Bangladesh Forest Inventory (BFI) Data Management Protocol

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Bangladesh Forest Inventory Data Management Protocol

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1. Introduction

The Bangladesh Forest Inventory (BFI) is a continuous process led by Forest Department (FD) under the Ministry of Environment and Forest. Over 100 staffs from FD are involved in the BFI tasked with the data collection, quality assurance and logistics. The BFI is a combination of different inter-disciplinary activities which apply the latest technology for data collection, processing and analysis. The methodology of BFI has been developed with inputs from hundreds of national and international experts from more than 40 institutions.

Approximately 1858 field plots will be measured in 2016-2017 to collect data regarding forest and tree resources of the country. BFI is a trend setter of using an android operated application "Open Foris" for field data collection and management. Using this application field teams are collecting and sending data to the central BFI unit. The data are initially input and managed in Open Foris, further processed through "R" software, and then finally stored in "Access Database". Overall the process saves considerable effort in manual data input and in paperwork which helps to save natural resources.

2. Scope and audience of the document

1) This document describes the procedures for the processing of BFI data.
2) It also describes the process of entering, clearing and producing reports.
3) This information may be useful to: researchers, surveyors, students, Forest Department, different government and non-government institutions etc.

3. Instructions for tools

3.1 Open Foris

Open Foris is a set of free and open source software, to make data collection, management and analysis flexible and effective. It is an initiative taken by FAO and supported by numerous public and private institutions. This is reliable tool for purposes like forest inventories, climate change reporting, socio-economic surveys, biodiversity assessments, land use change and forestry measurements etc. The initiative was created under the FAO-Finland Forestry Programme in collaboration with FAO's support to National Forest Monitoring and Assessment (NFMA) and the UN-REDD Programme. More information about Open Foris is available at http://www.openforis.org/

3.2 Open Foris Data Management

Two versions of Open Foris are using in the BFI program. Open Foris Collect Mobile is installed onto electronic tablets ("tabs") and is used for field data collection. Open Foris Collect is used for data receiving and processing on a desktop computer. Data collected with Open Foris Collect Mobile is exported to a Dropbox folder in '.collect-data' files and then imported to the Open Foris desktop version for conversion to other data formats (e.g. .csv). At this point, the data are used for

analysis. In some cases, due to unavailable network or other problems data are submitted to BFI unit with other methods such as pen drives (USB drives) or email.

Data management with Open Foris mainly starts after sending the data into Dropbox by field teams and ends after storing into database summarized by two main activities:

1) Importing data into Open Foris, and
2) Exporting data from Open Foris

3.2.1 Importing data to Open Foris from the Dropbox

Importing data from Dropbox should be done every day because field teams are measuring plots regularly in the field. Updating the progress of the field teams enables the BFI to know which plots are measured and when. The work process is as follows-

1) Click "Open Foris Collect" from the Start manu. Log in with User Name and Password (default name and password- admin)

2) Go to the Data management from the user interface (figure-1)

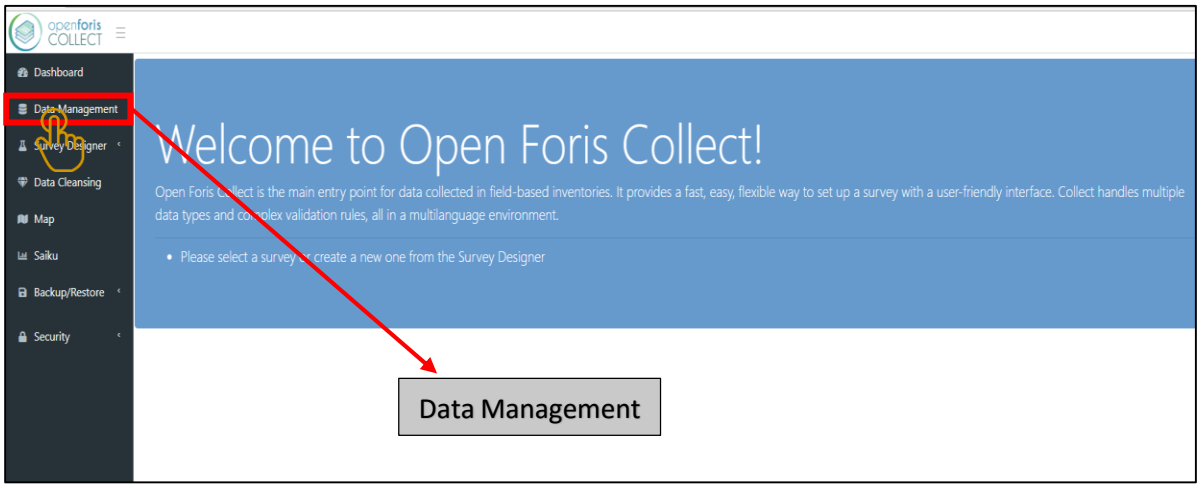

Figure 1: Open Foris Interface

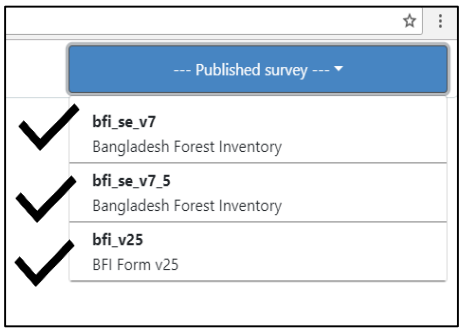

Figure 2: Selection of survey

3) Select survey from the top right corner of the window (figure-2)

4) Press “Import” to import data into open foris desktop (see figure-3)

