Contents

HOT Toolbox

This wiki is designed to provide HOT teams and OSM Communities with a repository of HOT Training Materials and a guide to the large amount of resources that already exist for the various components of mapping projects, from software guides to running mapathons.

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1.1 Mapping Project Workflow

There is no one way to collect data in the field and it will vary by context – but the following steps cover the essential steps you should take.

1. Coordinate with the local administration of the area you will be mapping

This entails identifying and contacting partner organisations working locally in the area that you are planning to map. Contacting these can be done via email, however, a letter or document detailing your intent weighs much more.

2. Obtain authorization from district and other officials

It's important to inform and get authorization from district officials. Write to the appropriate local official, copying relevant district-level authorities. Once you receive a letter of authorization, copy it to have on hand and distribute to higher-level authorities to make them aware of your project.

3. Prepare relevant field data collection tools and guides

To collect good data. you need to employ a well-defined data model. A data model reflects the information you want to capture. After establishing a solid data model, it is important to create logical Field Data Collection Forms that capture the data you are looking for in the best way.

4. Recruit mappers

Mappers will in most cases be drawn from community members, students or partner organisation staff.

5. Train mappers

It is useful to create a training schedule. Usually two days are enough time to cover data collection and discuss the community's needs. This is also an opportunity to select your field mappers.

6. Find transportation Motorbike riders provide a much-needed element of local knowledge, complementing the actual field mappers. Work with mappers or local partners and stakeholders to recruit local transportation

7. Field Mapping map guides (maps production)

Strategically organize and subdivide the area to be mapped. Using QGIS, prepare relevant guide maps that mappers will use in the field.

8. Field mapping – guide participants during data collection

Mappers should be well equipped with mobile phones having all the relevant tools and accessories to facilitate field mapping. Mappers move to the field with a mission order for their safety and comfort operating in these communities. Mapped data is sent to the server.

9. Field Data Cleaning and upload to OSM

Following the field data cleaning workflow, all collected data is cleaned and uploaded to OSM. Reviewing the data before upload ensures that the quality is good before it is shared.

10. Schedule follow-up at a later date

It is good to meet after field data collection activities to review the challenges faced in the field. This could take the form of a mapathon.

Example Technical Project Workflows:

- LEGIT Project Workflow

1.1.1 LEGIT Project Workflow

Local Empowerment for Government Inclusion and Transparency (LEGIT)

The Liberia Local Empowerment for Government Inclusion and Transparency (LEGIT) project supports the Ministry of Internal Affairs and Governance Commission as they lead, monitor and coordinate the implementation of the government's decentralization agenda.

HOT, in close coordination with the LEGIT project team, have contributed to several areas of the project, working with the Ministry of Internal Affairs (MIA)'s Department of Urban Affairs, city administrations in the cities of Gbarnga, Ganta and Zwedru, and selected CSOs and CBOs. HOT's objectives within LEGIT are to map administrative boundaries and service delivery infrastructure or points, support our Liberian partners to conduct mapping, develop a service delivery database and to support the development of urban resilience strategies for each city.

Project page:

Supporting Decentralization in Liberia

Dates: January 2017 - February 2019

Status: Complete

Tools used:

- Software
    - ODK
    - OMK
    - OSMAnd
    - Maps.Me
    - [JOSM]
    - QGIS
    - TileMill
- Hardware
    - POSM (used as an external hard drive)
    - Tecno C9

Field Mapping Workflow

1. Technical Set-up

- Remote digitization through HOT Tasking Manager
- Development of data model (in coordination with project partners and stakeholders)
- Creation of ODK & OMK Forms
- OMK set-up
    - Creation of mbtiles using TileMill (no aerial imagery, just vector layers)
    - Creation of .osm layers used JOSM
- Set up phones
- Created map assignment areas in QGIS to guide teams in data collection
- Created print maps of assignment areas (aerial imagery in background)

2. Field Mapping

- Field mappers grouped into teams with leaders
- Use of OMK (full survey) and OSMAnd (tracking field movement) by field mappers on a daily basis
- Extracting field data from phones on a daily basis

• Uploaded field data to POSM as a back-up on a daily basis

3. Data Cleaning

  • Manually merging field data files and resolving conflicts in JOSM at end of mapping activities
  • Data cleaning and upload procedures
  • Data cleaning in JOSM

4. Map Creation

  • Download data from OSM via QuickOSM
  • Creation of maps in QGIS using Print Composer & Atlas

1.3 Logistics

There are many components to managing logistics for field operations. The topics listed below are just a few components that we recommend all organizations and communities consider prior to starting field mapping activities.

Authorization from district and other officials

In many cases, mapping teams will need to carry an authorization letter or another form of permission from local officials to show credibility and to reduce potential conflict that could arise during the field data collection. We recommend that organizations and communities should request this letter from the appropriate authorities well ahead of planned mapping activities to reduce the risk of delay.

Workspace / Meeting space

The need and specifications for a workspace or meeting space varies from project to project. Some field mapping projects require a central base with full-day access and wi-fi whereas other field mapping projects have been operated from campsites.

Equipment

Different scopes of work will require different types of equipment. For example, ODK and Kobo software can run on most Android devices, but OMK software requires high specifications.

- What type of mobile devices will you use to collect data? (Mobile phones, tablets, GPS devices, etc.)
- Does everyone on the team have access to data collection devices?
- Does everyone on the team have access to computers/laptops? Or will the team plan to work in shifts?

See Hardware and Software for recommended tech specifications
(Add example equipment lists for previous projects)

Transportation

- How will mappers move around in the field?
- Is the scope of work/area of interest large enough that mappers will need transportation beyond walking?
- If teams/mappers need motorized transportation,
    - What types of transportation are available?
    - What types of transportation are safe for the context and circumstances?
    - Will this type of transportation have associated costs? (i.e. driver fees, rental, fuel)

Recruitment and compensation for mappers

Management of teams in the field

1.4 Safety and Security for Field Operations

Each context is so different that it is difficult to make specific recommendations for safety. Communities and organizations conducting mapping activities should establish contingency plans to address the different types of security incidents that may occur. Team members should coordinate all responses to such incidents so as to safeguard the rights and well-being of local community members, and ensure that staff members and volunteers are not put at risk.

For operations, the key to effective safety and security management is the creation of a culture of security. Each staff member and volunteer has a responsibility for their own safety and security, and that of other team members.

Please note: The below topics are suggestions for mapping teams to consider when building and discussing security plans for mapping activities, and is in no way comprehensive.

Considerations

- Personal Security
  - Behavior
  - Dress code
  - Language and communication
- Legal Requirements
  - Survey letter/Permission to conduct field activities
  - Local laws and customs
- Communications
  - Communication network
  - Internal Contact Details (mapping team)
  - External Contact Details (authorities)
- Travel
  - Attire
  - Visibility
  - Documentation
  - Accidents
  - Theft
- Common Crime
  - Types of crime
  - Frequency and patterns of occurence
  - Mitigation strategies
- Medical Emergencies
  - Pre-existing medical conditions of team members
  - Location and contact information for local health facilities
- Contingency Plans
- Incident reporting

Tips:

- Know the emergency services numbers for the local area
- Always have access to a first aid kit
- Teams should have someone trained in first aid
- Let people decide where they work and feel most safe in
- Avoid performing field work alone
- Always obtain relevant permits, licenses, permissions, and visas for work
- Develop a country specific security plan
- Create a minor incident and suspicious activity report
- Establish a process for regular monitoring and review of hazards
- If operating outside of your home country, sign up for travel alerts from your embassy

Resources:

- HOT General Hazard Mitigation Advice

1.5 Hardware

Mobile data collection: smartphones

When planning to use OpenDataKit:

Most any Android smartphone will do, as long as it has a relativy modern Android version (4.1+).

When planning to use OpenMapKit:

To enable OpenMapKit to run fluently and be able to handle larger background maps (in 'mbtiles' format) and OSM data, please make sure that phones have:

- At least 1.5, but preferably 2 GB of RAM
- Preferably 16 GB of storage
- A modern Android version (6.0+)

Furthermore, the following are recommended:

- A 5" screen for usability
- A decently sized battery. For extended usage, it may be necessary to have battery packs
- Make sure to have enough charging options, such as car chargers and extension cords

The following phones/models have been verified to work well on various projects:

Smartphones:

- Tecno Camon C9 (2 GB RAM)
- Tecno L9 (2 GB RAM, 16 GB storage)
- Huawei Y5 (2017) and Huawei Y6 Pro (2 GB RAM, 16 GB storage)
- Sony Experia L1 (2 GB RAM, 16 GB storage)
- Motorola Moto G5 (2 GB RAM, 16 GB storage)

Tablets:

- Samsung Tab A (SM-T285, 7", 2016) (1.5 GB RAM, 8GB storage)

Considerations for Hardware Management in Mapping Activities

- Create and have all mapping participants sign an agreement for the responsibility and liability of devices
- Create an equipment sign out log

1.5.1 Setting up phones and servers

Setting up phones for data collection

Device set-up and testing instructions for OpenDataKit (ODK), OpenMapKit (OMK), and OSMTracker can be found here.

