

Protocol for the collection of field data for rice mapping

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Overview Work package 4 maps rice areas using remote sensing, geographic information system (GIS), and crop modeling. This work builds on the Remote sensing-based Information and Insurance for Crops in Emerging economies (RIICE, <http://www.riice.org/>) co-developed by IRRI and implemented in South and Southeast Asian countries. RIICE technology is being introduced across Africa to enhance its rice monitoring system. A set of field protocols and forms was developed for seasonal field data collection. This protocol covers guidelines for the collection of field data for calibration and validation, Sections I and II, respectively. Section I describes in detail the step by step procedure and criteria for selection of rice and non-rice crop management and practices. The information collected are being used to extract temporal SAR backscatter values and spectral signatures exhibited by rice and non-rice crops typical of the region of interest. The signatures obtained are then being utilized in the analyses and calibration of the thresholds for the detection of rice and non-rice areas. Section II describes the procedure and criteria for field selection of rice and non-rice field samples. The information collected are being used to assess the accuracy of the rice and non-rice maps.

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I. Calibration data for rice and non-rice area mapping

I-1 Aim

The main purpose of this first field campaign is to collect information on rice and non-rice crop management and practices such as location of the fields, photos, rice ecosystem, land use and land cover (if not planted with rice), crop establishment method, field condition, variety, maturity duration, etc. The GPS location of the fields are being used in extracting information from remotely sensed-data (e.g. multi-temporal backscatter signatures of rice and non-rice crops and NDVI). The signatures are then linked to the crop management and practices obtained on the ground. The field information are being used in the analyses of backscatter signatures derived from Synthetic Aperture Radar (SAR) images and in the calibration of the thresholds for mapping rice areas.

I-2 Timing

Ideally, the campaign should be planned one to two weeks after the start of the season (Figure 1). Each field is only visited once during the season.



Figure 1. Homogenous rice field, photo taken during field campaign at start of season.

I-3 Equipment needed

For each team (should be 2 persons), prepare the following:

- Handheld Global Positioning System (GPS) device (camera mounted)
- Digital tablet/cellphone loaded with appropriate Kobo digital forms
- Personal Protective Equipment (PPE) as required by company safety guidelines
- Extra batteries (for GPS; rechargeable batteries would be preferable)
- Field notebook, pen/pencil

Notes:

- It is best to use GPS devices with access to GPS, GLONASS, and Galileo navigation systems (for a better positioning), and with an integrated camera (e.g. GPS Garmin Montana 680).
- If the above device is not available the team can use a normal handheld GPS and a digital camera. The camera should have an integrated GPS or should be able to connect via bluetooth to the GPS. The team must ensure that the camera is properly configured so that the GPS locations are effectively stored in the photograph metadata.
- If GPS locations can not be recorded by the camera and stored in the photographs, the team must ensure that the file naming of the photographs can be linked precisely to the GPS locations acquired by the GPS device.

- It is also good practice to synchronise the internal clock of the digital camera with the GPS, this can help in linking GPS positions and photographs.

I-4 Number of fields

For this field campaign the team collects field data following the steps described in section six (6) for the the required number of fields. The number of fields should be based on the extent of rice production area and should be discussed with the local partners.

A. Rice fields

- Collect the required number of rice fields in each production system, equally distribute the samples among the different production systems including irrigated, rainfed lowland, rainfed upland. The rice fields must be spread across various communes and villages to capture the variabilities in rice environment. Select at least 10-12 villages or communes (depending on size) in the region of interest, well distributed across and representative of the region of interest. Villages should be proposed by the local team or partner.
- The selection of the villages could be guided by local knowledge to sample places where rice production is the most important, while also considering diversity of production.

B. Non-rice fields and other non-crop land cover

- In the study region, coordinate with the local partners to identify the other main crops (other than rice) grown during the season (e.g. vegetables, cotton, maize, millet, sorghum) and other land cover types (e.g. forest, pasture, settlement, wetland, bare land or desert).
- Collect the required number of non-rice (other crops) and non-crop land cover.

Note: obvious land cover classes (forest, settlement, water bodies) can be minimally sampled on the ground, and easily complemented using Google Earth and other Earth Observation data.

I-5 Criteria for field selection

The local team or partner should as best as possible, select the individual fields to be surveyed considering the following **criteria**:

- Within a given rice production system, sample rice fields representing the **diversity of agronomic practices** existing on the ground (for instance considering - non exclusive - direct seeded and transplanted, plant density, varieties, land preparation). The selection of survey fields is critical to ensure that the signature of rice extracted from the satellite images are representative of the ground diversity.
- Maintain a minimum distance between fields, **at least 1 km**, avoid selection of multiple fields in groups or clusters.
- Fields should be **accessible**.
- Fields should be located at least **30-40 meters away from roads** and from a different land cover to avoid border effects.
- Preferably fields should **be in a flat or very gently undulating areas** (do not consider fields on slope more than 5%).
- Fields should be a **homogenous area** of at least 1 hectare (approx. 100 m x 100 m), and when possible closer to 2 ha (140 x 140 m). Homogenous means that the crop within the area/field is similar considering the phenological stage (same planting period), agronomic practices, plant density, etc. See example in Figure 2.