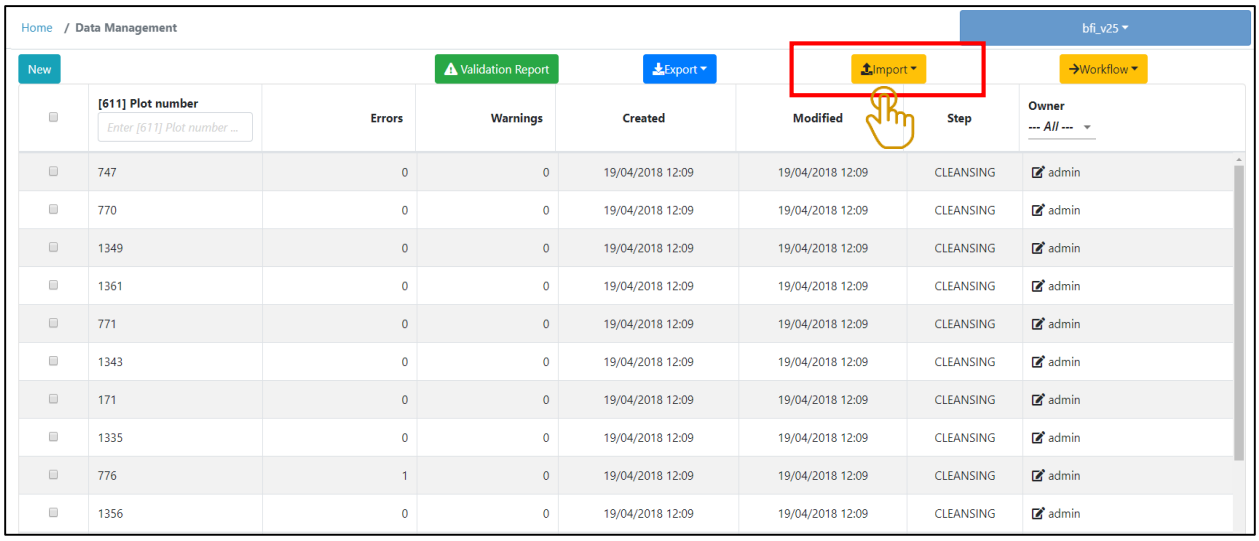

Figure 3: Data import into Open Foris

5) Press “from Collect format” to import data (figure-4); however, data can be imported from .csv format excel files also.

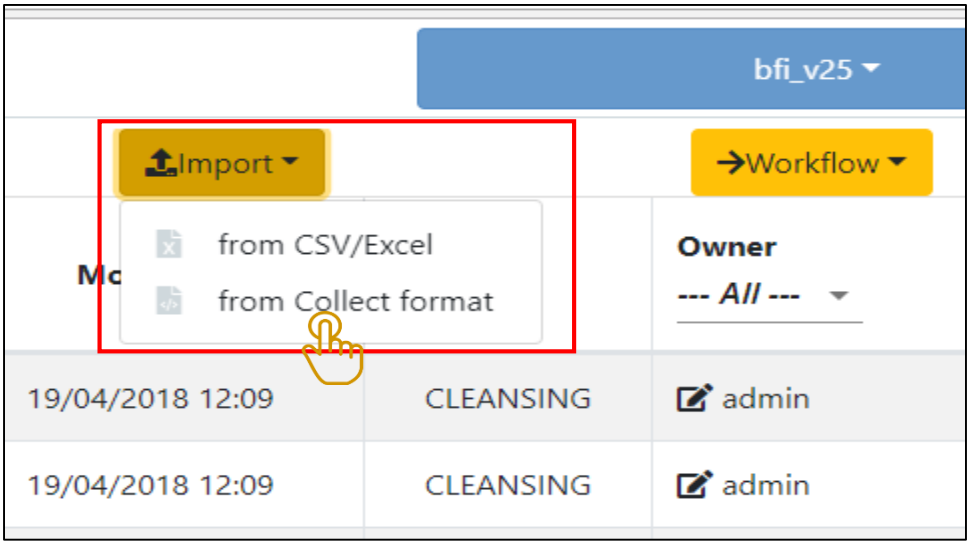

Figure 4: File import Interface

6) From the pop-up window click into the box to select a collect backup. Go to the Dropbox > BGD058 > 19 BFI Data for selecting necessary files to be imported (figure 5)

7) Access the folder for data importing and select the necessary file to be imported (figure 6) and press “Open”

