MAPPING COMMUNITY LANDS AND NATURAL RESOURCES

Making maps is a central part of the community land protection process. Maps provide powerful documentary evidence of a community's claims to lands and natural resources. Maps are also useful for community management of land and resources: when communities can see and conceptualize their whole territory, they can make better decisions about how to manage their lands and natural resources equitably and sustainably.

Maps should not be thought of as only an output; they are also an important tool for communities to use throughout the process and in their discussions about land and resources. Maps can help to:

- Inform discussions about land and resources;
- Show connections between a community's lands and larger systems (e.g., river system, ecosystems);
- Clarify boundaries between communities and their neighbors;
- Identify and catalogue natural resources located within a common area;
- Clarify the location of historical and cultural sites (traditional authorities/spiritual leaders may choose to map sacred sites to protect them); and
- Reduce land and natural resource conflict by increasing transparency, supporting clear use agreements, and promoting collaborative natural resources management, both within and between communities.

THE POWER OF MAPS

In Uganda, community members found map-making helpful, explaining how the mapping activities "made those who did not know of the communal land boundaries become aware" and helped them to feel a new sense of tenure security. A focus group of elders reflected that "a map helps to protect our land from outsiders." In Liberia, community members explained how "Drawing the map was very helpful because we knew where the companies are, where our resources are, and also where borders are. Now we have peace among ourselves." Community elders were especially pleased with the mapping efforts. They expressed satisfaction that the traditional sites were included on the maps. One elder said: "We now know where all our [cultural] places are; no one can say 'I don't know,' because we all can see it here on this paper. This will help strengthen our [practices] again." Another elder expressed a personal satisfaction that for the first time, "I have been able to see our whole community on a paper. All the places I used to visit; even if I can't go there anymore, they look near and real to me now. I am very happy."

HOW TO SUPPORT COMMUNITIES TO MAKE MAPS?

There are three main ways to work with communities to create maps of their lands and natural resources:

1. **Sketch mapping** involves community members drawing pictures of their lands and natural resources on a large piece of paper. The exercise can help to create a general understanding of the community's spatial layout and promote discussion of land and natural resources management. However, sketch maps are difficult to use to identify specific locations or distances.
2. **Satellite imagery mapping** involves using printed, high-resolution photographs of the community's lands taken from satellites. This imagery shows community lands and natural resources in detail and can be used to create maps that are more accurate and useful for calculating distance and area. In this strategy, community members draw maps on top of printed satellite imagery.
3. **Digital mapping** involves using mapping software to create digital maps of a community's spatial information. In some approaches, the software can be used to project satellite imagery from a computer onto a large screen, where community members can interact with it and identify features and areas that they use. As community members agree on the locations of features they want to map, facilitators create digital marks on the imagery using the software on their computer. Digital maps have the same benefits of satellite imagery mapping, but without the need to print imagery. This strategy requires mapping software, satellite imagery, a projector, a computer, and a screen to project the image onto.

This chapter explains how to prepare for, facilitate, and manage data from all three of these mapping methodologies.

The choice of mapping method will depend on each community's context, the resources available to facilitators, and the expected output or use of the map. For example, for nomadic or pastoralist communities that move over very large distances, it may be most useful to draw sketch maps and then use digital mapping or GPS to record uses and routes, as the land may be too large to print onto one map. For areas that have dense forest cover, satellite imagery may not be able to show enough detail to be useful – sketch mapping may be the only appropriate methodology. In some contexts, it may be useful to begin with sketch maps and then use satellite imagery or digital mapping later (in the same meeting or in a second meeting). Finally, it is important to consider any mapping requirements for official registration – governments often have technical requirements for maps that are used as evidence for registration or documentation of rights.

Some mapping methods require significant preparation time, so facilitating organizations should decide on which mapping method(s) will be used **at least one month before community mapping** begins.

WHAT ARE GENERAL STRATEGIES FOR SUCCESSFUL COMMUNITY MAPPING?

Regardless of mapping method, the following strategies will be helpful when undertaking community mapping activities:

1. **Carefully decide when to start mapping.** Facilitators should assess the degree of intra-community conflict and decide whether to start mapping immediately after finishing the "Laying the Groundwork" phase or to wait until the community has adopted its by-laws and elected a Land Governance Council that can peacefully resolve internal community land conflicts that may arise while mapping.
2. **Establish trust before beginning any mapping activities.** Communities may not feel comfortable mapping their lands and natural resources because maps might share sensitive information with outsiders. Mapping should only be undertaken after a community fully trusts both the process and the facilitation team. Before beginning mapping activities, spend time with the community talking about why maps are important and beneficial. If mapping is a highly sensitive topic, discuss mapping options with trusted community leaders and ask them to hold a community meeting to discuss mapping without the facilitators present. Do not require the community to draw maps if it does not want to or if it does not yet feel ready to map.
3. **Involve everyone.** All mapping activities should involve the whole community, including leaders, elders, women, youth and all relevant stakeholders. To prevent conflict, the entire community should be involved with all mapping activities until all boundaries are harmonized and land conflicts resolved. All maps should be publicly discussed to ensure that everything has been mapped fairly and accurately.