Open Data Kit (ODK)

Download application

For information on downloading and installing ODK, go to Data Collection Applications. #### Tool set-up

1. Find the ODK Collect app icon on your mobile device and tap to open the app.
2. After downloading the ODK app, an odk folder will be automatically created in on the internal memory of the device. Connect your device to a laptop to confirm that this folder is created. If you don't see this folder on your device's internal storage, Restart the device.
3. Once the device has been restarted, connect it to your laptop, and navigate to internal storage -> odk folder. You will find for sub-folders inside the openmapkit folder. I.e 'forms', 'instances', 'layers' and 'metadata' folders.
4. Add your xml forms to the forms folder.
5. In the ODK Collect Main Menu window, select Fill Blank Form. This will display all forms downloaded from the server, which you will be using to field data collection testing.
6. Once you confirm that you have all forms on your device, click on the device back button to exit the ODK Collect App.

Open Map Kit (OMK)

Note: You will need ODK to run OMK. We advise installing ODK first to allow for proper set-up and testing. #### Download application

For information on downloading and installing ODK, go to Data Collection Applications.

Tool set-up

1. After downloading the OMK app, a openmapkit folder will be automatically created in on the internal memory of the device. Connect your device to a laptop to confirm that this folder is created. If you don't see this folder on your device's internal storage, Restart the device.
2. Once the device has been restarted, connect it to your laptop, and navigate to internal storage -> openmapkit folder. You will find for sub-folders inside the openmapkit folder. I.e 'constraints', 'deployments', 'mbtiles' and 'osm' folders.
3. If you have a customized constraints file, in the constraints folder, delete the Buildings.json and default.json files. Add your custom the default.json file to the constraints folder.
4. Add your .mbtiles file to the mbtiles folder.
5. Add your .osm file to the osm folder.
6. Now you are set to start working with OMK. Exit the file manager window.
7. Open OMK application.
8. Tap on the Settings button in the top right corner. Under "basemap", select the appropriate .mbtile. Under "OSM XML Layer" select the .osm layer to use for your mapping. Exit settings.
9. Tap on the GPS button, your location will be displayed on the screen.
10. To begin mapping, exit OMK and open the ODK application. You will notice that OMK works within the ODK application.

1.8 Trainings and Workshops

This is a brief overview of considerations and resources to use while planning trainings and workshops for mapping and OSM.

Attendee requirements

Requirements for attendees will vary depending on the scope of the trainings, the intended participants, and the available resources. No matter the scope of the training, it is important to communicate these requirements BEFORE the training so that participants can come prepared.

Some attendee requirements may include:

- Have a laptop and mouse.
- Be computer literate with basic computer skills.
- Have enthusiasm and willingness to collaborate with others.
- Attendee's computers should have sufficient free disk space (approx 10GB) and attendees should have administrator rights so that they can install software on their computers.
- Attendees should have a PDF document viewer installed on their computers.

Workshop venue requirements

- Wi-Fi Capability
    - If the venue can provide Wi-Fi, confirm with the venue managers that the Wi-Fi has enough capacity for the number of attendees expected to show. For example, if you expect 10-15 people to show up to your event, the Wi-Fi will need to be capable of hosting 15-20 internet connections - remember, you will need to connect as well!
    - If there are no venues with wi-fi capability, consider the option of using a Mi-fi device or other Hotspot options
- Space, tables, and chairs to provide for your expected attendance.
- Enough power outlets for charging laptops and other devices.
    - If this is limited, you'll need to consider power strips and extension cables.
- Generator/electricity access for duration of workshop.

Materials to provide

See Software and Tools to Share **Creating an agenda**

See materials provided below.

Resources

- Beginning OpenStreetMap Trainer Toolkit
- Intermediate OpenStreetMap Trainer Toolkit
- Advanced OpenStreetMap Trainer Toolkit
- TeachOSM
- [LearnOSM]
    - Mapping Party

Training Agenda Examples

- Three-day mapping workshop
- Five-day mapping workshop
- Four-day GIS workshop

Training Agenda Template

- Template

1.8.1 Software and Tools to Share

It is highly recommended that prior to the training/workshop, all necessary installation files are downloaded and loaded onto USB drives for offline installation. The following is a list of all the recommended installation files you will need depending on the scope of the training/workshop.

JOSM

Installation instructions

- Java OpenStreetMap Editor installer
- Java

QGIS

Installation instructions

- QGIS installer

Mobile Applications

Installation instructions

- ODK apk
- OMK apk
- OSMAnd apk
- OSM Tracker apk
- Maps.ME apk

InaSAFE

Installation instructions

- Offline InaSAFE QGIS plug-in

2.1 OpenStreetMap

OpenStreetMap is a collaborative project to create a free editable world map and is at the core of HOT's mapping activities. You are free to use it for any purpose as long as you credit OSM and its contributors.

The power of OpenStreetMap is that it empowers anyone, anywhere in the world to add information to a collective map and use the data for any purpose. You can think of OSM as the "Wikipedia of maps" – it is an online database and global community of over 5 million registered users. This community collaborates to build a free and open map of the world to which anyone can contribute and which anyone can use in their own context. All that is needed to contribute to OSM is an internet connection and email address.

OpenStreetMap can, and has, been used for a wide variety of purposes - from disaster response to commercial use. The first organized use of OSM in disaster response was following the 2010 Haiti Earthquake. As high-resolution imagery of the affected area was made available to the public, over 600 individuals from the global OSM community began digitizing the imagery and tracing roads and other infrastructure. They made what quickly became the most detailed map of Port-au-Prince in existence, which was then used by search and rescue teams to help route supplies around the devastated capital and to coordinate many other aspects of the response and reconstruction effort.

Training Materials

- Introduction to OSM

Resources and further reading Read

- LearnOSM - Introduction to OSM
- OSM Wiki - Abot OpenStreetMap

Watch

- Two Minute Tutorial - What is OpenStreetMap?

2.1.1 Opening OSM accounts

With OpenStreetMap (OSM) at the core of mapping activities, it is critical that all team members and participants have activated OSM accounts. This will be necessary before using many mapping tools such as HOT Tasking Manager, JOSM, and HOT Export Tool.

Skills and Technology Needed

- Computer
- Activated email account
- Internet connection

Creating an OSM Account

To get started, you will need to create an account on www.openstreetmap.org. Please use the "Sign Up" tab in the top right corner to begin.

Please fill in all the fields in the form. We recommend using an email you have easy access to e.g. your work email, as you will receive a confirmation email to verify your account. You will not receive any spam/marketing emails. Click the blue "Sign Up" button when finished.

Next, please read and accept the contributor terms and agreements by selecting where you are based (France, Germany, or the Rest of the World), and clicking the blue "Agree" button on the bottom of your screen.

To activate your account, please now check your email and click on the link provided.
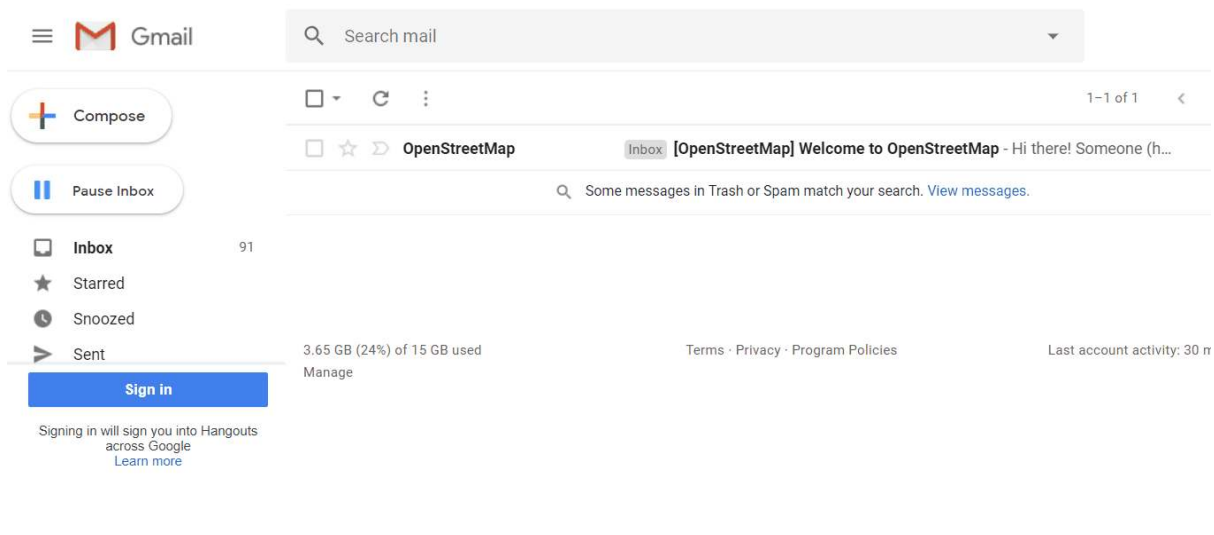
Considerations for signing up large numbers of individuals

- Prior to beginning the OSM registration process, all individuals signing up for OSM accounts will need to have an existing and accessible email account. If registering a large group of individuals at one time, we recommend asking the group if they have accessible email accounts. When planning mapathons and trainings in areas where regular email use may be low, we also recommend planning for time in assisting individuals with setting up email accounts.
- Consider internet connectivity and capacity prior to registering large numbers of individuals for OSM accounts. Having individuals taking turns to register or running registration simultaneous to other activities can reduce the load on a slow internet connection.
- It is crucial that usernames and passwords are remembered by participants so that they can access other tools that require OSM accounts to log-in. We recommend encouraging participants to find a way of safely storing this information for future reference.