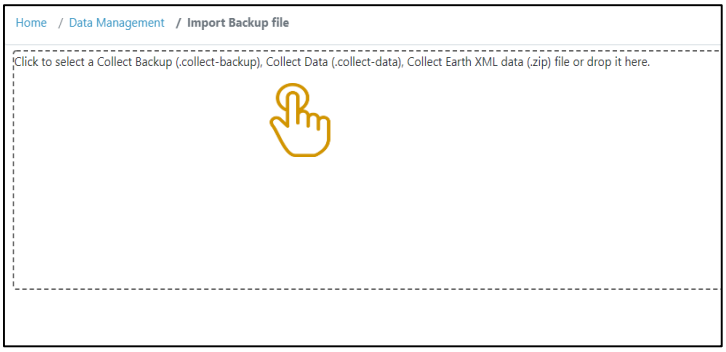

Figure 5: Data importing interface

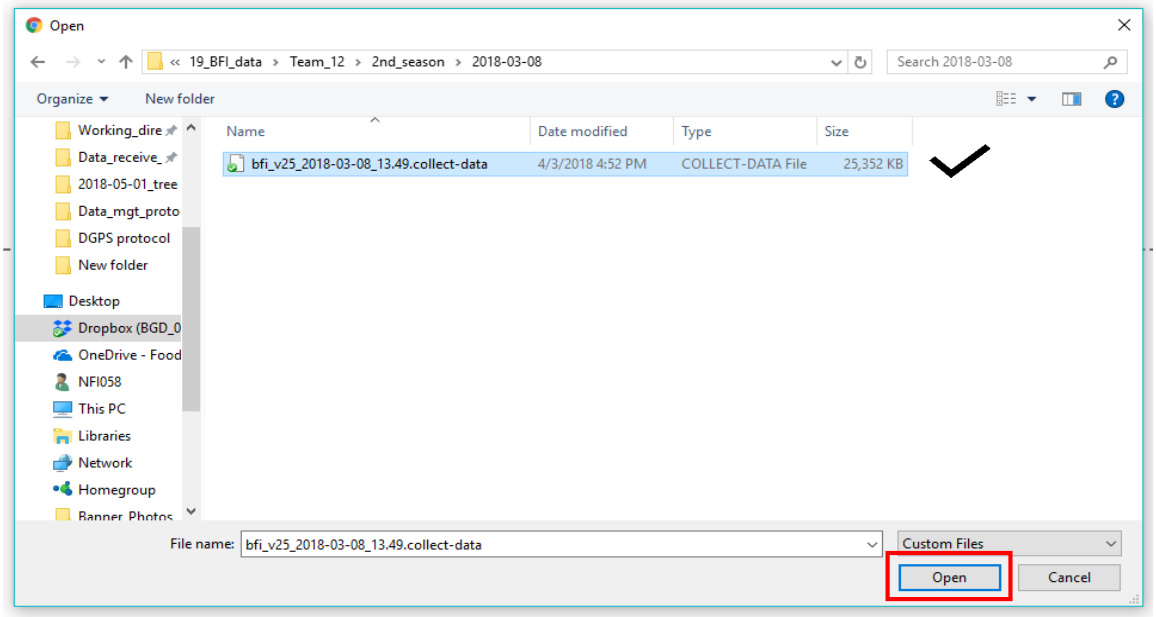

Figure 6: Select file to import from storing folder

8) In file will be visible in data importing interface press “Generate import summary” (figure 7) to import the data and overview the summary

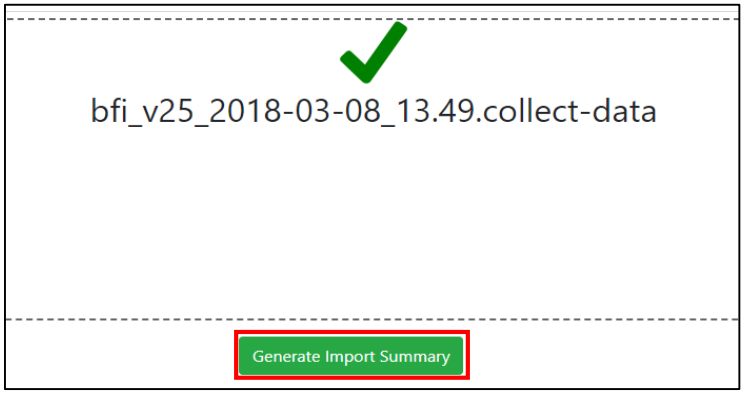

Figure 7: Data import

9) Check what is new in the list of records. Several signs can appear in the right side-
   - If equal (=) sign appears it indicates nothing new
   - If green colour mark appears it indicates new changes
   - If red colour sign appears it indicates existing data is updated then the data going to be imported
   - In case of new records, a separate section will appear below the "Data Import Summary" and upper than the conflicting records to be imported box. Select necessary records and click "Import" (Figure 8).

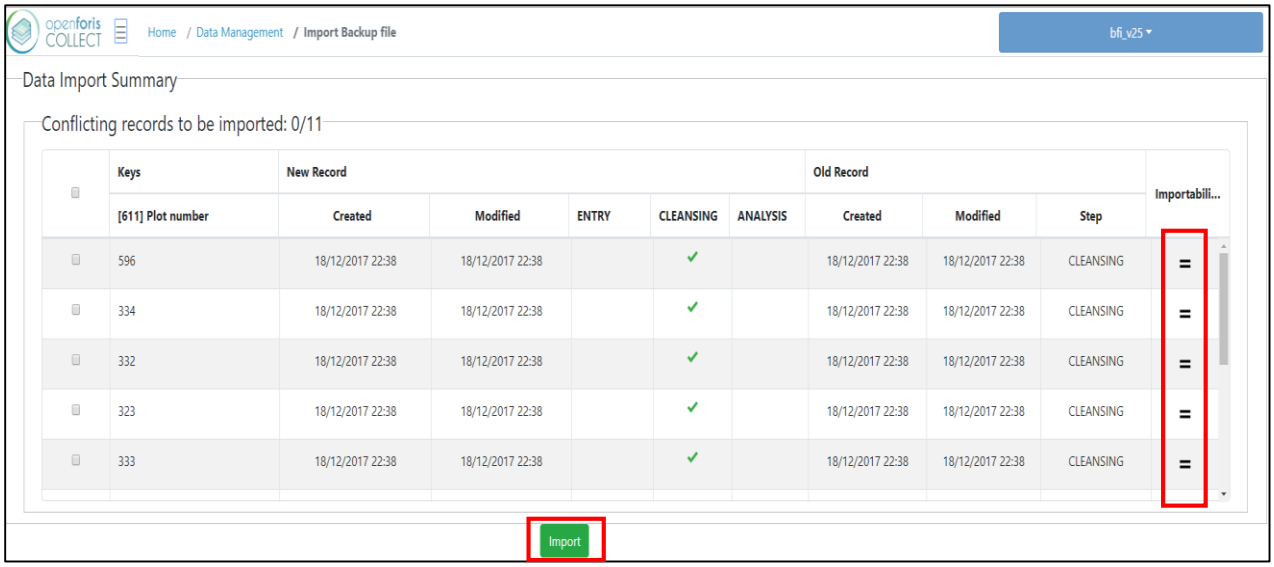

Figure 8: File check and import into Open Foris

Archiving data (Back-up file)

After importing, the data needed to be archived into the mass storage for back up. In case of any type of data loss or damage it will ensure the data availability for future purposes.

10) Move the backup file from Dropbox into the Mass storage folder named "6 BFI Data Archive" and store the data (figure 9).

