVE FOREST MONITORING	PARTICIPATORY MAPPING
4. Weaknesses and Challenges	» Internet may be needed in some part of the process or a local server. » Biggest barrier: problem-solving can be difficult for non-technical people. Depends on technical skills to solve problems. Every technology needs to develop an analytical framework to break down problems and solve them. » Exported data is not very easy to analyze. Need skills and need to know what you are looking for.	» Same as ODK. » Still needs extra features (e.g. trace track). » Results and data difficult to analyze. » Too much data can be collected. » Developers look just to one aspect and there is lack of a vision of the whole tool.	» Need Internet. » Need knowledge of informatics and GIS. » Find the right tools that can be used at the community level without Internet (ODK, etc.).	» Visualization of the data for analysis is not good yet. » The construction of the project itself is not user-friendly as you need specific code language (XML). » Localized and time-consuming. The impact of the tool is at the micro level and is case-specific. The idea is to tackle local issues.	» Unable to form a feedback group of those using it. » Ambiguity and uncertainty on open answers.	» Analysis of collected data is time-consuming as very large volumes are easily recorded. » Automatic assessment is still in its infancy as “signature calls” have a lot of variation due to behavioural issues but also due to location and additional noises being recorded.	» Better design of the tool is needed.	» It is difficult to get the information initially from the communities as there are power-relationships. » Participation is slow and builds on trust and there is no way you can do it quickly. » Conflicting interests and getting a single view is complicated. » Few leaders have power.
5. What are the key requirements to use the tool or approach in a community context?	» Needs to be simple enough for non-specialists to use. » Electricity, Internet (only to send data globally but not essential in the community level), smartphone with Android system, laptop, Excel software, power supply.	Same as ODK.	» Internet. » For field survey: smartphone with Android system. » Battery power. » Human: community knowledge to collect data.	» Smartphone with Android system. » Battery power. » Internet or network at some point. » Human: patience, ability to communicate and respect	» Smartphone with Android system. » Battery power. » Human: community knowledge to collect data.	» Recorders. » Memory cards. » Batteries. » Plastic bags.	» Mobile phone. » Battery. » Computer. » Internet (sometimes).	» Listen and have an open-minded approach. PM is a tool that could be used by anybody. » Depends on end result of PM. If wanted to use for advocacy, the requirements are higher.

	» Training. » Procedure and process need to be in place so people understand exactly what they need to do. » Community members need to be literate as there is some reading involved. » Budget.							» Trust in both directions. They need to trust the intermediaries and the users.

TABLE 2: WHAT TOOLS AND APPROACHES CAN BE USED FOR WHAT?

	ODK	GEOODK	MOABI DRC	SAPELLI	CYBERTRACKER	SOUND RECORDING	INTERACTIVE FOREST MONITORING	PARTICIPATORY MAPPING
Measure carbon (above- and below-ground biomass)	x	x		In development	x		x	x
Measure land cover	x	x		x	x		x	x
Verify remote-sensing imagery	x	x	x	x	x		x	x
Provide information on safeguards	x	x (leakages)	x	x	x	x	x	x
Comments and limitations	Can't use the polygon as reference in the phone.	Need Internet and three steps to convert shape files to GeoODK.	Sustainability: funding stream not secure. Need Internet, and it is more of an office-based tool.	Icons at the moment need to be adapted to community needs. A possible solution would be to add audio.	It is more challenging to programme than ODK.	Experience needed for listening; extracts the information digitally. Local people can be experts in learning the sounds.	Clear beep sound needed when recording needs to start. Needs GeoODK functionality for map reference.	Rain/water damage. Fragility. Managing papers is hard; reading others' handwriting could be difficult.

LESSONS LEARNED

This distillation from workshop discussions highlights some common lessons learned around developing and using technologies for community-based monitoring, reporting and verification related to communication, transparency and stakeholder engagement.