Training Materials

- Introduction to OSM (including Signing up for OSM Accounts)

Resources and further reading Watch

- Two Minute Tutorial - How to Sign Up for OpenStreetMap

3.1 Working with the HOT Tasking Manager

The HOT Tasking Manager is a mapping tool designed and built for the Humanitarian OpenStreetMap Team's collaborative mapping process in OpenStreetMap. The purpose of the tool is to divide up a mapping project into smaller tasks that can be completed rapidly with many people working on the same overall area. It shows which areas need to be mapped and which areas need the mapping validated.

Note: To become a project manager send an email to info@hotosm.org and they will make sure you get set up.

Skills and Technology Needed

- Computer
- Internet connection
- OSM account

Resources

- OSM Tasking Manager Wiki
- Learn How to Use the Tasking Manager
- Two Minute Tutorials: How to use the OSM Tasking Manager

Training Materials

- Worksheet: pdf | doc
- Presentation pdf | ppt

3.2 Working With Imagery

Assessing available imagery

Satellite imagery

There is only a limited number of companies/satellites that actually capture most of the available satellite imagery, with many more resellers providing access to and selling imagery. See Wikipedia for a good introduction. When assessing the imagery available for your project, try to look for:

- Freshness (the date of the imagery)
- Resolution
- Quality (color, contract, obliqueness/angle of imagery, lack of cloud cover)

Some useful tools to help in this:

- Visually compare imagery available for use in OpenStreetMap: http://osmz.ru/imagery/ (or from within JOSM)
- To find specific dates/scenes from DigitalGlobe satellites: https://discover.digitalglobe.com/
- To find image metadata on ESRI imagery: https://www.arcgis.com/home/webmap/viewer.html?webmap=c03a526d9

UAV/drone imagery

3.3 Editing with iD and JOSM

There are several ways to edit in OpenStreetMap. The two most commonly used tools and best programs for mapping projects are iD editor and JOSM.

iD Editor

The iD editor is a user-friendly tool that allows you to directly make changes in OpenStreetMap. iD is good for:

- Simple edits
- Fast Internet access to load the imagery and save the edits.
- Following a consistent and simple tagging scheme.
- When you are restricted from installing a program on the computer you are using.

Skills and Technology Needed:

- Computer
- Strong Internet connection
- OSM account

Java OpenStreetMap Editor (JOSM)
JOSM (Java OpenStreetMap Editor) is an open source editor for OpenStreetMap data. JOSM is best for:

- Adding many buildings (See buildings_tool plugin).
- Editing many polygons or lines that already exist.
- When you are on an unreliable Internet connection or offline.
- Using a specific tagging scheme (or custom presets).

Training Materials

- Mapping with iD Editor
    - Presentation pdf | ppt
- Mapping with JOSM
    - Worksheet pdf | doc
    - Presentation pdf | ppt

Resources

- Awesome OSM: A Comprehensive Guide on Mapping Building Footprints

4.1.2 Designing The Data Model

Tagging

Tags are used in OSM to categorize features, and to add information that is useful for: * Understanding of the map * Planning * Routing * Querying

OSM doesn't work with layers or attribute tables, but tags. Each tag consists of a key, and a value. Each map feature should have 1 or more tags Such as: * building=residential * highway=primary * amenity=school

Resources

- Check the OpenStreetMap wiki. Start at the Map features page, search, and discover!
- Research tag use and occurence on TagInfo

Data Models

A data model defines what features are surveyed or mapped and what attributes are collected for each feature. If a project will upload data to OpenStreetMap, the data model should be designed to match OSM tagging.

Example data models

- Uganda Refugee Crisis
- Ramani Huria

Training Activity

Presentation: https://docs.google.com/presentation/d/1CU6cBtu9ZAeCWKIz6xLVN4fBrdsN7R5tFELPXbepilI/edit#slide
Estimated time: Skills and technology needed:

4.2 Data collection applications

Overview

Several mobile applications exist to assist with field data collection. Choosing an application to use depends on mobile device capability, varying set-up requirements, and survey needs. Options include OpenDataKit, OpenMapKit, KoboCollect, OSMTracker, and Maps.me

Which data collection application should I use?

I want to collect…	ODK	Kobo	OMK	Maps.me	OSM Tracker	Mapillary
Qualitative survey data	✓	✓	✓	×	×	×
Quantitative survey data	✓	✓	✓	×	×	×
GPS Points	✓	✓	✓	✓	✓	×
Photos attached to GPS Points	✓	✓	×	×	✓	×
GPX Tracks	×	×	×	×	✓	✓
Streetview imagery	×	×	×	×	×	✓
Data attached to OSM points of interest	×	×	✓	✓	×	×
Data attached to OSM polygons (i.e. buildings)	×	×	✓	✓	×	×

Training Materials

  • Introduction to field data collection applications

Resources and further reading Watch

  • HOT Community Webinar: Mobile Data Collection Best Practices and Tools

1. Open Data Kit (ODK)

ODK is a free an open-source set of tools which help organizations author, field, and manage mobile data collection solutions. ODK Collect is part of ODK and is an Android app that replaces paper forms used in survey-based data gathering. It supports a wide range of question and answer types, and is designed to work well without network connectivity.

Skills and Technology Needed

  • Computer
  • Internet Connection
  • Mobile devices (see Hardware for specifications.)
  • ODK forms
  • Spreadsheet software (such as Excel or LibreCalc)

Use OpenDataKit (ODK) if: * You have access to mobile devices but they have limited RAM & storage * You do not need to collect data for buildings in OSM OR you are able to manually transfer data collected as points to OSM polygons after data collection. * You want or need to have an easy set-up option for data collection.

Resources

  • OpenDataKit: https://opendatakit.org
  • ODK Guide: https://docs.opendatakit.org/collect-intro
  • ODK Build: https://build.opendatakit.org
  • Building ODK Forms: http://xlsform.org/en

Download

  • Google Play: https://play.google.com/store/apps/details?id=org.odk.collect.android&hl=en_US

Set-up

1. Create ODK forms
2. Add ODK forms to mobile data collection devices. See Device and Tools Set-up and Testing

2. OpenMapKit (OMK)

OMK is an extension that launches directly from within ODK Collect when the OSM question type is enabled in a standard survey. It is what allows you to browse OSM features, and to create and edit OSM tags.

Skills and Technology Needed

- Computer
- Internet Connection
- Mobile devices (see Hardware for specifications.)
- OMK forms
- Spreadsheet software (such as Excel or LibreCalc)
- Additional files
  - .mbtiles
  - OSM layer
  - Constraint file
- Recommended: Server

Use OpenMapKit (OMK) if: * You have access to mobile devices with sufficient RAM & storage (see Hardware for specifications.) * You need to collect data for buildings in OSM * You have the capacity for more intensive set-up prior to data collection

Resources

- OpenMapKit: http://openmapkit.org

Download

- Google Play: https://play.google.com/store/apps/details?id=org.redcross.openmapkit&hl=en_US

Set-up

1. Create OMK forms
2. Create .mbtiles
3. Create .osm layer
4. Create constraint file
5. Download and set up ODK and OMK applications.
6. Add all above files to mobile data collection devices.

3. KoBoCollect

Kobo is in almost all ways similar to ODK Collect, and is built on top of the ODK platform. Kobo also has prebuilt analysis tools and is another popular option.

Skills and Technology Needed:

- Computer
- Internet Connection
- Kobo Account
- Mobile devices (see Hardware for specifications.)

Resources

- KoBo Collect: https://www.kobotoolbox.org
- UNHCR instance of KoBo Collect: https://kobo.unhcr.org/
- OCHA instance of Kobo Collect: https://kobo.humanitarianresponse.info/

Download

- Google Play: https://play.google.com/store/apps/details?id=org.koboc.collect.android&hl=en_US

4. Maps.Me

Maps.me is a navigation application that uses OpenStreetMap data, and can be used offline. It is suitable for collection Point of Interest (POI) information, as far as these fit within the types of data that Maps.me shows you on the map.

Skills and Technology Needed

- Internet Connection (for application download)
- Mobile devices (see Hardware for specifications.)
- Android or iOS device

Resources

- Maps.me: https://maps.me
- OSM Wiki: https://wiki.openstreetmap.org/wiki/MAPS.ME

Download

- Google Play: https://play.google.com/store/apps/details?id=com.mapswithme.maps.pro&hl=en_US

5. OSMTracker

OSM Tracker is "an offline GPS tracker designed for collecting points of interest (POI) to be added to the map and for recording GPX tracks." OSM Tracker is free and open-source.

Skills and Technology Needed

- Internet Connection (for application download)
- Mobile devices (see Hardware for specifications.)

Resources

- OSMWiki: https://wiki.openstreetmap.org/wiki/OSMTracker_(Android)
- LearnOSM: https://learnosm.org/en/mobile-mapping/osmtracker/

Download

- Google Play Store: https://play.google.com/store/apps/details?id=net.osmtracker&hl=en_US

Set-up

- Device and Tools Set-up and Testing

4.3 Navigation Applications

Several mobile applications exist to assist with field navigation using OpenStreetMap as a baselayer and functioning offline for low-connection environments. Options include OSMAnd and Maps.me

1. OSMAnd

OSMAnd is a global mobile map viewing and navigation app for online and offline OSM Maps. It is used for recording tracks as well as mapping features. It provides easy way to record and submit information in the field.