Note: This is not in contradiction with the first point made above. The selection of diverse fields allows capturing the rice crop diversity in the region, and the selection of homogenous rice fields allows getting a pure signal from the satellite image, to maximise the broad scale diversity and minimise the local diversity.

- As much as possible, avoid rice fields close to or with trees.

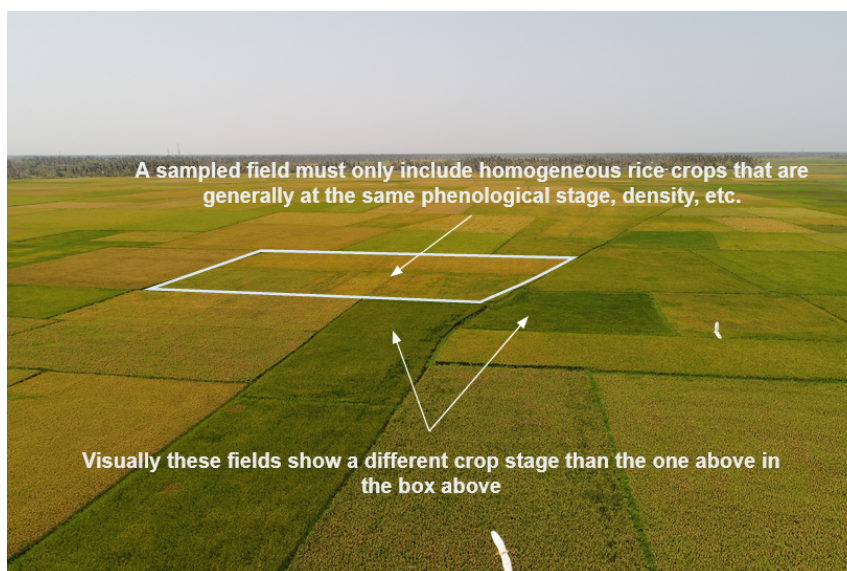


Figure 2. Sample image for homogeneous rice fields at maturity stage in Puri, Odisha, India.

I-6 Data to be collected

Three types of data need to be collected: field location (latitude and longitude) using GPS, field photos, and field crop observations.

A. Field location using a GPS device

The field data collected will be linked to the information from the satellite images using the GPS location of the surveyed fields. Collect the location of the individual field of interest using a GPS device (Figure 3). Follow these steps:

- Select a **regularly-shaped field** (i.e. square or rectangle). Get the coordinates of the four corners using a GPS. If the selected field has more than 4 corners, get the location of all corners of the field.
- Use the **GPS waypoint averaging** to record the location, wait for 20-30 seconds before recording to enhance the quality of GPS position. Ensure that the GPS is turned on when arriving on site.
- Record the GPS point ID, this will be considered as the Field ID. The GPS ID is the number displayed on the GPS device after collecting the waypoint location (latitude/longitude). Record all the field corners' GPS IDs in the Kobo form (e.g. if the GPS ID is 13, the Field ID that will be recorded in Kobo form is 13, Figure 4). Ensure that the GPS ID is also noted

in the Kobo form and back up field notebook, for crosschecking if needed.