- **Develop questionnaires with the community in language that is simple and easy to understand.** This has helped communities take ownership of the process and use it for their own benefit. In Guyana, using ODK forms has helped them know exactly how much land they use for their livelihoods, as this was more than their own territory. Communities had the tools to show the location and extent of the area they are using and ask the government for an expansion of their territory.
- **Gather information that is relevant for communities and not just of interest to government.** Measuring carbon-related indexes for REDD+ may actually not be relevant for the community. Data on forest cover/carbon needs to be collected at the same time and related with data-pertaining matters that are meaningful/relevant to the communities (e.g. presence/absence of essential food item, health, water quality, etc.).
- **Develop clear procedures and protocols for the collection, verification, analysis and reporting of the data collected.** This was a key lesson learned from the GCP-NRDDB CMRV experience in Guyana. This also allowed for the crew collecting data to understand their roles and responsibilities in the overall project and MRV process. These procedures have helped in the second phase of the work in Guyana in which the NRDDB team is training on its own other indigenous communities (the Wai Wai) with the support of WWF-Guyana. These same procedures will form the basis of the new Global Canopy Programme project in Acre, Brazil.
- **Establish a local management team that understands the basics behind the technology so that the community trusts them.** It is important for a local team to have a basic level of capacity to be able to do adaptive management of the tools and the process so they can troubleshoot and come up with new solutions when experts are far away. This was the case in Guyana, where some of the NRDDB technicians found new ways of dealing with issues when on-site technical support wasn't available.
- **Have everyone - government, private sector, communities and REDD+ developers - at the same table to discuss land use and overlapping activities.** In DRC, the Moabi team decided to develop working groups, as participants realized that it was important to sit together. The communication between the different ministries in the government is key to moving forward in a country where there are more than 200 land uses that overlap in certain areas. Since the DRC team has worked with Moabi, this has changed as the platform is tool to help show conflicting information that was not previously evident.
- **It is easier than you think.** Using mobile phones for forest monitoring is not difficult, especially when using tools such as CyberTracker and Sapelli, which work with icons. NGOs and communities can do it. The more complex challenge is how to approach the participatory work (e.g. the political context).
- **Ensure flexibility when developing and implementing new tools with communities.** From planning and development through testing the tool with communities, there needs to be flexibility because things rarely go as planned. For instance, Sapelli is currently being tested in communities in the Amazon and the Congo Basin with local partners and communities, and it is difficult to adjust to everybody's needs and expectations.
- **Communication between tool developers and communities can be challenging.** When an application is developed, reporting back to the communities is a key requirement as developers can interpret these needs differently. In the ExCiteS group that is developing Sapelli, anthropologists are trying to improve communication and feedback with communities. On the other hand, some tool developers found it most rewarding to test the tools in the field with the end users so that they are able to see first-hand some of the issues users face in the field that the developers cannot foresee from their labs.
- **When working with participatory mapping it is important to take time to understand the local culture and power dynamics.** This was especially important in Indonesia where there are many different cultures and languages. Communities need to develop trust in order to engage in a participatory process and share local knowledge. Thus, effective communication and building trust is key. In order for participation to happen, either the level of communications must match the level of the majority of community members, or the level of the community members has to be brought up to a level that allows for their participation.
- **It is important to have a clear goal and objective for participatory mapping.** This method can be used for many purposes, so it is important first

to define with the community the purpose of the exercise. In Guyana, for instance, participatory mapping was specifically used for REDD+, but afterwards the information was used to claim more territory for the government – because, as a result of the mapping exercise, the communities realized that they were using more land than they originally thought. This highlights how participatory mapping can, by its own process, increase capacities and awareness of the potential uses the process may have both for communities as well as the government. In DRC, participatory mapping has led to a better understanding of spatial location activities and data interpretation. This is expected to help the national MRV system enhance its accuracy in the assessment of forest cover loss in forest areas.

- **In participatory mapping it is best to stay with the community until the map is finished.** Participatory mapping is a powerful and engaging process. People need time to build trust with the team and also to develop the map itself. In Guyana, the team stayed for a short period of time and then left the community and later came back to check in on the mapping process. The team would not recommend this approach and noted that it is best to stay and finalize the map of one community before moving on to the next one.
- **A map is a representation of a particular moment in time, and it changes constantly.** Developing a map of a community's natural resources and how they use them is a process that requires time and patience. The first baseline map will evolve as people move from one place to another, as new buildings are built and as new areas are used by the community. In Indonesia, maps developed with the communities took six months to two years to complete and were never 100 per cent accurate because of changes in land use, buildings and the communities. However, at a certain point, the communities had to stop making changes so that they could use the map for territorial claim purposes.

Workshop Observations: Power sources and the local bar

Brazil

In Acre, Brazil, the team often has no access to the power network and, in many cases, finds itself needing to charge devices in public establishments such as bars. This is cause for smiles and friction with relatives as some think this is simply a good excuse to go to a bar. A solution that has been implemented is the use of solar chargers. However, these cannot be plugged directly into the phones and require an inverter. Several phone batteries were burnt before the team understood what was going on. Solar packs with power are now being used to charge the phones. These are kept in sunlight during the day.