Skills and Technology Needed

- Internet Connection (for application download)
- Mobile devices (see Hardware for specifications.)
- Android

Resources

- LearnOSM: https://learnosm.org/en/mobile-mapping/osmand/
- OSM Wiki: https://wiki.openstreetmap.org/wiki/OsmAnd

Download

- Google Play: https://play.google.com/store/apps/details?id=net.osmand&hl=en_US

2. Maps.Me

Maps.me is a navigation application that uses OpenStreetMap data, and can be used offline. It is suitable for collection Point of Interest (POI) information, as far as these fit within the types of data that Maps.me shows you on the map.

Skills and Technology Needed

- Internet Connection (for application download)
- Mobile devices (see Hardware for specifications.)
- Android or iOS device

Resources

- Maps.me: https://maps.me
- OSM Wiki: https://wiki.openstreetmap.org/wiki/MAPS.ME

Download

- Google Play: https://play.google.com/store/apps/details?id=com.mapswithme.maps.pro&hl=en_US

Training Materials

- Introduction to mobile data collection tools

4.4 Creating forms (ODK OMK)

Form design

Creating ODK forms

Forms can be created using spreadsheet software (such as Excel or LibreCalc) or using the ODK Form Builder. Documentation on how to design a form can be found here.

- Example ODK form
- Blank ODK form

Creating OMK forms Forms for OMK are slightly altered from ODK forms to incorporate the OSM tagging scheme and need to be built using spreadsheet software (such as Excel or LibreCalc). In addition to the structure of an ODK form, OMK forms require an additional 'osm' tab that alters the form structure for OMK. Documentation on how to design a form can be found here.

- Example OMK form
- Blank OMK form

Form conversion

After forms are developed, they need to be converted from .xlsx/.xls to .xml to be used by the ODK application. This can be done by using XLSform online or offline.

Set-up

Once forms are converted, follow these instructions for mobile device set-up.

4.5 Creating .mbtiles

Overview

MBTiles (.mbtiles) is the file format used for storing map tiles as a single file - the most common use case as baselayers for mobile mapping applications. There are multiple tools to create mbtiles, with selection based on baselayer type (aerial imagery), addition of vector layers, file size, zoom, etc.

I need .mbtiles with…

	HOT Export Tool	Tile Mill	TileHuria
Aerial Imagery Basemap	X	☑	☑
OSM Basemap	☑	X	☑
Vector layers (i.e. enumeration areas)	X	☑	X

Resources

- OSM Wiki: https://wiki.openstreetmap.org/wiki/MBTiles
- Mapbox: https://docs.mapbox.com/help/glossary/mbtiles/

HOT Export Tool

HOT Export Tool allows users to download OSM data by specifying tags, area of interest, and file type. Learning resources and walkthroughs can be found at the HOT Export Tool Learn page.

Tools and Technology Needed:

- Computer
- Internet Connection
- OSM Account

See Data Export Tools for more information and training materials on using the HOT Export Tool.

TileMill

TileMill is an offline, downloadable application used to create mbtiles. TileMill allows for vector layers to be inserted into mbtiles (i.e. assignment area shapefiles, roads).

Workflow for creation tiles with aerial imagery and vector layers can be found [here].

Tools and Technology Needed:

- Computer
- Internet Connection
- Optional: .shp files for vector layering

Resources

- TileMill Documentation: https://tilemill-project.github.io/tilemill/docs/crashcourse/introduction/

Download

- https://tilemill-project.github.io/tilemill/

Tile Huria

Tile Huria is a simple tool for creating mbtiles based on an area provided via Geojson format with aerial imagery.

Tools and Technology Needed:

- Computer
- Internet Connection
- .geojson file for area of interest

Data Collection Servers

Overview

When beginning a mapping project, many organizations ask if they need to have a server. After collecting data, you'll need to get the data from the devices. Sometimes, it works to simply collect and process data directly from the data collection devices. However, this does not scale well when you get more people collecting data, and also means your data is not backed up - if you lose the device, you can lose the data. Prior to data collection, it is important to have a data management strategy that is suited for your operations.

Using a data collection server allows for much better management of forms and deployments, collection and aggregation of responses, and can offer additional features for viewing, analysing and exporting data. Use of a server may be restricted by available resources (cost of a physical server) and/or internet connection (access to cloud server). The most used options are:

- **POSM** - a physical server that contains a set of OpenStreetMap tools, including OpenMapKit server. POSMs allow multiple users to connect and upload data from data collection devices to a central location without the need for internet access. This data can then be aggregated using the OMK Server and synced with OSM directly or downloaded for analysis and processing.
- **OpenMapKit Server** - OpenMapKit Server is a cloud based storage system for specially designed to store and compile OpenMapKit data. Data collected through OpenDataKit can also be uploaded to an OpenMapKit Server.
- **Kobo Toolbox** - An online application that allows users to build Kobo/ODK surveys as well as store, aggregate, and perform analysis of Kobo/ODK data.
- **ODK Aggregate** - ODK Aggregate is an online application (local options possible) that stores, aggregates, and allows users to perform basic analysis on ODK data.

If the use of a server is not available to you, it is still possible and crucial to store backups of data. In this case, data will need to be downloaded or otherwise shared with a central location, such as a laptop computer, and cloned to a secondary location such as a hard-drive or second computer.

POSM

OpenMapKit Server

Kobo Toolbox

ODK Aggregate

5.1.1 Server Data

Server data in this case refers to data sent to a server from the field. This data then has to be downloaded from the server, in order to prepare it for cleaning and validation. We will take for example data collected during the NMP Building Validation Project in Botswana. Servers used can be:

- A local Portable OpenStreetMap Server - **POSM** (for both **ODK** and **OMK** data)
- An online OpenMapKit Server (for both **ODK** and **OMK** data)
- KoboToolbox (for only **ODK** data)

Preparing OMK Data

Preparing ODK Data

Merging OMK data with ODK Data

5.1.2 Serverless Data

Serverless data in this case refers to data collected without the use of a server to receive field data. In order to clean and validate this data, it is copied from data collection devices (phones or tablets) directly. We will take for example data collected during the Local Empowerment for Government Inclusion and Transparency Project in Liberia.

5.2 OMK Field Data Cleaning Workflow

After field data collection with OMK, clean the data before upload to OSM. Below is an example version of the OMK Field Data Cleaning Procedure. This is provided for guidance but should be modified as needed.

Skills and Technology Needed * JOSM

Step 1. Create folders

Create the folder structure for the data cleaning process.

1. Create primary working folder: `[omk_field_data_cleaning]`
2. Create a container folder: `[village_name]_[current-date]`. For example: `akweteyman_2019-01-31`
3. Create a sub-folders within the container folder:
    1. Add a folder for the raw data: `/01_raw_[yourOSMname]`
    2. Add a folder for the working data: `/02_working_[yourOSMname]`
    3. Add a folder for the final data: `/03_final_[yourOSMname]`

Step 2. Raw Files

Supervisor or team leader will download data from the server, and select sections of data for individual data cleaners to clean up.

For Supervisor:

- *Each mapper's device id (IMEI) and username should be registered, to keep track of their submissions to the server.*

- *Using the filter option of the server, filter server submissions according to dates, download data for a specific data, divide it into subsections and give those to the data cleaning team.*

1. Create a sub folder `[server_downloads]` for all downloads from the server naming downloads according to the date of download, i.e `akweteyman_2019-01-31_server_download.osm`
2. While dividing out this data to the different team members, **purge** everything else except what you want to give to a specific team member, and then 'Save As...' that section. Do not copy a section of the data downloaded from the OMK server into another new file, as this will not sync while downloading data from OSM database to start cleaning field data. Read about the purge action: https://josm.openstreetmap.de/wiki/Help/Action/Purge
3. Do this for every team member you are giving data to clean.

For data cleaners:

1. The file your supervisor gives you will be named as: `[projectArea_name]_[current-date]_raw_[yourOSMusernam`
   For example: `akweteyman_2019-01-31_raw_lusdavo.osm`
2. Copy the file your team leader gives you to the `[projectArea_name]_[current-date]` → `01_raw_[your_OSMusername]_[id]` folder. Format dates as YYYY-MM-DD.

For example:

`akweteyman_2019-01-31` → `01_raw_lusdavo` → `akweteyman_2019-01-31_raw_lusdavo_10.osm`

NB: The represents project area subdivisions you are supposed to be working on.

Step 3. Add OSM Files to JOSM

Add file to JOSM

1. Open JOSM

2. Drag the .osm file into JOSM

Step 4. Sync Field Data with OSM Data

This step covers a series of checks on the data to check if there are any issues with the data.