THE IMPORTANCE OF BUILDING TRUST BEFORE MAPPING

In Uganda, initial efforts to map communities' grazing lands raised suspicions because some community members feared that the facilitating organization was scheming to grab their lands. These first maps were made during scoping visits, in meetings attended by only facilitators and community leaders. Afterwards, facilitators heard community members make statements such as: "The map has been taken, expect the worst!"

Later, facilitators carried out mapping exercises again, this time with the whole community, but before trust had been established. This map-making process also aroused immediate suspicions. Community members were hesitant to admit that any common grazing land remained, as they feared that by identifying their grazing land's existence they would expose it to land grabs by regional elites.

Many months later, after developing more trust with the facilitators and completing the harmonizing of boundaries of the grazing lands, communities met again to re-draw their map. This time, the post-boundary harmonization mapping efforts drew wide approval from community members.

4. **Avoid situations where a leader or a group of leaders draw(s) a map without the community present.** Facilitators may not be aware of how trusted the leaders are. Corrupt leaders may draw a map that community members do not agree with, or one that does not accurately reflect accepted land use and management practices.
5. **Put the community in control.** Community members, not outside facilitators, should always draw the maps. If possible, do mapping activities outside to allow people to practice drawing in the earth (before putting pen to paper) and gesture to locations. Allow community members to draw whatever they choose on their maps and to leave out whatever they do not want to include. For example, communities may not want to map the location of valuable natural resources out of concern that doing so would expose these resources to appropriation by outsiders. Similarly, communities may want to keep the location of sacred sites hidden. In such instances, facilitators can ask communities to indicate "general areas" that require specific protection, leaving the description of the area vague.
6. **Secure community agreement to stay focused on mapping and resolve conflicts later.** Mapping is not a neutral activity and can sometimes inflame conflict, especially in situations where community members have taken community lands without permission or in bad faith. Mapping activities may also motivate encroachers to work to sabotage their community's land documentation efforts. To proactively address such challenges:

- Before beginning mapping activities, revisit the community's Terms of Engagement and review how the community will deal with any intra-community sabotage/internal conflicts that arise. If the community does not have a plan, support it to make a plan before the mapping starts.
- Come prepared with conflict mediation strategies.
- When introducing mapping, ask community members to mark disputed areas on the map as "hot spots" and refrain from discussing the conflict further until a proper conflict resolution process at a later date.
- Explain that mapping alone does not decide the boundaries – negotiations and community approval are still needed before boundaries are agreed.

7. **Highlight women's contributions.** To ensure that all voices are heard, facilitators may need to divide women and men into separate groups to draw maps. Women tend to know the location of certain natural resources that men may not be aware of. As a result, their maps tend to be more thorough than men's maps. As women share their maps, facilitators can highlight women's contributions to emphasize the importance of women's active involvement in all community land protection activities.
8. **Involve traditional leaders.** Make sure that traditional authorities and other "knowledge-holders" who carry information about sacred sites and particular natural resources are involved and given space to speak. The involvement of respected traditional leaders can strengthen the map's legitimacy.
9. **Ensure that the maps are kept safe by trusted community members.** Always leave the maps – or copies of the maps – with the community.

10. **Help community members plan whether to keep their maps private or to share them publicly.** Communities may be concerned that drawing a map will expose information about their lands and natural resources to investors or government officials who may grab them in bad faith. Emphasize that the community can choose whether and how to share its maps outside of the community. Make it clear that the communities do not have to show their maps to anyone – they can keep their maps in the community, for community use only. Even facilitating organizations must get clear permission from the community before taking photographs or making copies of the maps.

11. **Encourage communities to use their maps throughout the community land protection process.** A community should feel that its map is a living record that can be updated to reflect changes in the community and landscape. Regardless of the type of mapping method used, communities may want to revisit their map throughout the process. For example:

- The community may want to add detail to its map by holding mapping exercises at the village or sub-unit level and adding this information to the community map.
- Maps can be helpful when brainstorming community by-laws: because the map includes all the natural resources located within the community, it can serve as a picture of all of the resources that should have rules to govern their sustainable use and management (see the chapter on *Community By-Laws and Legal Education*).
- Communities can use their maps to identify zones of land use, such as setting aside an area for a reserve forest or choosing an area in which to locate commercial enterprises (see the chapter on *Making a Zoning Plan*).
- Once a community and its neighbors agree on boundaries, it should record the harmonized boundaries on its map (see the chapter on *Documenting Agreed Boundaries*).