Guyana

In Guyana, those involved in forest monitoring didn't have power in their homes and needed to go to the local bar for two hours to charge their devices. This posed problems as some of their phones got stolen and also they had some discussions with their spouses about being in the bar so much!

TOOL ACCESSIBILITY, USE AND AFFORDABILITY

While tools and technology can improve the way communities and practitioners work, there are a number of questions and challenges that come along with these resources. These general observations highlight ways that tools can be more accessible, easy to use, and cost-effective.

Accessibility, ease of use and affordability:

- People work better with images when collecting data. The Sapelli example showcases how use of images enhances accessibility for non-literate communities.
- Tools need to work even without the Internet. In most of the cases tested, constant Internet access was not an option. Technical solutions must be available so that the tools can be used in real-world field conditions.
- Phones are not expensive but need to have charged batteries. This is a challenge if there is no electricity in a community.

Mobile phones can be problematic because some of the elements are taken for granted (e.g. electricity is often not available in communities). Therefore capacity for adaptation is needed. Technical training should cover not just the use of the specific phones but also all the moving parts that make the phones work. This includes the issue of the alternate power options (you need to know the type of power available in the area, if any; the phone specs; etc.).

How is technology good?

- Technology reduces clerical errors when collecting data.
- Technology simplifies many things – it makes data collection quick and easy to visualize, and many questions can be asked using one tool. But this is the case when technologies work, and they don't always work. Therefore, users should always have a backup system such as paper and pen and an independent GPS unit.
- Technology enhances communication in the communities when appropriate protocols and formats are used. If not, it can cause serious headaches.
- Some technologies can be helpful for social surveys and health surveys and to record illegal activities. In short, the CMRV framework can be used for social safeguards assessment if the right capacities, indicators and forms are available.

What are the caveats?

- New and improved versions of tools can have issues and lead to the need for more training and new kinds of problem-solving.
- Communities are not accustomed to constant changes in technology.
- Price and affordability: The software is often free, but communities need smartphones, tablets, batteries, Internet access, and training, all of which come at a cost. Web servers need to be paid for, and cloud space isn´t free.
- Training costs are high.
- Communities need to use the right technology. It is up to the communities to decide what is best for them depending on their needs, bearing in mind that technology is not always the answer.

LESSONS LEARNED

- Technology is a means to show the rest of the world that the data collected at the local level in remote areas of the world can be good and accurate.
- Technology in general solves more problems than it causes. The general opinion of tool experts is that the majority of the issues with technology can be overcome with proper training.
- That said, never underestimate the power of paper and pencil.

Workshop Observations: Is technology always good for CMRV?

"Technology can reduce errors in collecting data if well calibrated. However, if not, errors will become massive and what would have been a clerical error becomes a systematic one. Hence, technology is good for systematization, standardization and automation. However, accuracy will always depend on the human element. A key example is that if you go to the forest without calibrating the GPS in the phones, the human error would mean that the locations recorded are off target, and thus the technology fails."

Naikoa Aguilar-Amuchastegui, MRV Coordinator, WWF Forest and Climate Programme

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3 ENABLING CONDITIONS

COMMUNITY LEVEL

Enabling conditions can be defined as the circumstances that make REDD+ feasible. If the right mix of laws, international frameworks, know-how and infrastructure is in place, then REDD+ can be successful. In addition to policies, conditions also mean local capacity, information dissemination, and skills needed to make sure that community-based monitoring is well-designed, implemented, and understood, without causing unintended impacts or being prevented by practical or political challenges.[5]

Monitoring forests can bring about multiple benefits for communities, including:

1. Knowing the status of plants and animals communities use for their food and medicine
2. Improving their livelihoods
3. Conserving biodiversity
4. Understanding the process behind deforestation
5. Building local capacity and empowering local people
6. Informing decision-making at the local level
7. Facilitating adaptive management and providing data for national and international monitoring systems.[6]

Working with communities to collect data that is useful for national MRV reporting also poses several challenges. The primary challenge is that there is a basic need to develop trust between the different parties. Unfortunately, in some places there is a history of governments disrespecting the rights of indigenous peoples over their territories. Communities need to feel able to define the forest monitoring process that is most relevant to them, to identify their data needs and to build their capacity so they are empowered and can use the collected information for their own benefit. There are some considerations that need to be in place from institutional arrangements, communication and information flow.