1. You will need several *plugins* during this cleaning process. Read about plugins here: https://wiki.openstreetmap.org/wiki/JOSM/Plugins. Add the following plugins:

- `todo`
- `opendata`
- `utilsplugin2`
- `buildings_tool`

2. You will be using several filters during your cleaning process. Read about Filters here: https://josm.openstreetmap.de/wiki/Help/Dialog/Filter. Add the following filters: 'type:node untagged' 'new OR modified'

3. Prepare your data for cleaning:

- Select field collected data using the JOSM filter: `type:node untagged`
- Select all results (Ctrl+A)
- Add the selection to the TodoList plugin. In the plugin window, click '+ Add'
- Deselect results by clicking in the 'Map View' window
- Download OSM data in the area of the field collected data, to ensure we merge properly with existing OSM data
    - Press '2' on the keyboard to zoom to the extents of your field collected data
    - Select 'File -> Download in current view'
- Now save this file to your 'working folder'
    - File → Save As → `[projectArea_name]_[current-date]_working/[working_yourOSMusername]_[id]`
    - For example: `akweteyman_2019-01-31_working_lusdavo_10.osm`

Step 5. Cleaning Data

1. Select/enable the filter 'new OR modified'
2. Select only new or modified data using the JOSM filter: 'new OR modified', tick 'E' and 'I' to differentiate between field data and OSM Server data. Check if everything looks okay.
3. You are now going to clean the 'working' file in JOSM.
4. Add Imagery being used to clean data.
5. Uncheck the 'type:node untagged' filter to enable you edit features.
6. Convert all building nodes to polygons by using replace geometry feature.
7. From the ToDoList, inspect each feature (select the first one in the TodoList)

- Are the locations correct?
- Convert comments into possible tags as possible else change the key to fixme
- Are there any spelling mistakes in the attributes of this feature?
- Are the tags capitalised correctly?
- Are the tags fields filled correctly?
- Are we not duplicating existing OSM data?
- Expand all text and correct all text, examples below:
    - St. → Street
    - Ave → Avenue
    - Ltd. → Limited
    - BANK OF GHANA → Bank of Ghana
    - GOIL → Goil, etc

8. If okay, click 'Mark' in TodoList to proceed to the next item

5.1 Cleaning Apartments

Use the `Terrace a Building` tool to divide a building into the different number of apartment units that building has, then copy and paste attributes from an apartment point to the respective building terrace. If a building is 5 or more sided, manually draw the different apartments connecting them together.

5.2 Record Errors Encountered

Capture common problems that come up while cleaning data.

1. Data cleaners should record any errors and problems encountered (both while mapping and validating).
2. Please record this in a text file with screenshots if possible
3. Save edits to `<projectArea_name>_<current_date>/02_working`' folder.

Step 6. Save Final Files

NOTE: Some projects may require that datasets are split into public and private datasets, where the full dataset remains private, and personal/private data is removed from the partial dataset uploaded to OSM. For similar situations, use 6.1 and 6.2. For projects where all data collected is public and can be uploaded to OSM, skip to 6.2

1. Right-click the working layer and select 'Save As..'
2. You are to 'Save As..' to the final folder. Team Leaders are to review their team's data validation. If satisfied, get the Group Supervisor to double check the data.
3. Disable all filters used during data cleaning.
4. Run 'Validation' in the 'Validate Results' window. Correct any errors that are detected, and go through the warnings.
5. Notify supervisor for review.

6.1 Private Data

If full data set includes private/personal information: 1. Save to the final layer: `[projectArea_name]/[current_date` for example `akweteyman/2019-01-31/03_final_lusdavo` folder. * File name: `akweteyman_2019-01-31_final_lusdavo_` 2. From the saved file to be uploaded to OSM, remove the private/personal attributes before uploading to OSM (enable the type:node untagged and new OR modified filters). * For example: * building:population * building:sleeping_spaces * building:rooms * Building:rooms_painted

NOTE: Do not overwrite the _private file. These changes will be saved to a new layer in step 6.2.

6.2 Public Data for upload to OSM

1. Save to the final layer: `[projectArea_name]/[current_date]/03_final`, for example `akweteyman/2019-01-31/03_final_lusdavo` folder.
   • File name: `akweteyman_2019-01-31_final_lusdavo_10.osm`
2. Notify supervisor for review

Step 7. Upload to OSM

If Supervisor authorises, upload the validated data to OSM

1. Add the **source** tag to all field data. At minimum, `Field Survey`
   • Example: source= Open Cities Accra - Field Survey
2. Disable the 'type:node untagged' and 'new OR modified' filters

3. With your OSM Username and Password added to JOSM preferences, upload to OSM adding the appropriate tags for the project as a changeset comment.
   - Example: `#OpenCitiesAfrica #OSMGhana #MobileWebGhana #HOTOSM` Specify the data source for change as survey.

Step 8. Quality Assurance using OSMCha|QGIS|JOSM|Osmose

This is intended to be used by supervisors to ensure data quality

Once data is cleaned and uploaded to OSM, several tools will be used to monitor Quality Assurance. * OSM Cha: Will be used to monitor the edits made by users uploading data to OSM, Filters will be made using UserIDs of data to give a summary of modified, deleted, added nodes, which the QA person will review and either flag as bad or good, sending feedback to the person who uploaded the data. Example of filtered changesets * JOSM: JOSM Validation tools, filters and customised MapCSS will be used to flag data quality issues, then give feedback to the data entry people for improvement. * Osmose

For more information, see Quality Assurance Tools.

5.3 Data Cleaning with JOSM

There are tools built into JOSM, as well as additional plugins that can assist with data quality control during the upload process.

- **Filters** is a built-in tool that allows you to disable, hide, select, and highlight specific groups of objects based on flexible custom parameters. This tool will help you to spot and avoid common mistakes, and review data.
- The **Validation Tool** is another built-in tool that will review and search for common errors as well as provide warnings about potentially problematic data.
- The **Todo List** plug-in allows users to systematically review data that is to be uploaded, and monitor progress of data cleaning work. The "ToDo List" plug-in, needs to be downloaded before it can be used. Visit this page to learn how to install plug-ins in JOSM, then download the "ToDo List" plug-in.
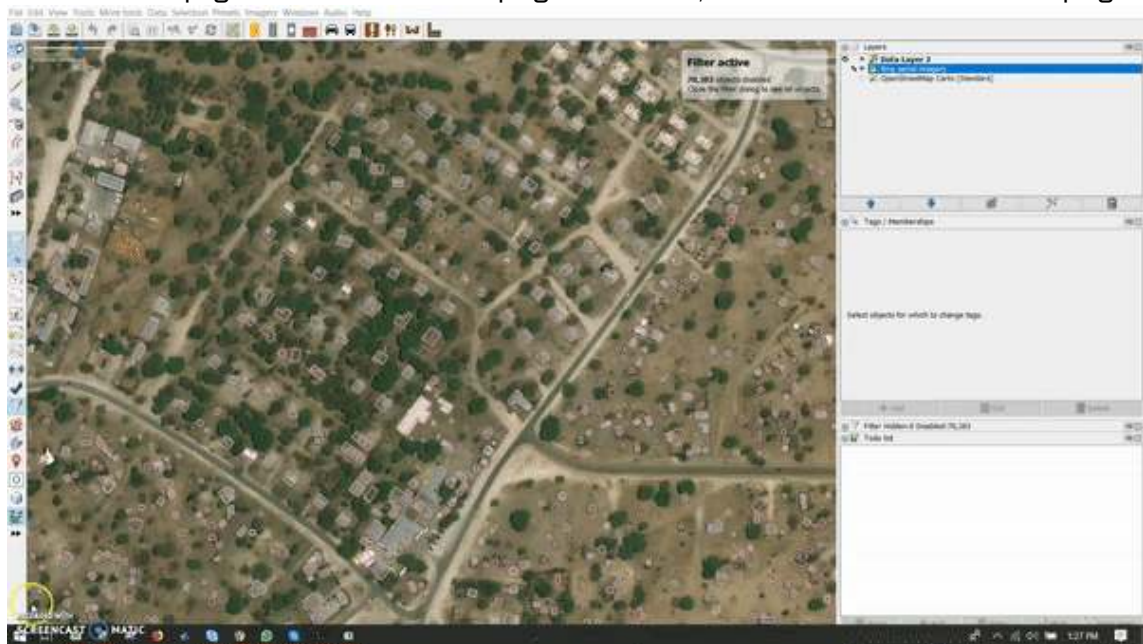
- **MapCSS Paint Style** is an advanced JOSM quality assurance tool that can be used to visually identify errors such as missing tags and road network issues. Existing MapCSS Styles can be imported or with some training, quality control teams can create their own MapCSS styles that match their data model.

5.4 Quality Assurance and Quality Control

Quality Assurance and Quality Control is the process by which mappers, and OpenStreetMap contributors in general, check data to ensure that all information uploaded to OSM meets high standards for usage and to prevent vandalism. As OpenStreetMap is a free and open platform that anyone can use and edit, it is critical to the sustainability of open data and OSM that everyone participates in the quality assurance and quality control process – from field data collection to data cleaning to long-term maintenance of existing OSM data.

The data quality dimensions identified through this framework as the highest priority for assessment of all datasets are:

- **Completeness**
- **Consistency**
- **Accuracy**
- **Timeliness**
- **Accessibility**

For each data quality phase, the following sets of questions should be answered:

Phase 1

Defining Needs & Requirements

Why are we collecting this data? Who will use it?

What data are we collecting?

What information will we and other users need to know about the data we collected?

What is the geographic scope of our data?

What is the temporal scope of our data collection? Does this timeline meet the needs of the users?

What quality metrics are required for the datasets? Is there an allowable margin of error or acceptable data gaps?

Have partners reviewed and agreed upon the needs and requirements of the project?

Does the scope of this project fall under the OSM Organized Editing Guidelines? If so, does it meet the requirements?

Phase 2

Defining Data Collection Methodology

Have permissions been secured to conduct data collection in the area of interest? Has proper community outreach been conducted with the community and stakeholders relevant for the area of interest?

Have team members been provided specialized and hands-on training for their role?

Has all software and hardware been selected based on the needs of the project? Has all software and hardware been tested?