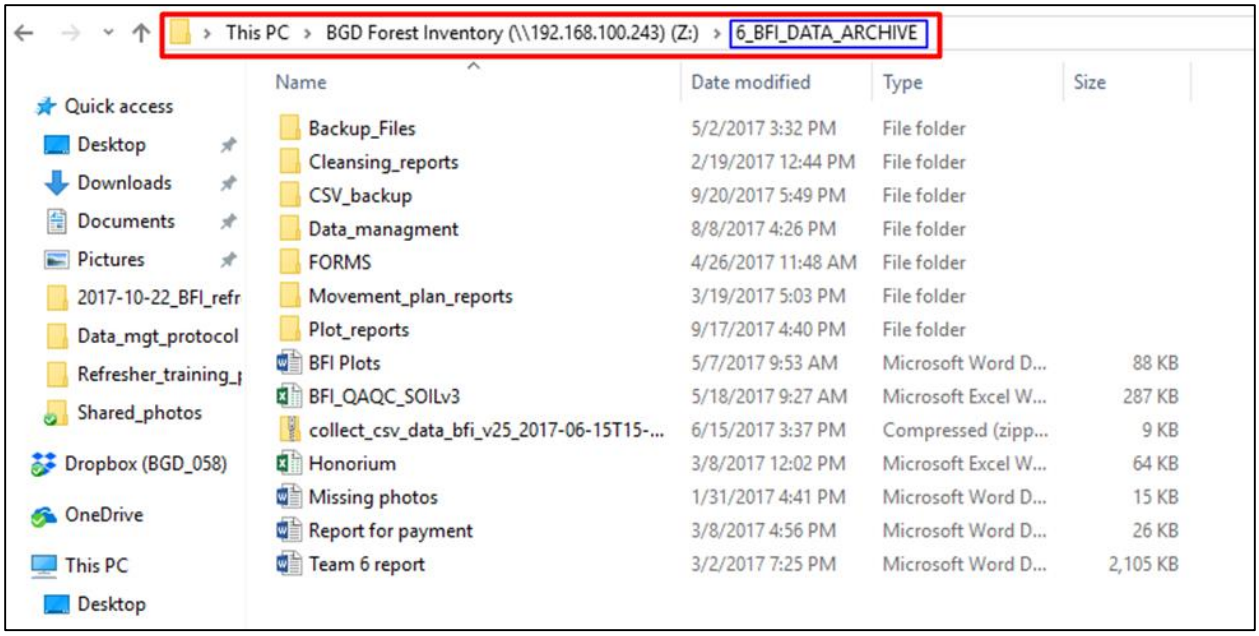

Figure 9: Data storing location

Deleting data from tabs

If the teams don't delete plot data from their tab, the memory will be occupied with an enormous amount of data which creates extra pressure on Open Foris Collect. This may affect the work efficiency of the tab and cause data loss or other problems. In Open Foris Collect the previous plot data are joined automatically with the new plot data if not deleted from the tab. Therefore the file last stored on the tab should have all the previous plot's data, but this should be checked.

11) Before deleting data from the tab a backup file should be created.

12) BFI central unit should store and backup the plot data file, so that the field teams can delete this information from the tab to reduce data load. Carefully ensure that no unsaved plots are deleted from the tab.

3.2.2 Exporting data from Open Foris and Updating the Database using R software

After importing into Open Foris the data should be exported and stored into the mass storage for backup.

Exporting data from Open Foris:

Data from Open Foris should be exported into both CSV and XML format. It is also necessary to take a backup to avoid losing data.

Exporting in CSV:

1. Open data management from home page of Open Foris (figure-1, 2 & 3)
2. Press “Export” to export data from open foris (figure 10)

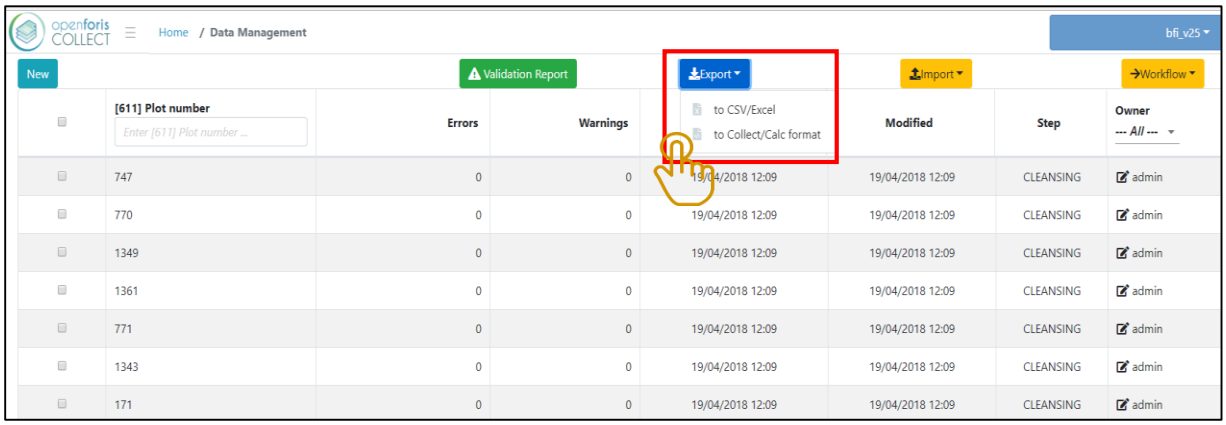

Figure 10:Data exporting from open foris

3. Data can be exported into two options- CSV and Collect. Select “CSV/Excel” to get all the data into excel sheets (figure-10)
4. From the new pop-up window select necessary options for data exporting into .csv format
   - From “Step” click the down arrow and select “Cleansing” (Entry/Cleansing/ Analysis) (figure-11)
   - From the “Export mode” tick mark on the box of “All entities”
   - Click the arrow of “Additional options” to expand and select the following boxes:
     - “Include composite attributes merged column (date, time, coordinate)”
     - “Include code item label column”

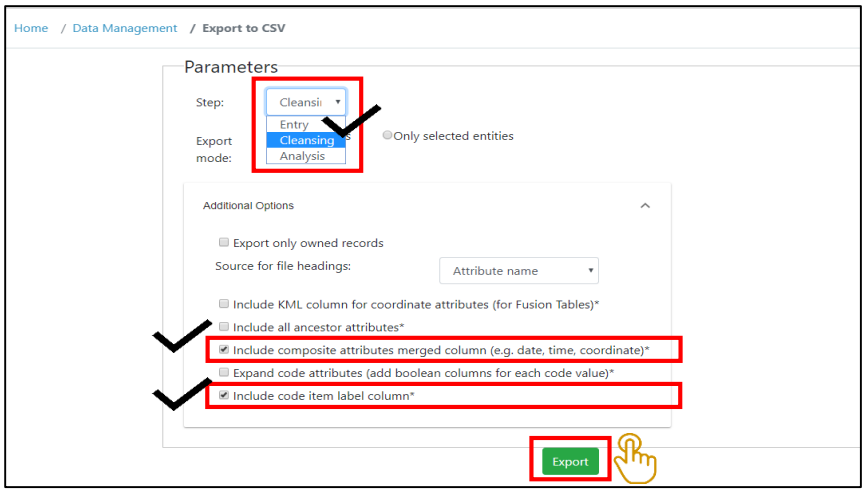

Figure 11: Data export into .csv format

5. Click ‘Export” and wait for the process to be completed (see in figure-11)
6. Download the processed file

Management of .csv files:

7. Double click to open the CSV downloaded Zip file
8. Copy all contents (CSV) from the folder and paste to Data folder on the mass storage
   - File path of “data” folder: BGD Forest Inventory (Mass storage) \ 6 BFI_DATA_ ARCHIVE\ Data Management \ Data
9. Delete existing CSVs before pasting the new updated files into the “Data” folder

Exporting in XML:

10. As described earlier select “Export” from “Data Management” of Open Foris interface
11. Select “Collect/Calc format” file type, in this format total data will be exported with photos
12. From the popup window click “Additional options” and tick mark on “Include uploaded files (image, documents etc.)” box; then press Export button (figure12)
13. After complete export, download the Collect-data file

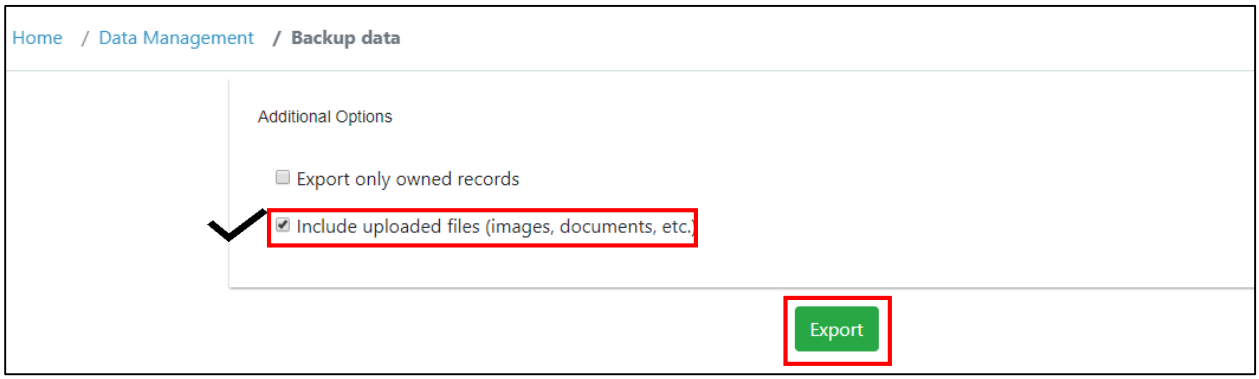

Figure 12: Data export interface for Collect format

Management of Collect files:

14. Copy the downloaded file into “Backup” Folder of Mass storage
    - Path way of “Backup” folder: BGD Forest Inventory (Mass storage) \ 6 BFI_DATA_ ARCHIVE\ Backup_Files \All_Data
    - Paste into “All_Data” folder

4. Database Management

Update the Database Using the Exported data and R software:

After exporting data into necessary format and storing into the appropriate folder, the database should be updated for further activities.

1. Go to the "Access" folder of "Data Management" (BGD Forest Inventory (Mass storage)\ 6 BFI_DATA_ ARCHIVE\ Data Management) (figure 14)
2. Double click on "BFI_database.accdb" file to open the database (figure-14)

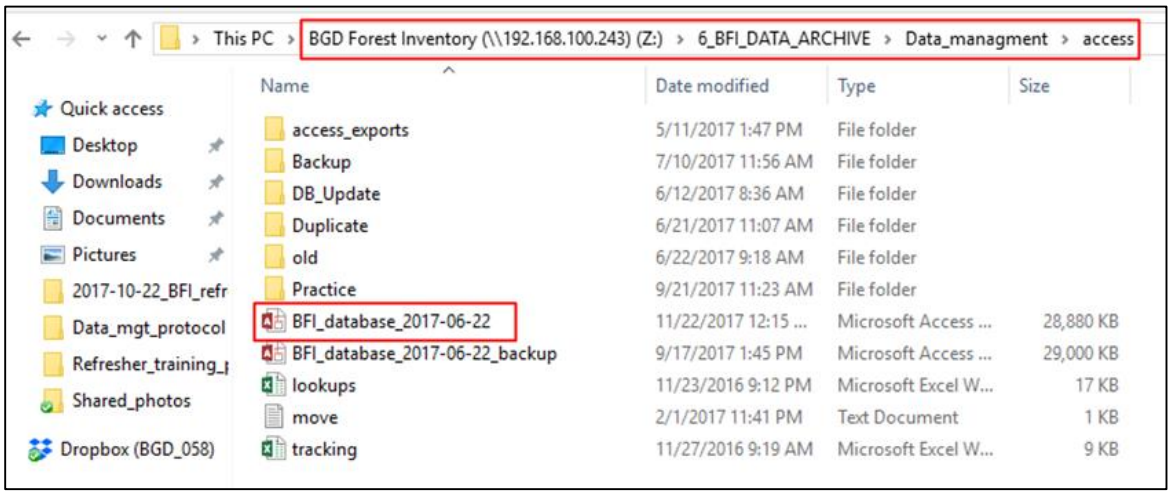

Figure 13: BFI central database location

3. In the opened access database click the "Enable Content" button
4. Click "Run R Code" from the user interface (figure-14)
5. To run the code, select all R script by pressing "Cntrl + a" after opening the window of "R Studio" (figure- 15)
6. After selecting the total script press "Run" or "Cntrl + enter" to run analysis in "R"
7. Wait until the "Script Complete" appears in the console
8. After completing the script close the R window but don't save any change, if it asks to save change select "No" which will leave it unsaved.