1. **Communication flow.** Avoid the use of acronyms and complex technical terms. When you use overly technical terms you are building a wall in the communication. Go back to the essentials and keep communication as straightforward as possible, both with communities and governments. In complex situations where there is a disagreement between government

5 Enabling conditions: Supporting the transition to a global green economy, UNEP, 2011

6 Hawthorne SD and Boissière M. 2014. Literature review of participatory measurement, reporting and verification (PMRV). Working Paper 152. Bogor, Indonesia: CIFOR.

and communities, transparency is key and both parties need to recognize their mistakes in their approaches, methodologies and results. Transparency can help establish where you are in the MRV process, what data you have and how you collected it. When this happens, people can come forward and offer help improve the data rather than the government needing to go to the community and ask for their collaboration. By doing so you are making them part of the process. Governments should acknowledge that data collection for REDD+ is complex and should ask for the help of other organizations and communities when needed. In this way, everyone is on the same page.

2. **Collecting official information where indigenous people have control over their territory.** In Guyana, the Amerindians have titles over their land, and in the case of the Rupununi District the land is totally controlled by the community. In this situation it is necessary to integrate the community in the field data collection process rather than bringing in technicians from the government to do so.

3. **Land tenure and boundary delimitation.** It is important to define who is doing what and where. In Guyana, the government has found this to be a contentious issue in some communities, and this has been a challenge for the government in how to define territorial boundaries throughout the entire area. Knowing where communities use resources can empower them in their negotiations with the government.

4. **Relationship between the communities and the government.** Monitoring forests is important for the government and for communities. While the government needs to report on carbon emissions for REDD+, communities need to focus on their livelihoods, and both are interlinked. Communities are often the best ones to monitor forests; carbon data is not more important than community needs and should not be separated from safeguards.

5. **Different priorities between government and community about what needs to be recorded.** Community MRV or other types of forest monitoring are beneficial for both government and communities. For REDD+ mitigation and adaptation action it is important to monitor carbon, but there are other elements that communities would like to monitor that it is more related to their needs (e.g medicinal plants, food, etc). A solution is to set up a system for the government and the community that allows both to move in the right direction to achieve the same goals. MRV should be linked to mitigation action and impact monitoring, not just carbon quantification. The use of data and analysis should be useful both for the government and the communities.

6. **Integrating MRV at the community level with the national efforts.** In Peru, the government made progress on defining an initial carbon stock map using existing information at the project and programme levels. However, there is no political will to incorporate communities into this national accounting. There is a need to develop a joint agenda so that communities can validate information that is collected by the government.

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LINKING LOCAL AND NATIONAL MONITORING SYSTEMS

Community forest monitoring is an essential process that should be put in place in forest countries that are engaged in REDD+. However, there can be gaps between what is recorded at the local level by the communities and the national reporting needs for MRV to the United Nations and/or other donors. There are several challenges and enabling conditions that need to be in place at the policy and institutional levels for CMRV to be useful for REDD+. The key enabling conditions that were considered are:

1. **Adequate institutional frameworks.** Participants identified mutual trust as a cornerstone for CMRV to be able to link with national MRV. Information flow between different ministries within the national and local governments, communities and projects is essential. Communication needs to be delivered with an intercultural approach, with clear rules and roles, and in an appropriate format and language and should consider different forms of communication (radio, consultation meetings, maps, Internet, etc.).

Major aspects of institutional arrangements include:

- A legal framework that can help support institutional arrangements between the different stakeholders
- Consistent protocols for how to implement the linkages between CMRV activities and the national MRV system. The governments and the communities need to comply with these protocols.

2. **Transparency.** Transparency is related to data-sharing issues and the importance of monitoring and evaluation. Participants highlighted on many occasions how accessibility to government data was very important to the community. Usually CMRV is seen as a one-directional information flow from communities to the national MRV system. However, communities can and should be able to capitalize on the use of national MRV data to evaluate and assess their progress toward self-established goals. Being able to do so builds up trust and capacity and enhances information flow. Additionally, communities are entitled to access if the data they have provided is being used in the right way.