PRIVACY AND DATA SECURITY

Communities may not want maps of their lands to be available to outsiders. The creation of paper or digital maps may raise concerns about information privacy. It is important that communities formally agree to having their map information stored, shared, or digitized. Communities and facilitating organizations should make clear, written agreements concerning who can access the data, when, and through what approval process. To suport these decisions:

- Prepare a clear explanation of how the community's data will be stored, how community members can access the data or digital map, and what procedures and permissions are necessary to allow access or data sharing to anyone other than the community's appointed representatives.
- If using a physical hard drive, develop a protocol for who can access the data and how to keep it secure.
- Because physical data storage devices can be vulnerable to theft or damage, consider making a back-up copy of all files and storing this somewhere secure, like a safety deposit box or safe.
- Consider storing data in a cloud-based server (such as Dropbox or Google Drive). Before choosing a server, research the data privacy and data access controls of any cloud storage system or discuss it with partner organizations or GIS/data management professionals.

SKETCH MAPPING

Sketch mapping is the simplest and most accessible form of mapping. Sketch mapping activities take about three hours and the only materials required are large pieces of paper and colored markers. However, sketch maps do not show accurate size, distance and spatial location. They may also be difficult for people outside the community to understand.

Step 1: Prepare by reviewing the general spatial layout of the community. Look at satellite imagery or existing maps before the meeting to become familiar with the landscape.

Step 2: Hold a community-wide meeting with representatives from all sub-units within the community or who use the community land. Work with community leadership and Community Land Mobilizers to ensure that women, youth, elders, leaders, and all relevant stakeholders attend and take part in this meeting. Before the meeting, explain the mapping activity to leaders and Mobilizers and ask them to help explain the activity in a way that will address any potential concerns.

Describe the steps of the mapping activity. It may be helpful to draw a sample map (of an imaginary community) to demonstrate the end goal of the activity. Describe the benefits and potential challenges of mapping. Facilitators might also ask communities to:

- Think about the benefits and dangers of mapping valuable natural resources and sacred sites, and only map what they are comfortable mapping;
- Agree to simply mark conflicted areas on the map, avoid discussing them, and to commit to a proper conflict resolution process at a later date;
- Make a plan for how they will keep their map safe and private; and
- Decide whether the facilitators can take a photograph of the map for their records.

Allow community members to ask any questions they have about the activity. Address all concerns and do not begin mapping until everyone feels comfortable making maps.

Step 3: Agree on what should be on the map. Ask the community to brainstorm a list of things to include on its map. Write down the brainstormed list to reference during the activity. Community maps often include:

PHYSICAL FEATURES, NATURAL RESOURCES	INFRASTRUCTURE	SOCIAL FACTORS

• Major landmarks (roads, rivers, mountains etc.)
• Boundaries of community
• Boundaries of communal land areas
• Rivers, lakes, streams, ponds, wells/boreholes
• Wetlands, swamps, bogs
• Pasture/grazing areas (used in different seasons), livestock rest areas
• Planted crops and garden areas
• Dry areas and wet areas
• Seasonal use areas
• Forests
• Places to gather food, medicinal herbs, building materials, etc.
• Areas where wildlife gather or migrate
	• Settlement areas
	• Shops and markets
	• Roads/Paths/Trails
	• Schools
	• Churches
	• Clinics or other facilities
	• Farm/livestock infrastructure
	• Offices of governments, NGOs or other institutions
	• Areas given to companies or outsiders for any purpose (such as mining, tourism, logging)
		• Neighboring communities
		• Sacred/religious, cultural, and historical sites
		• Places that are fenced or private land
		• Conflicts: Places and resources in dispute (Mark in red)
		• Access routes (including ones used by pastoralists or other migratory groups)
		• Movements (can be shown on the same or another map, mark the direction with arrows if destinations are off the map)
		  ◦ Places where outsiders enter
		  ◦ Places where villagers go outside the boundaries to access land or natural resources

An example of a Sketch map.

Step 4: Divide the meeting into small groups (by village, or by women, men, and youth) to draw sketch maps. Provide each group with several sheets of blank paper and colored markers. Ask the members of each group to draw a representation of how they understand the landscape of their community. Facilitators and Community Land Mobilizers should pick a group and stay with it throughout the map-drawing efforts, offering support as necessary. During the sketch-mapping process, facilitators should:

- Invite the groups to begin the process by using a stick to sketch the map into the earth – this may help people feel more comfortable drawing maps with pens and paper. Alternatively, bring lots of paper, so that groups can draw and re-draw their maps until everyone agrees.
- Ask groups to draw a legend – a list of what they will map, with a corresponding symbol or color that they will use when drawing each item to indicate each item on the list.
- Once a group feels ready to draw their final group sketch map, ask the group to choose an artist (or a few artists) to do the drawing, guided by the group's inputs and instructions. Remind groups that everyone should contribute and that the maps should be as clear, detailed and accurate as possible.
- Make sure the map is labeled with community name, group, and date.
- Encourage community members to include notes about landmarks that define boundaries or particular locations (such as roads, rivers, rocky outcrops, trees) and notes about the distance between points or areas (to help with scale and orientation).
- Ask each group to choose a spokesperson to present the map to the large group.