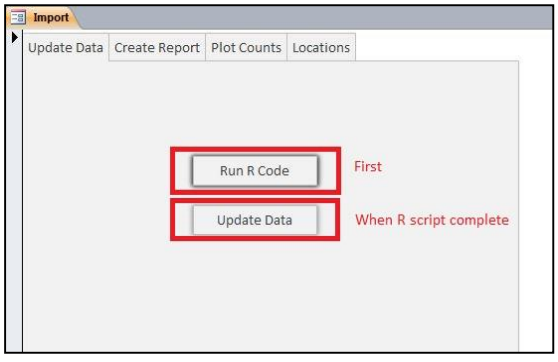

Figure 14: Access database interface

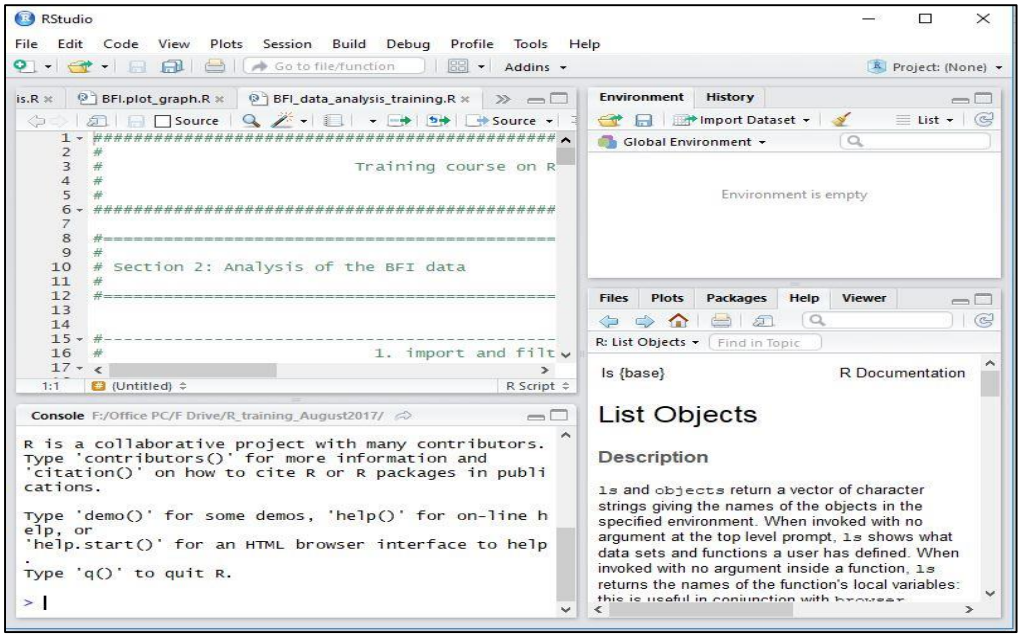

Figure 15: "R" script run for BFI data

9. From the database window press “Update Data” (figure 14)

Plot Report Preparation:

Individual plot reports are needed for data cleansing and cold checks as well as verify re-measurements. Pdf format is preferable for preparing plot reports but it can also be prepared in other formats like .doc, .docx, and .xls. BFI database is designed to prepare plot reports in very simple way through a report query. Preparing plot report is as follows (figure 16)-

1. First go to “Create Report Query”
2. Click the arrow of “TeamName” scroll down and select team
3. Then click the arrow of “plot_id” scroll down and select plot number
4. If you want to view the report then click “View Report”
5. For making pdf report click “Create PDF”
6. Save the plot reports in the pre-defined folder for each team.
    - File path for reports: Mass Storage\6_BFI_DATA_ARCHIVE\Plot_reports

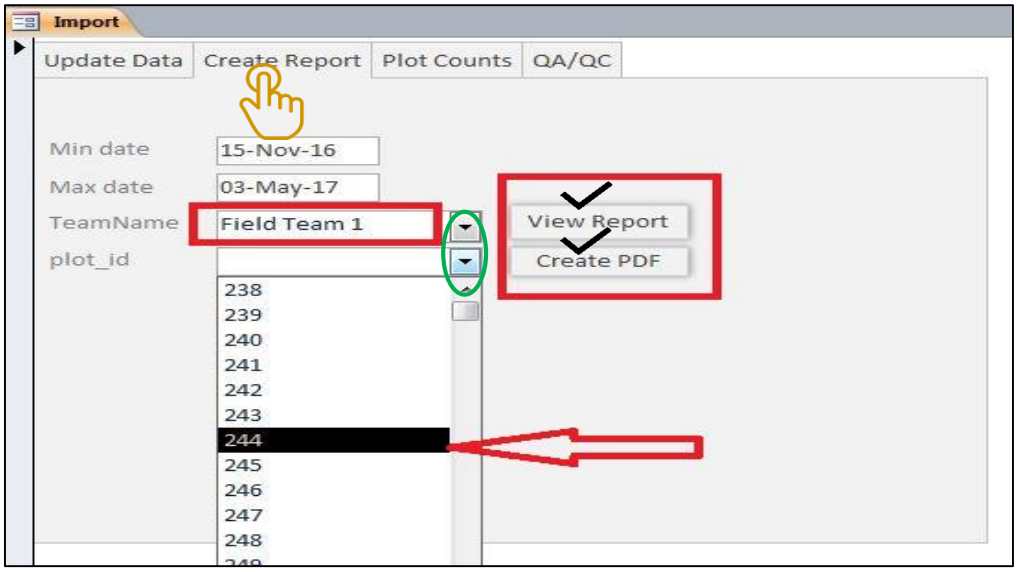

Figure 16: Create plot report interface

Export to QGIS:

Sometimes, it is needed to check the location of the plot center. The land features, accessibility and other features needs to be checked with GIS software. Plot coordinates need to be exported from Access database to view into GIS. (figure -13)

1. Open QA/QC tab.
2. Run "Create location file"
3. A text file will automatically be generated and exported into "My Documents"
4. This file can be converted into. kml to view into GIS software