3. **Funding.** We need to have the right resources in place to implement these systems, and money needs to flow down from the international, national and local levels. The most ideal situation would be to have a national fund for this work and to focus on sustainable finance. However, communities and governments need to come up with a joint strategy because the issue of funding is also present at the national MRV level. So far, most if not all MRV activities (community-based or not) have been financed by projects. Long-term sustainability of the systems and processes is a key issue that will need to be addressed in a strategic way. Otherwise, current successes like the Guyana NRDDB example may stagnate or fall apart. This is also linked with the issue of long-term capacity building to ensure that capacities remain in place and are resilient.

4. **Capacity building.** Communities need to receive adequate and continuous training in the many different aspects of CMRV so that technology can be incorporated in a sound way. This aspect needs to receive special attention and funding, as it is a cornerstone of the CMRV system. However, funding alone will not be sufficient to deal with this issue. A sound strategy needs to be developed and implemented for CMRV and also for the national MRV as mentioned in the previous point about financing. Technical trainings alone are not enough, and a resilient system that incorporates capacity building and training as part of the overall MRV process needs to be put in place. Partnerships with local academic institutions was highlighted as a possibility.

CHALLENGES AND APPROACHES

The integration of the data collected at the community level into national MRV systems poses many challenges that greatly depend on the sociocultural, political and economic contexts of each country. There are no general formulas to integrate data collected by communities into national MRV systems. What is important is to analyze the key driving forces of each sector in the country. Government representatives from Colombia, Peru, Guyana, Ecuador, Mexico and Acre, Brazil, reflected upon these challenges and provide a collective view of some solutions in the following section.

In Guyana, key challenges are related to trust, methodologies and equipment, and data sharing. REDD+ was first implemented at the national level and also at the project level with different time frames. The work on CMRV with communities of North Rupununi was part of a project coordinated by the NGO Global Canopy Programme, and the project is part of the REDD+ Community Demonstration site. Methodologies developed for collecting forest data differed between the government and the project, and efforts were duplicated. This was because the

government was developing its definition of forests and inventory during the project time frame, and in the absence of guidance the project followed methodologies defined by Iwokrama. Now forests were reassessed and inventory guidelines were defined by the government and are the ones being used by community. Finally, the data sharing was a challenge in itself, as the government did not have adequate protocols at the time to pass the information it had collected back to the communities. The government did not collect data on community land; it provided satellite data to the community as part of the MOU with NRDDB.

In Acre, Brazil, a major challenge was building trust among the different stakeholders.

In Colombia, armed conflicts and security issues are an enormous challenge as the government and NGOs cannot monitor agricultural expansion in an accurate way. Thus the official data and the community data often don't match up.

In Peru, a key challenge is to come to political decisions about how to integrate community data into the national processes.

Challenges related to working with governments and community-based monitoring, reporting and verification include:

Government institutions and departments often have separate databases, so inter-government communication is not easy. In Acre, there are many public policies implemented with different communities, but the information is not organized. This is also the case in many REDD+ countries in which REDD+ implementation and MRV end up needing combinations and collaboration of technical team members from different ministries and agencies.

Focused monitoring supply chains for forest products. When monitoring deforestation, it is important to know what is happening in the forest. Different parts of the supply chains are receiving the benefits, but data characterizing the amounts and recipients is not always available. In Acre, communities have complained about this gap, but the government has not yet organized the information.

Access to remote areas for "ground truthing" remote-sensing data. In Acre, the government is developing maps, but it is difficult to determine how accurate they are. This is why working with the communities could be key as they can review and validate government information. This could also improve information about roads and may help the government facilitate better access to health services, educational resources and other types of assistance.

Government information is diluted and there is a lack of communication. In Acre, the government does not have a monitoring and evaluation scheme. There is also little transparency in sharing what is happening with communities.

Armed conflicts and security issues in monitoring agricultural expansion. In Colombia, the armed conflict is a key constraint in establishing processes for forest monitoring. Corpo-Amazonia, a subregional government institution, knows the actual forest status but had difficulties in establishing monitoring processes. There is sufficient information at the local level, which was built with the communities, but it differs from the official information. The government has problems establishing monitoring processes with the communities as access to certain lands is not permitted by the illegal armed forces that control each area, and, when possible, the information that is obtained is not accurate as illegal agriculture is not reported, especially in areas where there are illicit crops (e.g. coca leaf or poppy).

Access to technology and low technical capacity. In Colombia, few professionals that manage complex technologies are willing to share their expertise with others as a means of controlling this knowledge for their own benefit. This means that it is a challenge to maintain an adequate number of technical experts in a country. This issue is exacerbated by the fact most technical staff work in non-permanent positions or have short-term contracts linked with funding coming from short-term projects. This has been the case as well in most of the REDD+ countries in which capacity for MRV is financed by foreign cooperation packages.