Some groups may not have a good idea of what their community looks like from above, or may be only able to draw maps of their own small villages and not the entire community area. To address this facilitators can:

- Come prepared to draw a basic outline of physical features of area (roads, rivers, coastlines, hills) then ask participants to add details and boundaries.
- Ask community members to map out their individual villages, and then work with the whole group to combine the village-level maps into a map of the entire community.

WOMEN AND MAPPING

In some cultures, women may be reluctant to draw a map, or may insist that they do not know how to draw. In such situations, facilitators can:

- Start a discussion about how women's perspectives are important for comprehensive mapping. It is helpful to remind women that because of their work and responsibilities in the community, they may be more aware of certain aspects of the landscape and the natural resources located on it than the men. **Remind women that women tend to map more thoroughly than the men**, and to include resources — such as water sources —necessary to their livelihoods and household roles. Explain that when the women share their maps with the wider group, men are often surprised by how much more the women have included.
- Ask women to first draw in the earth with a stick; in regions with high illiteracy rates, the pen and paper may be the challenge, not the women's spatial awareness. In such cases, the entire mapping exercise may be completed in the earth, and then the facilitators can work with the women to transcribe it to paper.
- It may be that women are shy – ask several times for a woman who can draw. As the mapping exercise starts getting interesting, women may move past their shyness and be ready to take pen in hand. Pay attention to group dynamics and solicit the participation of women who look eager or particularly engaged.

Step 5: Group presentation of the maps. When the groups have finished drawing their maps, bring everyone back together and invite each group to present its map. Encourage spokespeople to explain their group's discussions (including any disagreements and challenges that arose) and legend. After each group has made its presentation, the community should discuss all the maps.

Community members may have difficulty agreeing on the location of a certain boundary, or may disagree about which map is most correct about a certain feature of the landscape. Support peaceful discussion: ask people to explain their reasoning or provide evidence for their opinions. If the disagreement cannot be resolved, support the community to mark both ideas on the map, and give people time to revisit the disagreement in future meetings. Community members may choose to visit the site and examine the landscape for proof of the current reality on the ground.

Step 6: Combine the maps into one sketch map. After each group has presented its map, support the community to draw a single combined map (on a fresh piece of paper) that includes details from each small group. After the maps have been combined into one final map, the community may want to reflect upon it and continue to add details until all important features and natural resources are accurately represented. This may take a few drafts – come prepared with extra paper.

Combining the maps and agreeing on them can take time. If the time for the meeting runs out before the community agrees that the map is finished, ask the Community Land Mobilizers to hold community meetings to finalize the map before the facilitators' next visit.

Finally, when the map is complete, ask the community to identify any points, lines, or areas that should be made more accurate using GPS coordinates later, once boundaries are agreed upon.

An example of a Sketch map.

Step 7: Make a plan for how the map will be safeguarded. Leave the sketch map with the community. Support the community to create a plan for keeping the map private and safe. Have the community elect or appoint someone to store the map safely for the community's use. Consider leaving extra supplies to support the community to revisit and revise their sketch map as necessary. Leave extra sheets of paper with the community for this purpose.

Step 8: Ask for community members' permission to photograph the maps for record-keeping. Ask for permission to photograph all the maps (small group maps and combined map) for record-keeping purposes. When working with many communities, it is easy for files and photographs to become disorganized. Ensure that map files are kept in a clear, well-maintained management system that clearly identifies which maps correspond with each community and ensures that the maps are safe from unauthorized access.

Step 9: Later, after completing the boundary harmonization exercise, update the maps and consider making a more permanent version. Once a community and its neighbors have agreed on boundaries, the harmonized boundaries should be recorded on the map (see the chapter on *Documenting Agreed Boundaries*). To ensure that the map will not degrade over time, print and laminate a copy of the final map or support communities to paint it onto a board or fabric to display in a central community meeting place.

SATELLITE IMAGERY MAPPING

Satellite imagery can help to improve the accuracy of communities' maps. Maps made with satellite imagery are also easier to digitize/convert into the kind of technical maps necessary for formal community land registration and titling. Organizations can also use satellite imagery of an area during initial community selection and scoping and logistics planning. However, this technique requires more preparation than sketch mapping and recent, high-quality satellite imagery is not always available for all locations.

The process of satellite mapping is very similar to sketch mapping. It is not necessary to do sketch mapping first, but facilitators may want to use sketch mapping as a first step. Supporting communities to work with satellite maps may take several hours longer than sketch mapping, as community members may be unfamiliar with looking at images of their community from above. However, in some communities the activity may take less time than sketch mapping if the imagery helps people to see and understand the spatial layout of their community and landmarks.