Do data collection forms meet the need of the project and data model? Have data collection forms been trialed by surveyors and with survey subjects?

How will collected data be stored? What data protection strategies are in place?

Where will the data come from and what standard indicators will be used that can help achieve objectives?

Phase 3

Collecting Data & Producing Datasets

Are data collectors able to report issues and challenges in the field?

Is data quality being monitored during field data collection?

Is field data being safely secured on a daily basis?

Phase 4

Cleaning and Validating Datasets

Has raw data been reviewed for errors prior to upload or packaging? What tools were used in this process and why?

Do the cleaned data sets include private data or publicly identifiable information? If so, has the dataset been split into public and private sets?

Has data been properly uploaded to OSM with designated changeset comments and tags?

Has data uploaded to OSM been reviewed for additional quality assurance? What tools were used in this process and why?

Phase 5

Ensuring Sustainability & Providing Documentation

Has data been made available through an open and accessible program?

Has the availability of data been communicated to relevant stakeholders?

Have the workflows, tools, and processes used for the project been documented? Is this documentation open and available for users outside of HOT?

Have local stakeholders or other groups with potential for sustaining data use and data collection been trained in project methodology?

Quality Assurance Tools

The following are Quality Assurance tools commonly used in the HOT workflow. A detailed overview of these and other QA tools can be found at the Quality Assurance Tools Wiki. Different tools check for different errors and issues. If you want to:

- Check for attribute completeness, use MapCampaigner.
- Check for potential vandalism, use OSMCha.
- Check for contributions and upload issues by indivdual user, use OSMCha.
- Check for tagging issues, use Osmose AND JOSM Validation.
- Check for geometry issues, use Osmose AND JOSM Validation.

MapCampaigner

MapCampaigner is a tool developed by HOT to monitor attribute completeness for predefined areas of interest (AOI). Based on your data model, the tool checks and highlights any map features that are missing pre-defined tags within your AOI, and allows team validators to download and fix those features.

OSMCha

OSMCha, or the OpenStreetMap Changeset Analyzer, is a tool designed to review uploads and changes to OSM data, largely to prevent vandalism and bad edits made to map data. This tool allows users to filter by username, location, dates of upload, and other metadata features. OSMCha is useful for monitoring the progress of data cleaning and upload teams.

Osmose

Osmose is a tool that monitors multiple quality control issues in OSM. These include issues with feature geometry (such as overlapping buildings/nodes, incomplete features, and duplications), and also common tagging issues (such as missing, unsuitable or poorly formatted tags). More information about Osmose can be found at the Osmose OSM Wiki Page.

Note: to properly use this tool and view errors, you will need to use the Google Chrome internet browser. Firefox, Opera, Safari, and other browsers may not display the information correctly.

Steps to correct key issues identified by Osmose

1. Open JOSM on your computer.
2. Navigate to http://osmose.openstreetmap.fr in the Google Chrome internet browser.
3. Use the zoom, pan, and search features on the map to navigate to your area of interest.
4. Use the left panel to toggle common issues on and off.
5. Identified issues will appear in the map as pins matching the icons from the issues panel. Click on each pin to learn more about the object and associated issue(s).
6. In Osmose, locate the 'Export' button at the top of the page. Click 'Export', then 'JOSM'.
7. Fix the issues identified then re-upload to OSM.

6.1 HOT Export Tool

HOT Export Tool allows users to download OSM data by specifying tags, area of interest, and file type. Learning resources and walkthroughs can be found at the HOT Export Tool Learn page.

Tools and Technology Needed:

- Computer
- Internet Connection
- OSM Account

Training Activity

Presentation: Estimated time:

In this activity, you will practice using the HOT Export Tool for downloading OSM data for use in QGIS. The HOT Export Tool is an online-based tool, so you will need to be patient with internet connectivity.

To get started, open an internet browser and go to: https://export.hotosm.org/

To use the HOT Export Tool, you will need to log in using your OSM username and password, by clicking the red "Log In" button in the top right-hand corner. After logging in, click on 'Create'.

Practice

- On the map to the right, zoom in and find a location of your choice (i.e. Zwedru, Accra).
- Once you have zoomed in to your area of interest, select the box tool from the Tools Menu on the right.
- Click one corner to start drawing a box, then select the opposite corner to complete the box. This is your AREA OF INTEREST that will be downloaded.
- On the left side of the window, fill out the "1 Describe" options:
  - Name: "[YOUR OSM USERNAME] Test Export"
    * For example, "jessbeutler Test Export"
  - Description (optional)
  - Project (optional)
    * For example, "Government Inclusion Project"
  - Click 'Next'
- Fill out the "2 Formats" options:
  - Select File Format: Shapefile (.shp)
  - Click 'Next'
- Fill out the "3 Data" options:
  - Select 'Education'
  - Select 'Government'
  - Select 'Healthcare'
  - Click 'Next'
- Fill out the "4 Data" options:
  - Deselect 'Publish this Export'
  - Click 'Create Export'

This process will take several minutes to process.

- When the export process is completed, the 'Status' bar will be updated to 'COMPLETED'
- Download the shapefile by clicking on the shapefile link, as highlighted above.
- Open the downloaded .zip folder and save it to a folder of your choice on your computer.
- You can now use the shapefile in a GIS software such as QGIS.

6.2 Humanitarian Data Exchange (HDX)

Humanitarian Data Exchange (HDX) is a data platform for storing and sharing humanitarian data. The platform is managed by OCHA's Centre for Humanitarian Data. Types of data available on HDX include: Data includes:

- Geospatial datasets
- CSVs & spreadsheets
- text & image files

Tools and Technology Needed:

- Computer
- Internet Connection

Training Activity

Presentation: Estimated time:

In this activity, you will practice using Humanitarian Data Exchange (HDX) for downloading OSM data for use in QGIS. HDX is an online-based tool, so you will need to be patient with internet connectivity.

Downloading data

1. Visit data.humdata.org
2. In the Find Data search bar, type your area of interest (i.e. Liberia, Tanzania), and click search
3. Browse list of available datasets
4. Select a dataset of interest
5. Download data file

Adding data

1. Visit data.humdata.org
2. In the Add Data window, select 'Upload File'
3. You will need to sign in or register as an organization
4. Make sure data file meets HDX standards
5. Upload data file

7.1 QGIS

QGIS (or Quantum GIS) is a free and open source geographic information system (GIS) program. GIS programs allow users to display, manage, and analyze geospatial information on the computer, and create map products. Geospatial data that can be used in GIS includes aerial imagery, GPS data, and spatial datasets.

Skills and Technology Needed

- Computer with
    - Windows, Mac, or Linux operating system
    - Sufficient free disk space (approx 10GB) and administrator rights to install software
- Geospatial data
- Recommended: computer mouse

Resources

- QGIS Training Manual: https://docs.qgis.org/2.18/en/docs/training_manual/
- QGIS Tutorials: https://www.qgistutorials.com/en/docs/learning_resources.html

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Training Materials

- Introduction to Open Source GIS and QGIS
    - Presentation pdf
- Installing QGIS
- Navigating QGIS and Adding Data
- Plug-ins
- Creating maps in print composer
- Creating an Atlas

7.1.1 Installing QGIS

QGIS is a free, open source geographic information system. The program can be shared and installed offline or downloaded online.

QGIS is available for download for the following operating systems:

- Windows
- Mac OS
- Linux

Skills and Technology Needed

- Computer with sufficient free disk space (approx 10GB) and administrator rights to install software
- Recommended: computer mouse

For Windows

Prior to installation, you need to determine whether or not your computer runs on a 32-bit or 64-bit system. 1. Open the Start Menu, right-click on "Computer", and select "Properties". 2. Under "System", the correct system type will be listed.

Installing from Shared File

If you are offline, you will need to install QGIS from a shared file. The QGIS Installer can be downloaded and shared via USB. This file can be shared with colleagues and others who wish to install the program. To install from a shared file: 1. Go to folder shared to you and downloaded to your computer. 2. Select the appropriate installer folder based on your operating system (Windows 32-bit; Windows 64-bit; or Mac). 3. Open the installer to begin the installation process.

Installing from QGIS Website [image]

If you did not receive an offline installer, you will need to install from the QGIS website. Additionally, it is highly recommended to download software directly from the QGIS website whenever possible. This ensures that you have the most up-to-date version of the program. The QGIS file is larger than 300MB and may take a long time to download, depending on your internet connection.

To install: 1. Visit: http://www.qgis.org/en/site/forusers/download.html 2. Select your appropriate operating system (i.e. Windows, Mac, Linux). 1. For Windows - select your appropriate system (32-bit or 64-bit). 3. Click on the QGIS Standalone Installer to begin the download process. 4. Once installed, open the installer to begin the installation process.

Resources

Further QGIS Install instructions: https://docs.qgis.org/testing/en/docs/user_manual/introduction/getting_started.html#ins qgis

Considerations when installing QGIS for large numbers of individuals

- Consider internet connectivity and capacity prior to installing QGIS for large numbers of individuals via internet. It is highly recommended that prior to the training/workshop, installation files are downloaded and loaded onto USB drives for offline installation.
- When downloading offline installers for a large group, make sure to download an installer for all operating systems. Note: it will be important to download the Windows installer for BOTH 32-bit and 64-bit.
- The downlaod and installation process often takes longer than anticipated, especially when factoring in technical skills and hardware compatibility. Therefore, it is recommended to begin download and installation process early in the training or during breaks to ensure a smooth process and adherance to agenda.
- Prior to the training/workshop, request attendees to make sure that they have enough space on their computers (10GB+) for installation of QGIS.