Divided competencies in different government institutions. In Peru, the environmental issues are defined by the Ministry of the Environment, but forest management issues fall within the Ministry of Agriculture. So from the central government there are different competencies, and consensus between these two groups is vital in order to progress. In this case, both ministries did come together to determine national forest inventory.

Recommendations:

Develop a national system with clear guidance before starting projects. In Guyana, national MRV and CMRV were conducted a year apart, and there was lack of communication between the two processes. This resulted in having different methodologies for collecting carbon and monitoring forests.

Ensure sufficient time for training. In Guyana, trainings for communities lasted just three days. This was not enough time for community members to understand the whole, complex process of forest monitoring and CMRV.

A list of technologies and their characteristics should be available to the communities from the inception phase. With the information available to them, communities can decide (with the supporting technicians) what is most relevant and meaningful to them. In DRC, communities need to feel that they are fully responsible in the process they are getting into.

Develop a good governance system for CMRV with government, communities, the private sector and NGOs. This is especially important when there are several stakeholders that are interested in forest monitoring. In Indonesia, the government, private sector and communities need to sit together to agree on rights to the forest. In these situations, intermediary agencies and groups such as NGOs, universities and civil society can press the government to have open communications between stakeholders. It is necessary to have a good governance system in place before a forest inventory protocol can happen. To ensure sustainability of a governance system, a capacity-building strategy must also be defined and implemented.

Government needs to develop policies for communities and needs to think about what is important to them. In Brazil, there is an absence of consistent information gathering and sharing between policymakers and communities. Government time scales and budgets don't take into consideration the complexities of working with communities that need more time, dialogue, training and agreements to achieve mutual benefits.

Government structures need to integrate socio-environmental issues and work in a holistic manner. This is often a challenge when governments have different offices overseeing environmental and social issues. In Peru, for example, the Ministry of Environment works separately from the agricultural sector and the indigenous peoples' office. Integrating the work of these offices for REDD+ is a long-term process and cannot be done through just one government office.

In places with armed conflicts, be sure to involve all parties at talks at the regional or local level. All stakeholders need to be acknowledges in the process.

Identify means and ways of carrying out forest monitoring that are aligned with each territory and their culture and way of life. For instance, illegal agriculture generates money that is not reflected at the local level but causes local prices and living costs to increase.

In summary, some key guidelines to overcome the mentioned challenges include:

1. Establishing clear roles and responsibilities and identifying what part of MRV will be tackled;

2. Providing clarity on the data different parties are interested in collecting;

3. Defining protocols for data sharing;

4. Ensuring that communities are organized internally before embarking on this work;

5. Confirming that all stakeholders are committed to transparency and mutual access to data;

6. Establishing long-term capacity strategies;

7. Matching technologies with the work context (e.g. access to power or Internet, community capacities).

4

CASE STUDY: COMMUNITY-BASED FOREST MONITORING IN NORTH RUPUNUNI, GUYANA

Guyana has a very small population of about 800,000 in an area about the size of the United Kingdom. After Suriname, it has the lowest population density of any moist tropical country. With all the natural resources and so few people it's a place where one would expect prosperity, but in fact the gross domestic product per capita is one of the lowest in the region. Guyana has widespread alluvial gold deposits, and the big jump in gold prices over the past few years has grown the economy but put enormous pressure on Guyana's forests.

Community-based monitoring work is particularly important in Guyana because it focuses on building skills that are valuable to the communities both for REDD+ and beyond. Guyana's indigenous communities remain highly dependent on natural resources – farming, hunting, and fishing. The fact is that indigenous populations all over the country are growing, while their titled land is finite, so there is growing pressure on their natural resources. Community-monitoring work helps communities build their skills to monitor the resources that are important to them, and to recognize when their resources are threatened. That enables them to be proactive and develop plans to manage their resources before they disappear. REDD+ is not just carbon and forests, it is about fish stocks, and wildlife populations and community health and well-being.[7]

Workshop Observations: CMRV is key in Guyana

Ten per cent of the total population of Guyana is indigenous and own 13.9 per cent of the forests in the country.

Since 2011, the North Rupununi District Development Board, the Iwokrama International Centre for Rainforest Conservation and Development, and the Global Canopy Programme have been working with 16 Amerindian communities to build local capacity to develop and run a CMRV system.