Step 1: Choose mapping software and learn how to use it. For free, easy mapping software, try Google Earth Pro (download it at www.google.com/earth/download/gep/agree.html and use the license key: GEPFREE). There are many online tutorials in various languages for learning how to use Google Earth Pro software.

Step 2: Search for imagery. There are many different potential sources for satellite imagery. The best scenario is to find a source that allows the download of a georeferenced imagery file (often a .tif file). Facilitating organizations should collaborate with partner organizations, governments, or satellite imagery providers in order to search for available imagery files.[1]

The quality of imagery depends on how recent it is, how clear and detailed it is (resolution), whether it is distorted, or whether there are too many clouds obscuring the landscape. Using Google Earth (or other free online tools like Bing maps), zoom into the general area of the community until individual buildings, roads/tracks, and fields or cleared areas are visible. If the imagery is low quality, it will be hard to see individual buildings and details in the landscape, which will make the images unsuitable for mapping. Also look at the "Imagery Date" – if it is more than 5 years old it may be too old for the community's needs.

In addition to satellite imagery, there may be other types of printed maps that are useful to use or refer to, such as: national survey base maps, topographical maps, and cadastral maps.

EXAMPLES

Low resolution imagery (difficult to use)

Medium resolution imagery (acceptable)

High resolution imagery (excellent)

1. Contact Namati for support to access other sources of free or donated imagery. Before requesting, purchasing or printing imagery, it is best to take GPS coordinates of the community's approximate center and (if possible) any agreed boundaries. This confirms locations more precisely and helps ensure that the imagery used is for the correct location.

EXAMPLE

Company that owns imagery

Date imagery was photographed

Coordinates of the location where the mouse cursor is

Step 3: Prepare the imagery for use in community meetings. Decide whether to create the posters or ask for design assistance from a partner organization or geospatial professionals.

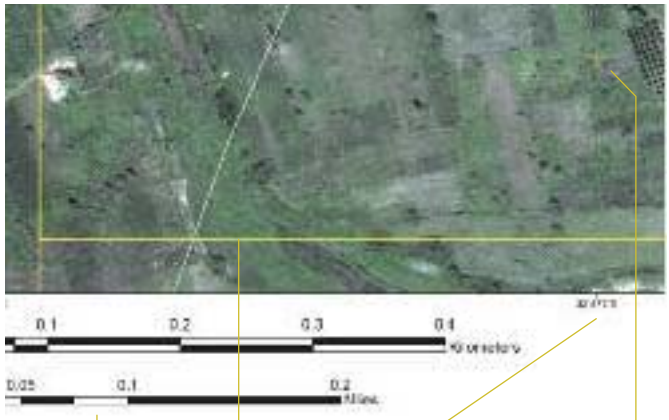
If designing the posters internally, choose a graphic design program or more advanced mapping software (such as QGIS or ArcGIS). If using downloaded imagery files, use mapping software or design software to format it into large posters. If using imagery from Google Earth Pro, export .jpg of imagery at the zoom level needed and reassemble them in design software.[2]

Format the imagery into a series of large posters or banners that are big enough to allow community members to gather around them and see the imagery comfortably. For small communities, it may be possible to represent the whole community on one poster; for larger communities, it may be necessary to print the images on several large posters or banners and lay them side by side. (If a community needs many posters, create a zoomed-out "Index Map" to show how all the pieces fit together).

To ensure that facilitators print the correct imagery, it is useful to take a few GPS coordinates at key sites within the community, and then use the coordinates to identify which satellite imagery is needed. (For more on using GPS, see the chapter on ***Documenting Agreed Boundaries***.)

Posters should have a title (the community's name), a bar at the bottom showing the scale, a north arrow or compass, geographic coordinates along the edges showing the longitude and latitude, a thin line that outlines the map, and a faint grid or tick marks (like '+') across the map (these are used to line up the posters if there is more than one during digitization).

EXAMPLE



Scale bars.

Outline of map.

Geographic coordinates.

Tick mark that shows where X-Y coordinates (latitude and longitude) cross.

2. In Google Earth Pro, it is only possible to save JPG image files up to 4,800 pixels wide. If printing imagery from Google Earth Pro, add a note to the map that gives attribution to Google Earth and the imagery company (e.g. © Google Earth 2015 and © Digital Globe 2015). Do not charge fees for printed copies of Google Earth imagery. For more on saving images from Google Earth: https://support.google.com/earth/answer/148146?hl=en

Step 4: Print and laminate the satellite imagery posters. Print the imagery posters in high resolution and in color and laminate them to protect them from water and dirt. Ideally, print at least two copies of each poster to allow two small groups to work with them at the same time. (An alternative to printing posters is to design and print the imagery as large plastic or cloth banners if a banner printing business is available.)