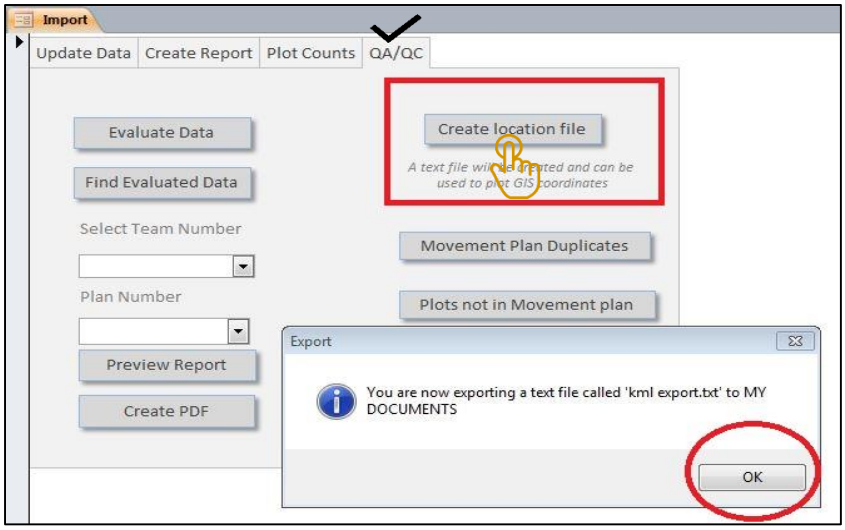

Figure 17: Export plot information into QGIS

Plot Count Activities:

Some common search options for different information are designed into some simple database queries. Total number of plots, team-wise distribution, zone-wise distribution etc. can be found very easily by simple clicking (figure 14).

1. "Plots Per Team" creates a table of plot numbers completed for every team.
2. "Total Number of Plots" outputs the number of plot currently stored in the database.
3. "Plot Numbers" outputs plots numbers with respected team numbers, measurement date, administrative location, zone etc.
4. "Zone Plot Per Team" and "Zonewise Plot (total) outputs the zone wise distribution for all plots and plots completed by individual field teams.
5. By counting plots for each team, we can directly update the movement plan of any field team.

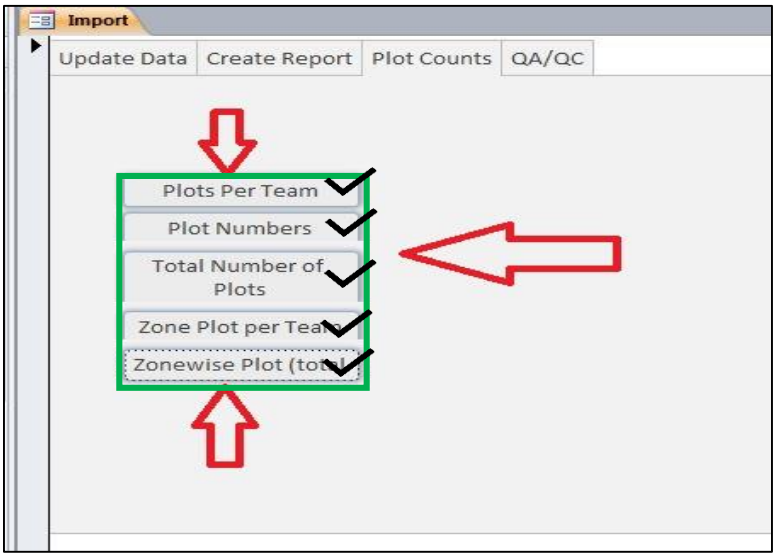

Figure 18: Plot count activities

QA/QC Activities:

The performances of field teams are evaluated according to the accuracy of collected plot data. The quality of each plot data is checked before declaring the plot "clear for payment" (Figure 19).

1. All plots data are checked using OFC, "R" script QA/QC check report, plot data report and QGIS then the findings are entered the "Evaluate data" tab against the relevant plot id.
2. An evaluation report can be prepared for each team for payment, because this report indicates the quality of data and defines which plots are suitable for payments.
3. If any team measures plots outside of their movement plan, or if the same plot is found in more than one movement plan, queries may be run to detect those plots.

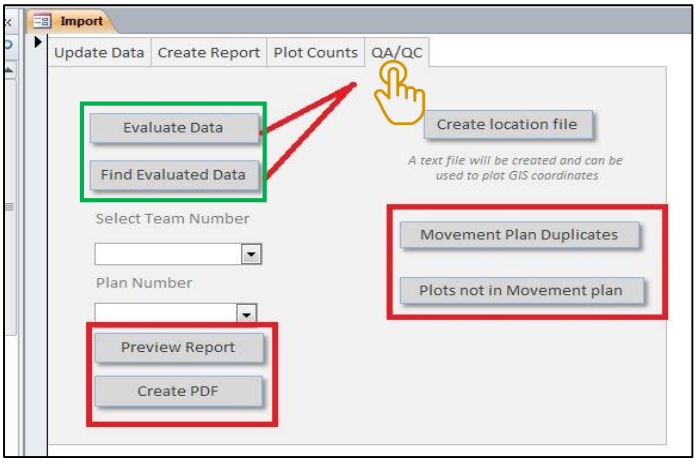

Figure 19: QA/QC checks for plot data

5. Data cleansing

To ensure data quality major errors need to be resolved. Primary cleansing activities are performed without making major modifications in the original data set. The preparations of the elements needed for this process are already described. Following are the steps for data cleansing:

5.1 Preparation for data cleansing

1. Before starting data cleansing, Open Foris needs to be updated by importing the files.
2. The database should be updated with the files exported from open foris.
3. All plots report will be prepared and the plot location file should be updated for QGIS

5.2 Run QA/QC R code to identify issues that need to be fixed

4. To ensure data quality some issues may need to be fixed and these will be identified by R
5. R must show the .csv files exported from Open Foris
6. Run the R code for QA/QC of BFI plots
7. When R script will be completed, it will automatically show you the issues that need to be fixed
8. The problems, related plot numbers, type of problems etc. will be previewed
9. The relevant plots can then be exported in excel file for cleansing

5.3 Type of problems

There are two types of problems identified by R script-

i. Problems that can be fixed centrally
ii. Problems that can't be fixed centrally

The table below shows the issues identified by R according to their category:

Table 1: Problems/issues category need to be fixed

Problems/Issues can be fixed centrally	**Problems/Issues cannot be fixed centrally**
lf_object plot missing	species missing in saplings
max_veg_grass but ...no of trees	unknown species in sapling
max_veg_shrub but … no of trees	unknown species in trees
tree dbh is… cm and tree measured at… m	dbh is NA in saplings
Trees in a no-veg plot - wrong lf?	h is NA for saplings
	h is NA for trees
	Leaf cover is above the maximum crown cover estimation
	Leaf cover is below the minimum crown cover estimation
	Outlier in Height-Diameter relationship
	Reference point is absent
	Reference point is more than 200m away from plot centre
	Restricted area—plot inaccessible
	Other-Pirate in the forest- plot inaccessible

Problems that can be fixed centrally:

The person responsible for data cleaning will fix the issues manually plot by plot.