The project has been building capacity for a local project management team and a total of 32 community members working as data collectors, to successfully run a community-based monitoring system. This system uses mobile data collection – smartphones and open-source software (Open Data Kit).

What to monitor? Building on baseline data in the region and previous monitoring initiatives[8], NRDDB, Iwokrama and GCP set out to develop a participatory monitoring approach appropriate to the specific goals of the community MRV process. At workshops held in November 2011, Toshaos[9] and village councillors brainstormed and prioritized what they wanted to monitor and the main management issues in their villages.

From the list that resulted, priorities were selected with the Toshaos to agree on a realistic set of monitoring activities that would provide relevant information both for evaluating REDD+ impacts (potential and future) and also to contribute to management decisions at the village and district levels. The indicators that were agreed upon were related to natural resources, forest change, well-being and impacts. A survey indicated that 85 per cent of the people thought that the monitoring framework established reflected the priorities of the community.

What are the data-sharing protocols? Sharing community data is a sensitive issue, and clear rules need to be developed to avoid misunderstandings. For this reason the NRDDB team decided to develop a data-sharing protocol based on consultation processes and approval by the community. The information collected was classified as:

- Green: Data that can be shared because it has already been agreed upon with the community or has received the community's approval.
- Yellow: Data that is still unclearly classified and requires some process of consultation to clarify its status and the terms under which it can be used.
- Red: Data that is sensitive and that requires approval by the community before it can be shared; its use may be limited in many ways.

What is the data for? The data collected provides local communities with information on drivers of forest loss, changing land-use practices and socio-economic realities. This information can help improve management strategies and strengthen local institutions as well as inform external intervention programmes. Additionally, it can be integrated into wider initiatives for REDD+ currently being developed in Guyana as part of its Low Carbon Development Strategy (LCDS).

The CMRV project has also been working closely with the Guyana Forestry Commission in testing and demonstrating the efficacy and value of community-based monitoring approaches as part of efforts to inform the development of the national monitoring, reporting and verification system, and in order to support Amerindian participation in the proposed opt-in mechanism for REDD+ in Guyana.

Further training is taking place in North Rupununi to continue to improve local capacity to independently carry out monitoring activities. There is also an emphasis on working with the Toshaos and village councils to integrate the monitoring data into local development and resource management plans.

NRDDB established itself as the technical expert to deliver CMRV in Guyana. Because of the know-how they gained in North Rupununi with the 16 communities, the local project management team has provided training for the WaiWai, which own 1.5 million acres of the Kanashen Community Owned Conservation Area (five per cent of Guyana) on CMRV. The team also shared their experiences in Acre, Brazil.

7 NRDDB presentation by Brian Allicock and GCP website.

8 Including work from Iwokrama biodiversity monitoring surveys, Project Fauna, Makushi Research Unit, Project Cobra, Newcastle University, the Smithsonian Institution, Conservation International, the Royal Ontario Museum and the Wapichan people, among others.

9 In accordance with the Amerindian Act, 2006, the National Toshaos Council (NTC) was established as a body corporate comprising all Toshaos (leaders of Amerindian communities) whose function is to promote governance, define strategies to reduce poverty, provide health and education to communities, and promote conservation and sustainable use of their resources.

Courtesy North Rupununi District Development Board

INFORMATION MONITORED BY PROJECT CREW IN NORTH RUPUNUNI

THEME	INFORMATION TO GATHER	INTEREST		
		COMMUNITY	GOVERNMENT	INTERNATIONAL COMMUNITY
Natural Resources	**Community Resources** Mapping of land cover and natural land use	xx	x	x
	Natural Resource Use & Availability Habits, status and trends in extractions of natural products (game, fish, timber, NTFPs), with a focus on declining species	xx	x	xx
	Freshwater Quality and Quantity	xx	x	x
Forest Change	**Traditional Farming** Makushi farming practices and trends	xx	xx	xx
	Drivers of Forest Change Type, location and area of deforestation and degradation per year	xx	xx	x
	Biomass Carbon stocks in different fallow and primary forests	xx	xx	xx
	Ground-verification Ground-truthing of forest changes detected by satellite imagery	x	xx	x
Wellbeing	**Wellbeing** Status and changes in community wellbeing including health, education, wealth, social issues, cooperation, happiness	x	x	xx
	Mapping of Community Infrastructure Location of houses, schools, churches, health clinics, businesses, roads, landing strips, other	xx	x	x
Impacts	**Project Impacts** Evaluation of changes in knowledge, technical capacity and wellbeing as a result of MCRV	xx	x	xx

5 KEY TAKEAWAYS

The interconnections between community, political, sociocultural and environmental issues are all very apparent when working with CMRV. Technology may be part of this work, but that depends on the community needs and decisions about the best way for them to monitor their forests. In short, technology is not the defining factor in determining whether CMRV takes place or not. Throughout the discussions with community members, government and REDD+ practitioners, common themes and ideas arose around key messages on this topic.