MATERIALS NECESSARY FOR SATELLITE MAPPING:

- Satellite imagery posters or banners
- Clear plastic (often called "acetate" or "Mylar") cut into map size pieces
- Tape
- Colored permanent markers
- Rubbing alcohol and cloth (for fixing mistakes)
- Large paper or cardboard
- Magnifying glasses (optional – to help people see details)
- Tubes or boxes to carefully transport the imagery and plastic sheets.

Step 5: Become familiar with the images. Spend time looking closely at the posters; facilitators should be comfortable helping community members identify landmarks and navigate the imagery.

Step 6: Organize a community-wide meeting with representation from all **sub-units** within the community or that use the community land. Before the meeting, explain the activity and satellite imagery to the local leaders who will be opening the meeting. Ask them to explain the satellite imagery to participants in a way that will address potential concerns.

Step 7: Divide the meeting into small groups and orient each group to the imagery (see Step 3 of the sketch mapping process, described above). Give each group a copy of the printed imagery. Without using the pens and markers yet, ask community members to identify major landmarks, meeting places, basic infrastructure, and their homes and fields, neighboring communities, etc. Ask community members to point to approximate locations of boundaries and any communal lands, forests, or water bodies.

Make sure that youth and elders have time to look at the map and ask questions. Elders may find it difficult to see small things on the map; it may be necessary to have magnifying glasses for their use, or to find a place where there is no glare or reflection of sunlight on the maps.

Step 8: Agree on what should be on the map. Ask the group to decide on a list of things to draw on its map (see Step 2 of the sketch mapping process, described above). On a separate piece of paper, have the group members make a legend (a list of what they will map) with a corresponding symbol or color that they will use when drawing each item to indicate each item on the list.

Step 9: Prepare the group to draw over the map. Overlay a piece of clear plastic over each printed poster and tape it in place. Ask a volunteer to mark the corners of the map outline and tick marks (this is in case the plastic needs to be lined up again – it is also important for digitizing the map later). Label the plastic pieces with the community name, group, and date. Ask the group to choose an artist (or a few) to do the drawing.

Step 10: Support each group to draw a map of the community. The group should work through the list of what to map, first agreeing on what to draw and where, then giving careful instructions to guide the artist(s). Infrastructure like schools and clinics can be drawn as single points or icons (such as a dot or 'x'), lines (for things like roads and footpaths), or outlined shapes (for areas like grazing lands). Prompt the group to make sure that it maps major landmarks, boundaries, common areas, roads, and key infrastructure. If possible, take notes about any discussions that provide details about landmarks that define boundaries, areas used for specific purposes, or other details that seem significant to the group.

Some groups may be nervous about drawing on the plastic. If so, encourage them to start with the labels and easy, non-debatable landmarks. Remind them that if they make a mistake they can erase a line (using the rubbing alcohol and a cloth), cross out a line and redo it, or get a new piece of plastic and start over again.

Step 11: Group presentation of the maps. When the groups have finished, reconvene the groups and invite them to present their maps and explain any points of disagreement or areas that were challenging to map. Encourage spokespeople to explain the process their group followed and what was discussed. If the drawn maps are difficult to see, it is possible to carefully separate the plastic from the imagery poster and hold it up against the white back of the poster – however, the drawn shapes may appear very abstract without the imagery behind them for reference.

Step 12: Combine the maps into one. Have the group choose an artist to draw a combined community map (either on a new piece of plastic overlaid on the imagery or on one of the small group maps). The community should discuss the final map to ensure that it is accurate and includes all important natural resources. Ask the community to identify any points, lines, or areas that should be made more accurate using GPS coordinates later, when boundaries are agreed upon. If it is appropriate and will not inflame conflict, facilitators may want to ask the community about potential past and present land disputes and boundary disagreements in order to note them on the community map for future resolution.

Step 13: Ask for community permission to photograph the maps for record-keeping. Once the community has come to consensus and agreed on the combined map, ask for permission to photograph the map for record-keeping. Carefully separate the plastic from the imagery poster and hold it up against the white back of the poster. Take a clear, high quality photograph (especially if digitizing the map later). Leave the original map and satellite imagery posters with the community.[3] Ensure that map files are kept in a clear, well-maintained management system that clearly identifies which maps correspond with each community and ensures that the maps are safe from unauthorized access.

Step 14: Make a plan for how the map will be safeguarded. Leave the digital images and map with the community. Support the community to create a plan for keeping the map private and safe. Have the community elect or appoint someone to store the map and imagery posters safely for the community's use.

Step 15: Digitize the map (optional). Maps that communities draw on plastic overlays are vulnerable to damage. A good way to preserve the mapping information, and allow for modifications and updates to the map, is to redraw the plastic map as a digital map, as explained in the "Map Digitization" box below.

Step 16: Once boundaries are agreed, update the map. This should be done both on the printed satellite images and on any digital versions of the map (see the chapter on *Documenting Agreed Boundaries*).