Problems that cannot be fixed centrally:

These problems can only be addressed by re-measuring the plot or by severely modifying the data. These issues remain unchanged but are mentioned in the Access data base according to the plot number and indicated in the. This helps decision makers to take right decision.

5.4 Primary data cleansing process

When all preparations are done and the issues generated by R are finished, the data cleansing can begin.

1. Go through the R generated problems/issues document
2. For a problem check the plot number from the document
3. Open plot report of that specific plot in Access
4. open the record of that plot in Open Foris
5. Check for the identified problem and fix it in Open Foris
6. Solutions: if any attribute is measured outside of the recommended area then remove the attribute, if maximum vegetation is grass/shrub but some trees (in case of >5 only) are

present add tree as an lf object, if lf object is non-vegetated type but trees are present as an object then change the lf object type by reviewing other descriptions etc.

7. When the problem is solved write about the changes that were made in the plot notes with reviewer's initials
8. Mention the modifications with the "evaluate data" query and include the name of reviewer
9. If there are problems that cannot be fixed centrally then no changes are required, but please mention them in the "evaluate data" query of the Access data base
10. If any plot is evaluated and other changes are required then the "find evaluate data" query should be used
11. When changes are made in Open Foris save that, but do not publish the record
12. In the place of reviewer please assign the team number, it will make easy to search any plot record from Open Foris
13. When cleansing is done export the data from Open Foris and update the database again
14. After completing this process, the information about changes and issues will be available.

BFI data management diagram is shown in figure 20. The primary data cleansing process described in the upper section is a part of data management. After primary data cleansing is completed with the QA/QC script the data will be ready for the data analysis and further processing.

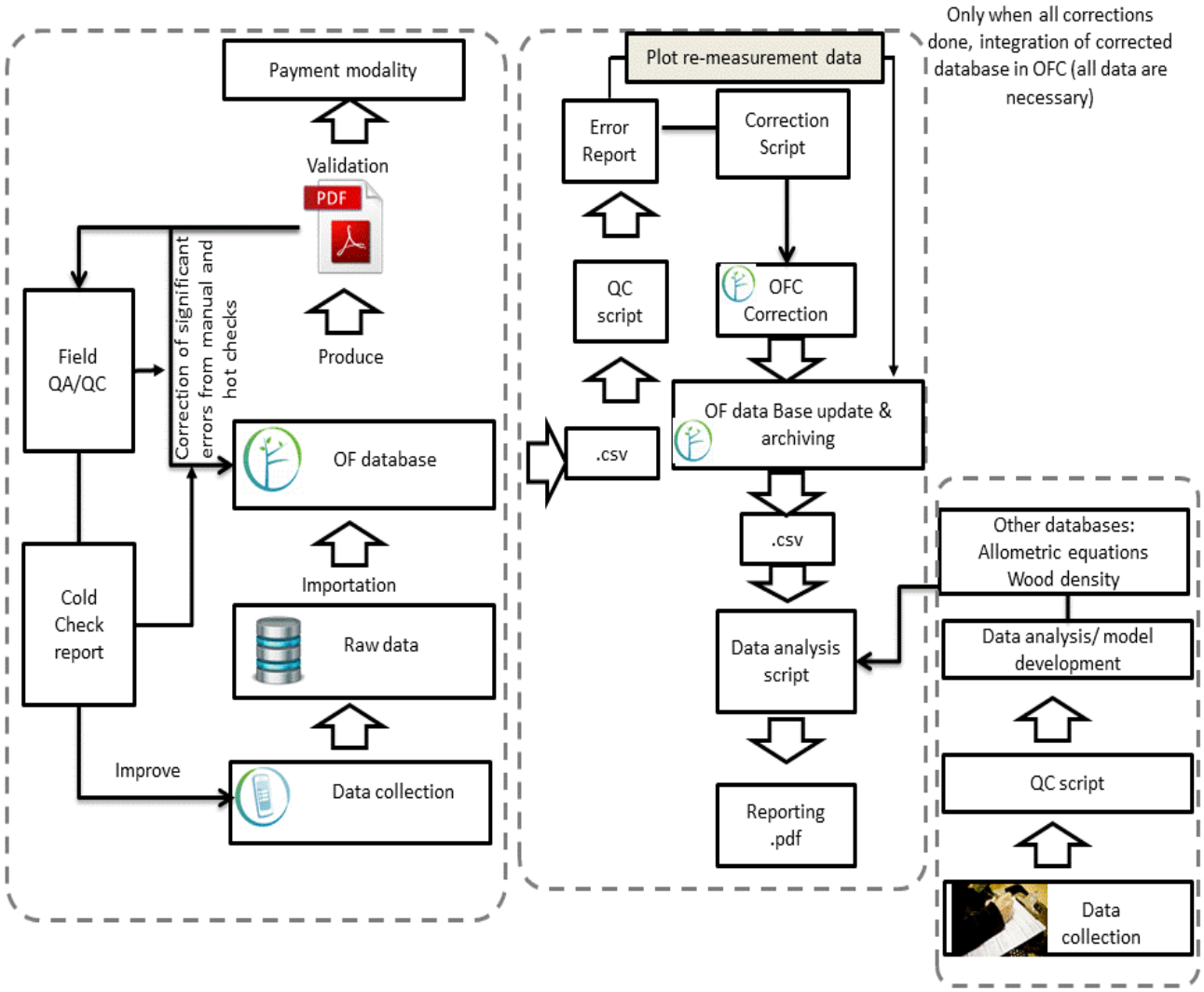

Figure 20: BFI data management diagram

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