KEY TAKEAWAYS

1. **Community forest monitoring cannot be a part of the national MRV system if there is no political will to incorporate these vital stakeholders into REDD+ implementation.** The tools presented in this report are circumstantial, and if the political will exists, information will flow through whatever means are available. If there is no political will to collaborate, no tool will be able to solve the deadlock on its own. Clear rules of engagement as well as adequate institutional frameworks are vital first steps when working with CMRV.

2. **To achieve an effective CMRV, it is vital to first reach consensus with all stakeholders on the basics of the work.** Before engaging in REDD+ and CMRV, primary stakeholders should be identified and invited to discuss their specific needs, what type of information will be collected, how this information will be handled, who will have access to it and for what purposes and, finally, how the benefits will be distributed. The direct stakeholders are communities and the government, and additional stakeholders may include the private sector, NGOs, developers, and the media and broader society.

3. **Information gathered should be relevant to both communities and the government.** The needs, interests and obligations from communities and government around collecting forest data are generally different. On one hand, communities may be interested in recording data on aspects that are relevant to their livelihoods, such as presence of medicinal plants, certain animals that they eat, non-forest products, local governance issues, land-use planning, etc. On the other hand, governments are more interested in carbon accounting and stocks and other indicators of forest degradation and deforestation to report on their national REDD+ status to international bodies such as the UNFCCC or the World Bank. It is essential that data collection reflects both community and government needs.

4. **The data collection method should be appropriate and relevant for communities.** Data collection can be done many ways: from paper and pencil to more advanced technology such as mobile phones with GPS and specific applications. When using technology, the tools and applications should be selected according to local and national needs and should work in harmony with the developers who are creating and updating these tools. It is also important to agree upon a standard delivery format for collecting data – this can often be more important than the data collection method itself.

5. **There must be a clear end use for the data that was collected and an agreed-upon understanding of how the communities benefit from gathering this data.** This is essential to developing motivation for communities to participate in CMRV. Data-sharing protocols need to be clearly defined from the beginning through a participatory process.

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6 CONCLUSIONS

Understanding a forest's past, present and future health is one of the most important aspects of REDD+. Without methods to assess and quantify how much carbon trees can absorb – the measurement, reporting and verification of emissions reductions using both remote sensing and ground-based data – there can be no verified validation of the impact of REDD+ on a landscape, and no trust in the process.

Forest and forest-dependent communities are key players in doing this work well. Monitoring tools need to be flexible, accessible and appropriate for the context. Technical tools must be developed taking the local situation, local technicians and local capacities into consideration. No single standard or approach for community-based monitoring will suit the needs of all countries, regions or stakeholders because each setting enters the process with its own unique set of technical capacities, social and political realities, and geographic conditions. Even if they are effective, tools that are not appropriate for a specific community or its context will hinder the work and the community's engagement with the technical capacity-building process.

Community-based action is an important part of forest monitoring and addressing safeguards. However, just like REDD+, community-based monitoring is constantly evolving. We hope that the technologies, lessons learned, and recommendations here are useful to those working on forest and climate issues, and we look forward to collaborating with practitioners, policy makers and others around the world to keep this dialogue open.

This report is the result of work and participation of many people and institutions. In particular, we would like to acknowledge the workshop participants who shared their time and talents to help define a common understanding of community-based monitoring reporting and verification along with real-world experiences, feedback and ideas for how to do it better. Without your contributions, this process would not have been possible - thank you.

7 FURTHER READING AND RESOURCES

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WORKSHOP ORGANIZERS

WWF

SilvaCarbon

GCP GLOBAL CANOPY PROGRAMME

WWF's Forest and Climate Programme works to ensure that the conservation of tropical forests as carbon stores is secured by green economic development that benefits people, the climate and biodiversity in transformational ways.

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Why we are here
To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.

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