7.1.2 Basic QGIS

overview **Resources: Presentation:**

Training Activitiy

Navigating QGIS

Familiarize yourself with the various parts of the QGIS browser, hover your mouse over icons to view names of various tools. *Note: Your browser may have different tools than the image below.*

1. Layers panel - This is where layers (i.e. imagery, building layers) will be listed. The order of layers in the panel impacts the order of layers in the map - in other words, the layer at the top of the list will appear as the top layer in the map.
2. Toolbars - Most of the tools you will regularly use in QGIS will appear as icons in the toolbars at the top, such as save, zoom, pan. The number of toolbars depends on various features you have activated or installed.
3. Map Canvas - When layers are added to the Layers Panel, they will appear in the map canvas.
4. Status Bar - Coordinates, scale, and projection will appear in the Status Bar.

[image]

Installing Plug-ins

Tools and skills required

- Internet connection

Plugins allow you to extend the functionality of QGIS. In this exercise we shall install and use one plugins: **QuickMapServices** *Note: Managing and installing plugins requires an internet connection. If the Plugin Manager is not working, check your internet connection.*

To install plugins, click on the menu item Plugins ⊠ Manage and Install Plugins.

1. In the dialog that opens, find the QuickMapServices plugin.
2. Then click the Install Plugin button.
3. QuickMapServices allows you to add free, online basemaps to your QGIS maps, including OSM basemaps.
4. Once installed, QuickMapServices can be accessed in the top menu Web ⊠ QuickMapServices
5. In the QuickMapServices sub-menu, several types of basemaps can be accessed including OSM.

[image]

For aerial imagery, in the QuickMapServices sub-menu, open 'Settings'.

1. Click the 'More Services' tab.
2. Select 'Get Contributed Pack'.
3. Return to the QuickMapServices sub-menu. There will now be a long list of options for basemaps, including Bing.

[image]

Styling Layers

Data layers can be styled in two ways: copying from other layers in the project, and opening the properties tab. For this purpose, we recommend copying the style from the previous data layers. To copy styles:

1. Right-click on any of the previous census data layers (styled green).
2. Select 'Style', then 'Copy Style' (as in the image below).
3. Next, right-click on the new layer, select 'Style', then 'Paste Style'.
4. Styles from point layer styles can only be copied and pasted to other point layers, polygon layers styles can only be copied and pasted to other polygon layers, etc.

To manually select a style:

1. Double-click on a layer in the Layers Panel or right-click on the point layer and select 'Properties'.
2. Select 'Style' from the left-hand menu.
3. In this window you can change 'Fill' Color, 'Outline' Color, 'Size', 'Outline style', 'Outline Width' and more to your own choice.

Creating a New Print Composer

Open the 'Project' menu from the main toolbar, and select 'New Print Composer'. In the pop-up window, create a title for your map. This can be a unique name to describe your map's purpose such as "Political Map of Liberia" or simple such as "Map 1".

A new window will be created with a blank page. This shows how your map will look printed out.

You will need to add the common elements of a map to the map canvas:

- Map
- Title
- Legend
- Scalebar

Each of these elements can be added by opening the 'Layout' menu on the top toolbar.

Practice:

- Add your map by selecting 'Add Map' from the 'Layout' menu. You will need to draw the box by clicking and dragging the corners.
- Add a title to your map by selecting 'Add Label' from the 'Layout' menu. Like the map, you will need to draw the box by clicking and dragging the corners. The default text is 'QGIS'. This can be changed in the 'Item Properties' panel.
- Change the font and size of your title.
- Add a legend to your map by selecting 'Add Legend' from the 'Layout' menu. Like the map, you will need to draw the box by clicking and dragging the corners. You can add or remove legend items in the 'Item Properties' panel.
- Add a scale bar to your map by selecting 'Add Scalebar' from the 'Layout' menu. Like the map, you will need to draw the box by clicking and dragging the corners.
- Move these items around your Map Canvas until you are pleased with the layout of your map. Think of your audience: will they understand the information you want to convey?
- Compare your map with your neighbor's map.
- Save your map as a PDF by opening the Composer menu and selecting 'Export as PDF'.

7.1.5 Creating an Atlas in QGIS

Creating an atlas in QGIS allows users to create a series of maps for geographic regions with a set template. This atlas template allows for a large number of maps to be generated for areas of interest, such as districts, wards, and other administrative areas, with the same style and layout.

HOT Project Examples:

- Ramani Huria (Dar es Salaam, Tanzania)
- LEGIT (Liberia)

Training Activity

Presentation: Estimated time: Skills and technology needed: * Installation of QGIS * Navigating QGIS and adding data * Creating maps in print composer * GIS data files (i.e. shapefiles, geojson) * Example shapefiles zip

This activity covers the process of generating and configuring an atlas in print composer. Example shapefiles are provided for this activity but can be followed with shapefiles provided by the user.

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1. Preparing map data

Before creating an atlas, you will need to add and style layers. While styling layers, you will need to consider how the layers will look in print composer. As maps in the atlas may be at varying scales, it may be necessary to return to styling after generating the atlas to make adjustments.

Practice:

- To follow along with the practice steps, add the following vector data to your map:
  – Dar_sub-wards_EPSG_4326
  – Dar_wards_EPSG_4326
- Change the background color of the project. Open the 'Project' menu from the top toolbar, select 'Project properties'. Under general settings, change the background color to blue.
- Style the ward layer (Dar_wards_EPSG_4326) by right-clicking on the name in the Layers Panel and selecting 'Properties'. In the pop-up window, select 'Style' from the side menu. Style as described below:
  – Select 'Simple Fill' from the upper left window.
  – Change 'Symbol layer type' to 'Outline: Simple Line'
  – Change the color to purple.
  – Change the 'Pen style' to 'Dash Dot Line'
  – Select 'Apply' and then 'OK'.
- Duplicate the ward layer (Dar_wards_EPSG_4326) by right-clicking on the name in the Layers Panel and selecting 'Duplicate'. Right-click on the copy layer and select rename. Rename this layer as 'Ward_grey_background'.
- Style the 'Ward_grey_background' layer by right-clicking on the name in the Layers Panel and selecting 'Properties'. In the pop-up window, select 'Style' from the side menu. Style as described below:
  – Select 'Simple Fill' from the upper left window.
  – Change 'Symbol layer type' to 'Simple fill'
  – Change the color to the html code #edeae2 (or select a light grey color).
  – Change the 'Outline style' to 'No pen'.
  – Select 'Apply' and then 'OK'.

- Style the sub-ward layer (Dar_sub-wards_EPSG_4326) by right-clicking on the name in the Layers Panel and selecting 'Properties'. In the pop-up window, select 'Style' from the side menu. Style as described below:
    - Select 'Simple Fill' from the upper left window.
    - Change 'Symbol layer type' to 'Outline: Simple Line'
    - Change the color to yellow.
    - Change the 'Pen style' to 'Dot'.
    - Select 'Apply' and then 'OK'.
- After styling the sub-ward layer (Dar_sub-wards_EPSG_4326), select 'Labels' from the side menu in 'Properties'.
    - In the top drop down menu, change the option from 'No Labels' to 'Show labels for this layers'.
    - For 'Label with', select the option 'Vi_nam_N' from the drop-down menu.
    - Change your 'Text' options such as font, font size, font color, etc.
    - Select 'Apply' and then 'OK'.
- After styling all layers, ensure that your layers are in the following order in your layers panel. (To adjust layer ordering, left-click and hold on a layer and then drag up or down in the list.)
    - Dar_wards_EPSG_4326
    - Dar_sub-wards_EPSG_4326
    - Ward_grey_background

2. Creating a Map Layout in Print Composer

Open the 'Project' menu from the main toolbar, and select 'New Print Composer'. In the pop-up window, create a title for your map. This can be a unique name to describe your map's purpose such as "Dar Sub-Wards".

A new window will be created with a blank page. This shows how your map will look printed out.

At minimum, you will need to add the following common elements of a map to the map canvas:

- Map
- Title
- Legend
- Scale Bar
- North arrow

Each of these elements can be added by opening the 'Layout' menu on the top toolbar.

Practice

- Add your map by selecting 'Add Map' from the 'Layout' menu. You will need to draw the box by clicking and dragging the corners.
- Add a title to your map by selecting 'Add Label' from the 'Layout' menu. Like the map, you will need to draw the box by clicking and dragging the corners. The default text is 'QGIS'. This can be changed in the 'Item Properties' panel.
- Change the font and size of your title.
- Add a legend to your map by selecting 'Add Legend' from the 'Layout' menu. Like the map, you will need to draw the box by clicking and dragging the corners. You can add or remove legend items in the 'Item Properties' panel.
- Add a scale bar to your map by selecting 'Add Scalebar' from the 'Layout' menu. Like the map, you will need to draw the box by clicking and dragging the corners.
- North arrow can be added by selecting 'Add Image'. Like the map, you will need to draw the box by clicking and dragging the corners. In the 'Item Properties' panel, open the 'Search Directories' option to select from a choice of symbols.
- Move these items around your Map Canvas until you are pleased with the layout of your map. Think of your audience: will they understand the information you want to convey?