3. In some cases, the community may prefer the facilitator to hold onto the map for the time being. Or, if the map is incomplete or there are significant conflicts or concerns that came up during the meeting, it may be advisable to ask the community to keep the map and imagery until another meeting can address concerns and finish the map.

DIGITAL MAPPING

In some contexts, it may be impractical and expensive to print satellite images of a community's territory, such as in the case of a pastoralist community that ranges over thousands of hectares. However, it is possible to use satellite imagery without printing if it can be projected onto a screen or white sheet at a large community meeting (ideally held inside, in the evening or in a dark place so it is easier to see what is projected). The community then creates its map directly in the digital software, helped by trained facilitators. This technique, called "Direct to Digital," allows the community to look at the whole territory, zooming in and out as needed, to see it as a whole or in detail.

Step 1: Choose mapping software and learn how to use it (as described in the sketch mapping process, above). This includes learning how to navigate in the software and how to create points, lines, and polygons in the software (see the "Map Digitization" box below).

Step 2: Prepare a secure, organized system for managing communities' spatial data and protecting data privacy (see the box on "Map Digitization" below).

Step 3: Before the community meeting, save the imagery to a laptop so it is available offline when in the field. While Google Earth software can be used without an internet connection, it cannot load new imagery when offline. It is necessary to choose either of the following options:

- "Cache" the imagery: Unfortunately, there is no way to actually download the imagery that displays in Google Earth for offline use. Instead, the software "remembers" a certain amount of imagery that it has viewed recently – but only for the same location, and the same zoom level, that it did before. However, there is a limit to how much imagery the software can remember. Therefore it is best to "cache" imagery for only one community at a time. To do this, navigate to view all the imagery needed for a community, at the zoom level needed, and make sure to let it load completely. Test by turning off the internet connection and checking if the software remembers all the imagery needed.
- Relying on "cached" imagery alone can be stressful in case something goes wrong with the software or if different imagery is needed. For this reason, it is preferable to acquire the actual imagery files by finding free or donated imagery files, or purchasing files. Consider contacting Namati or other partners for support on acquiring the imagery files and uploading them into Google Earth or other software.

Step 4: Ask the community to prepare for the meeting. Request that the community choose an indoor location for the meeting (such as a church, or larger house). If the meeting must be outdoors, it may be best to call an evening meeting. If possible, demonstrate the process to leaders and Community Land Mobilizers in advance of the meeting so they understand the process and can help facilitate. Explain the activity, the satellite imagery, and the mapping software, and what happens to the information created in the activity. Ask them to help explain these to participants in a way that will address any potential concerns.

MATERIALS NECESSARY FOR DIGITAL MAPPING:

Two facilitators are needed: one to use the computer, and the other to run the meeting.

- Satellite imagery files (if available)
- A laptop computer
- A good quality projector
- A power source and/or back-up battery for the laptop and projector
- A projector screen or white sheet
- Optional: a video camera/audio recorder (to record what is said as evidence of how the map was produced, and as a back-up in case the computer crashes)
- Optional: laser pointer (to help point to areas on the screen)

Step 5: Organize a community-wide meeting with representation from all villages or settlements within the community or that use the community land. Make sure to arrive with enough time to set up the laptop, projector, power source, screen and any other equipment. Project Google Earth from the laptop to the projector screen or a white sheet. One facilitator should stand near the screen to facilitate discussion, while the other works with the laptop computer.

Step 6: Take the community on a tour of the imagery, zooming in, moving around, and changing the angle as needed to help communities orient themselves and identify areas. Demonstrate the process of adding to the map using points, lines, areas and polygons.

Step 7: Discuss what to map and create an agreed list of resources and infrastructure to record. (See Step 2 of the sketch mapping process, described above.)

Step 8: Create digital map features. Ask the community to proceed through the list of things to map, describing each resource and pointing out where it is on the projected imagery. While the meeting facilitator manages the discussion, the facilitator on the computer enters the information directly into the digital imagery on the computer screen, in real time, using the digital mapping tools in the software.

Make sure that every individual who wants to speak has had a turn to add or edit information. Remind the community that no marks are permanent: any point, line, or polygon drawn onto the satellite imagery can be revisited and changed over the course of the meeting and in the future if necessary.

Step 9: Review the digital map and ask the community to approve it. As with the other mapping techniques described above, discuss any conflicting information. Ask the community to identify any points, lines, or areas that should be made more accurate using GPS coordinates later, once boundaries are agreed upon. If it is appropriate and will not inflame conflict, facilitators may want to ask the community about potential past and present land disputes and boundary disagreements in order to note them on the community map for future resolution.

Step 10: Print small copies of the initial map for the community to refer to during the rest of community land protection process. Emphasize that this is not a finalized map – the boundaries still must be negotiated with neighbors and marked. Explain that the community can request to project and review the map again if desired.