3. Atlas Generation

After completing the layout for your map, you are ready to generate the atlas. In the right-hand panel, select the tab for 'Atlas generation', near the 'Composition' and 'Item properties' tabs. If this tab is not appearing, select the 'View' menu from the top toolbar, then select 'Panels' and check 'Atlas generation'.

In the 'Atlas generation' panel, check the box next to 'Generate an atlas' to begin configuring your atlas.

4. Atlas Toolbar and Navigation

Once the atlas is generated, you will be able to preview and navigate through the atlas with the atlas toolbar. To navigate, first select the 'Preview atlas' button. Changes can be made to the atlas layout while in preview mode.

5. Configuration

The configuration options in the atlas generation panel controls how the atlas is generated.

1. The 'Coverage layer' is the layer that contains the geographic areas of interest for your atlas. For example, for an atlas showing maps of each district you will need to select your district layer.
2. 'Page name' allows you to name pages by either selecting an attribute from the coverage layer or building an expression from attribute table values.
3. If you do not want to show all areas included in your coverage layer, 'Filter with' allows you to filter out geographic areas that you do or do not want to include in your atlas. This option requires an expression to be built.
4. 'Sort by' allows you to order your atlas by an attribute of your coverage layer.

Practice

- Select 'Dar_sub-wards_EPSG_4326' as the coverage layer.
- For page name, select 'Vil_Mtaa_N'.
- Check the box for 'Sort by' and select 'Vil_Mtaa_N'.
- In the atlas toolbar, select 'Preview atlas' and navigate the pages to see the changes.

6. Building expressions for data-driven text

Expressions allow for text such as labels and titles to be data-driven, or generated from attributes. When working with an atlas, expressions take attributes from the coverage layer.

1. Text that is not data driven should be written within single quote marks. Example: 'Map'
2. Spaces between words should be indicated with a space within single quote marks. Example: 'Map of'
3. Selected values and plain text need to be separated by the operator '||'. This operator can be typed or selected from the 'Operators' list. Example: 'Map of' ||
4. Data-driven text, or text that is generated from attributes, can be selected from the 'Fields and Values' list. Example: 'Map of' || "Ward_Name"
5. An 'Output preview' will generate at the bottom of the expression builder window.

Practice

- Select or create your title box and select "Insert expression" in the 'Item Properties' panel.

- Use the 'Fields and Values' list to generate the following expression:

  "Vil_Mtaa_N" || ',' || "Ward_Name"

- Check the output preview to make sure the expression was typed correctly.

7. Inverse polygon layer

Adding an inverse polygon layer can focus the map by shading out or completely covering features outside your area of interest.

1. Return to the main QGIS window.
2. Select the layer used as the coverage layer in the Print Composer. Right-click and select 'Duplicate'
3. Right-click on the layer copy and select rename. Rename the layer.
4. Right-click on the layer and open properties. Select 'Style' from the side menu.
5. In the top drop-down menu, select 'Inverted polygons'.
6. Under 'Sub renderer:', select 'Rule-based' from the drop down menu.
7. In the rules list window, double click on '(no filter)' to open the 'Edit rule' window.
8. In the 'Edit rule' window, select the '…' button to create a filter. An expression builder will open. In the expression window, type or build from the Variable list: $id=@atlas_featureid
9. In the 'Edit rule' window, make sure that the symbol type is Simple Fill.
10. Change the transparency to 50%.
11. Change the color to dark grey.
12. Click 'Ok' to exit all option windows.

Practice:

- Complete all steps above.
- For step 2, this will be the "Dar_sub-wards_EPSG_4326" layer.
- For step 3, rename the file "Sub-wards_transparent".

8. Adding overview maps

Overview maps allow the audience to understand the map's focal location within the context of a larger area. For example, an overview map may show a ward's location within the city. In QGIS, an overview map can be created that will automatically show the map location for each atlas page.

1. In the main QGIS window, select the layers you would like to have in the overview map. These should typically be layers that can be viewed easily on a small scale (i.e. boundaries, highways, waterways). Multiple layers can be selected at a time by holding Ctrl on your keyboard while selecting.
2. Right-click on these layers and select 'Duplicate'.
3. Select all of the copied layers. Right-click and select 'Group Selected'. This allows for better data management and makes it easier to turn groups of layers on and off depending on the map needs.
4. Right-click on this group and rename it 'Overview Map'
5. Turn on all grouped layers and turn off all others by clicking the check boxes next to the layer names.
6. Return to your Print Composer.
7. Open the 'Layout' menu from the top toolbar and select 'Add map'. Draw a small box for your overview map.
8. Go to the 'Item Properties' panel for the second map and open the 'Overviews' options.
9. Click the green '+' button to add an overview.
10. For 'Map frame', select 'Map 0' from the drop down menu.
11. 'Frame style' will allow you to change the color, outline, and transparency of the map frame.
12. In the 'Items Properties' panel, open the 'Layers' option and select 'Lock layers'. This will keep the limited layers while allowing for the main map to show all layers.
13. Return to the Main QGIS window. Turn off all grouped overview layers and turn on the other layers.

Practice

- Follow all steps above.
- For Step 1, select the layers 'Dar_wards_EPSG_4326 copy', 'Dar_sub-wards_EPSG_ 4326 copy', and 'Ward_grey_background copy'.'

9. Atlas Review

After completing the layout and atlas generation, it is important to check each page of the atlas for correct expression generation (i.e. all pages are correctly titled) and that the appearance of layers and labels in each map appear correctly. If there is a large difference between map scales for different pages, styles, labels, grids, and other factors may need to be adjusted to best suit all map scales.

Practice:

- Use the 'Atlas toolbar' to navigate through your atlas pages.
- For each page, check:
    - Map layer visibility
    - Label visibility
    - Expression-driven text (i.e. title, additional text boxes)
    - Scalebar size and placement

10. Output filename expression

Prior to exporting the atlas, an output filename expression needs to be built. This expression will determine the name for each page of the exported atlas files. See 'Building expressions' for instructions on building expressions.

The default expression is 'output_'||@atlas_featurenumber which will produce a filename such as "Output 3". This can be changed to create a more accurate filename for your maps.

Practice:

- Select the expression builder button
- Build the expression: "District_N" || ' ' || *"Ward_Name" || "* || "Vil_Mtaa_N"
- Check the output preview at the bottom of the expression builder to make sure that the expression has been built correctly.

11. Exporting Atlas

To export the atlas, select the 'Export Atlas' button in the Atlas tool bar. Select the appropriate file type (Export as Images, Export as SVG, or Export as PDF) and select the folder where the files will be exported to.

12. Atlas Templates

Atlas templates can be saved and added to other QGIS projects. To save a template, open the 'Project' menu from the top toolbar and select 'Save as Template'. This will save as a Composer Template (*.qpt* .QPT) file.

To add the template to another project, open a new print composer. Open the 'Project' menu from the top toolbar and select 'Add items from Template'. Note: items will be sized to the original document page size. Item sizes may need to be adjusted if the new project is using a different page size.

7.4 OSM Analytics

OSM Analytics allows users to understand more about how and when editing took place, or assess quality within OSM, use the OSM Analytics suite of tools. You can view how data has changed over time within OSM, understand quality within an area, or analyze what type of data is available.

More information about OSM Analytics can be found here and here.

Data Use and Analysis

There are a handful of free tools available to extract and utilize OSM data for decision-making. By either using OSM data in conjunction with free population data sets from, for example, World Pop or other thematic datasets from the Humanitarian Data Exchange or even combining it with your own generated data, various tools can be used to clean, analyze and visualize information to inform project planning and decision-making.

This section covers:

1. **QGIS** - a cross-platform desktop geographic information system (GIS) software that allows you to analyze and edit spatial information, as well as compose and export geographic maps.

   Level: Advanced

   qgis.org

2. **uMap** lets you create maps with OSM layers quickly. The platform features sample maps to inspire your use of layers, points of interest, design and licensing.

   Level: Beginner

   umap.openstreetmap.fr

3. **Overpass Turbo Query** is a web-based data filtering tool for OSM. You can run queries and analyse the resulting OSM data interactively on a map. There is an integrated Wizard that makes creating queries easy.

   Level: Beginner/Intermediate

   overpass-turbo.eu

Additional tools not detailed in this section:

1. **MyHeatMap** allows you to view your geographic data interactively. Combining geospatial data with a colour-coded gradient makes it easier for your audience to quickly interpret your information.

   Level: Beginner/Intermediate

   openheatmap.com

2. **Data Wrapper** allows you to quickly create beautiful and responsive charts - in seconds. It is a three step process: copy/paste your data, visualize your data by choosing from many charts and map types and then publish your final creation into your format of choice.

   Level: Intermediate

   datawrapper.de

6. Data Export Tools

Data Export Tools allow users to download OSM data for use and analysis programs such as QGIS. The following are Data Export Tools commonly used in the HOT workflow. For more information on how to use these tools, use the training materials linked below.

HOT Export Tool

HOT Export Tool allows users to download OSM data by specifying tags, area of interest, and file type.

Humanitarian Data Exchange (HDX)

Humanitarian Data Exchange (HDX) is a data platform for storing and sharing humanitarian data managed by OCHA's Centre for Humanitarian Data.

QuickOSM

QuickOSM is a QGIS Plug-in that allows users to directly download OSM data for specific tags into QGIS.
Instructions for using and installing QGIS Plug-ins including QuickOSM can be found in here.

Training Materials

Data Export Tools Presentation - English