Step 11: Keep records organized and safe. When working with many communities, it is easy for files (especially digital map data) to become disorganized. Maintain a clear file management system that is safe from damage and from unauthorized access (e.g. a password-protected cloud-based file storage account based in a country with strong data privacy laws).

Step 12: Update and print the final map. Once a community has completed boundary negotiation and boundary marking (see the chapter on ***Documenting Agreed Boundaries***), update the community's digital map, ask the community to verify it and then print and laminate a large poster of the map for the community's records.

MAP DIGITIZATION

"Digitization" means converting information into a digital format, like creating a digital version of a paper map or photograph. Creating digital versions of community maps using mapping software is a way to preserve the information, because paper maps or maps drawn onto printed satellite imagery are vulnerable to physical damage or loss. Digital maps are easier to update, make copies of, and store in organized records. Digital versions of maps are also easier to use for measuring area and distance. If communities have their maps available as digital information, they can choose to share that data with governments, other mapping initiatives, or other organizations.

If the facilitating organization and a community decide to digitize the community's map(s), the following factors should be considered:

- Sketch maps: These are not well suited to digitization. If using only sketch maps, encourage communities to include as much information as possible about landmarks and distance estimates.
- Satellite maps: Make sure that the printed satellite imagery posters used to draw maps include a coordinate grid and tick marks – these will make digitization much easier.
- All maps: Ensure that communities draw their maps with lines that are easy to see. If the lines are very thin or in a pale color, it will be difficult to see them when digitizing.
- All maps: With community permission, take at least one very clear, bright, high-quality photograph of each map that shows all the drawn information. If it is a map drawn on satellite imagery, place the overlay on a white background before taking the picture.

If the facilitating organization does not already have preferred mapping software, it is necessary to consider a range of software and choose one that best suits the facilitating organization's needs and resources. Seek input from partners and collaborators, or look for online tutorials.

No matter which software is chosen there are several basic steps for simple map digitization:

1. **Navigate to the community's location within the software.** Use the captured GPS data for the community to find the region quickly.
2. **Import the picture taken of the community's sketch or satellite map.** Open/add/import the photograph of the drawn map as an image overlay.
3. **Align the photograph to the place on the map showing the community's land.** Move the photograph layer around until it matches with the satellite imagery at the location of the community. For satellite maps, use the coordinates and grid tick marks to line up the photograph. For sketch maps, this is more difficult – use land marks to approximate the overlay. It may be necessary to stretch, compress, or twist the photograph to help it to align with the satellite imagery.
4. **Add the GPS data.** If the community collected GPS coordinates for its landmarks and boundaries, import this data or manually create points at the coordinates. Adding GPS data to the map keeps all the information in one place and can help to align the map photograph. (If GPS data is collected later, it can be added to the digital map when available.)
5. **Use software tools to create points, lines, and polygons.** Mapping software typically uses the terms "points," "lines" and "polygons" to describe the types of data added to a map.

- Points are for one specific location, such as a well, school or clinic. Lines are a series of connected points, used for things like paths, roads or access routes. Polygons are shapes made of an outline of points that encloses an area, used for things like forest areas, fields, buildings, or the area of a community's land. Paths can measure distance and polygons can measure circumference and area.
- Most software allows users to modify the appearance of points, lines, and polygons with different colors, line styles, icons, and transparency/opacity.

- Remember that points, lines, and polygons can overlap. Use different colors and transparency settings to display overlapping features.

Using the overlaid photograph as a guide, convert the information that the community drew into points, lines, and polygons. Make these carefully – zoom in and out to make it easier to work. If a mistake is made, the user can usually select individual points to edit.

6. **Organize data into folders.** In most software, each new point, line, or polygon is created as a new "layer" of data. When creating many layers within the same map it is easy to get disorganized. It is helpful to organize the layers into a hierarchy – for example, in Google Earth create a sub-folder called "Forest Areas" and move all forest area polygons or points into that sub-folder.
7. **Link photographs, notes, videos, and documents (like the community by-laws) to the maps.** Most software allows adding of other data to maps, including photographs, videos, and notes. In Google Earth, this is possible in the "Properties" editing box for points, lines, or polygons. It is also possible to add map data from other sources, such as layers of map data from government agencies.
8. **Save the map!** Even if the software has an automatic save function, it is best to save the maps regularly – mapping software uses a lot of memory and can be prone to crashing. Save regularly to avoid losing work.
9. **Follow good data management practices.** If creating maps for many communities, it is important to keep digital maps carefully organized. Make sure that map files, photographs, and data points are labelled with the name of the community and the date made. Make sure to develop a folder organization system that facilitators follow consistently to know where to find communities' data in the future.

SAMPLE DIGITAL MAP MADE BY DRAWING LINES AND POLYGONS TO TRACE DRAWN MAP