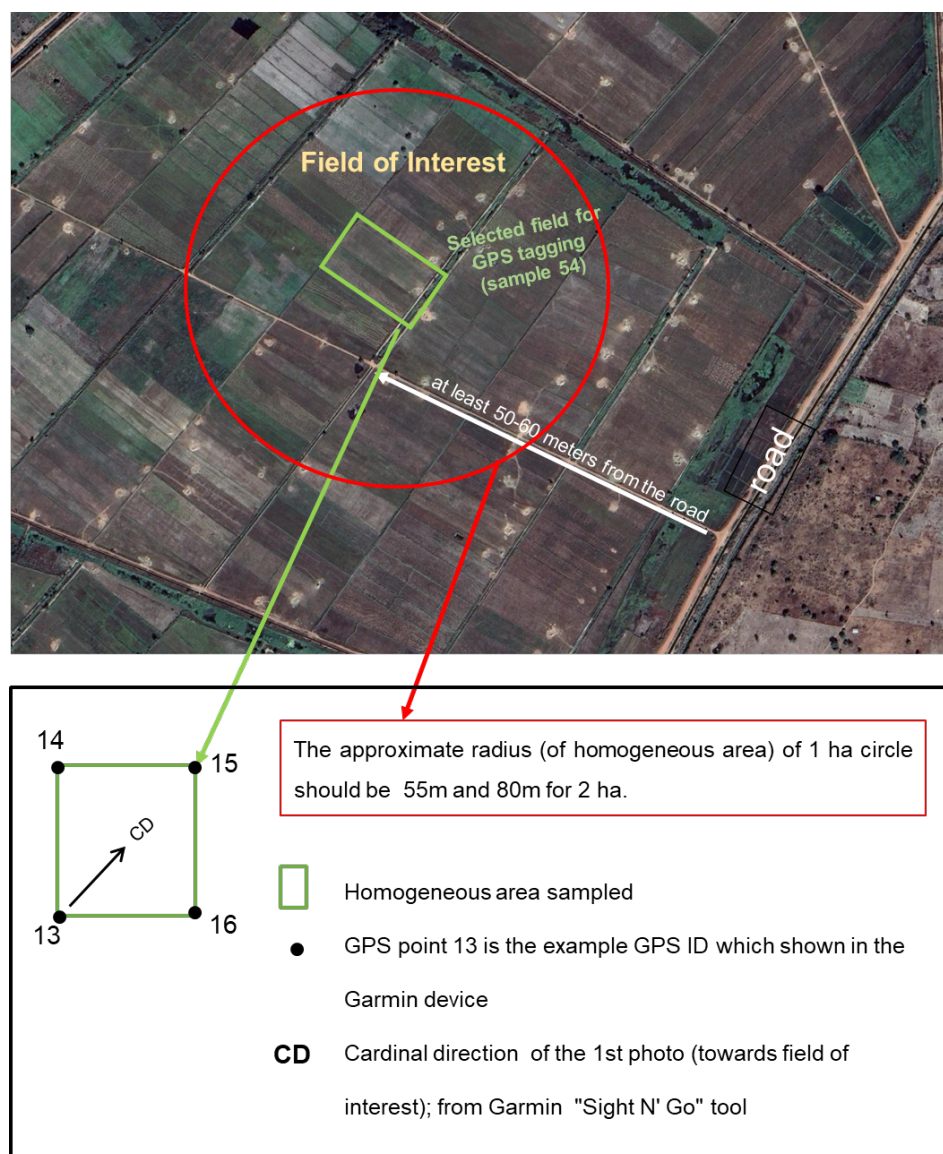
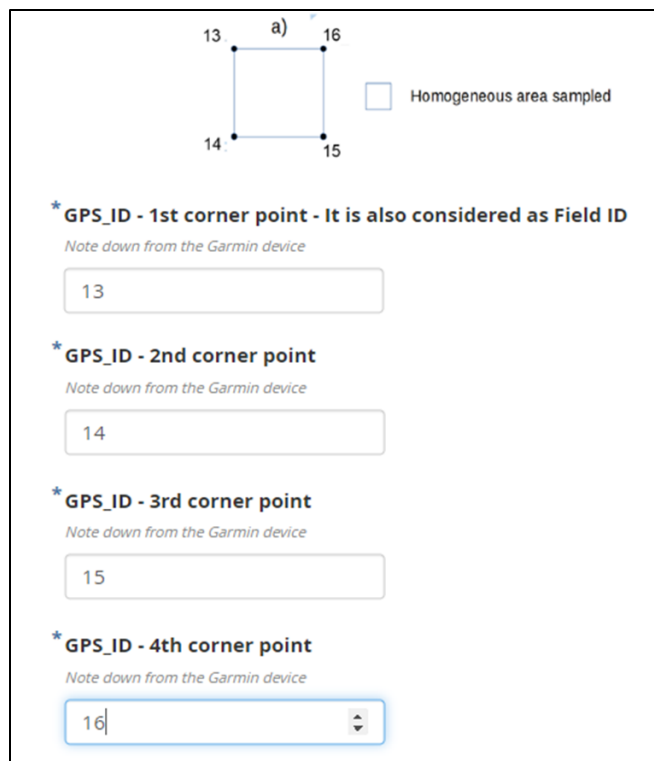


Figure 3: Guide to getting field corner location using a GPS device.



a)

13 16

14 15

Homogeneous area sampled

***GPS_ID - 1st corner point - It is also considered as Field ID**
Note down from the Garmin device

13

***GPS_ID - 2nd corner point**
Note down from the Garmin device

14

***GPS_ID - 3rd corner point**
Note down from the Garmin device

15

***GPS_ID - 4th corner point**
Note down from the Garmin device

16

Figure 4. Interface of Kobo form filled with GPS ID.

B. Photos of the field and surrounding areas

Field photos will be used as supplemental information in the analysis and classification of rice area maps (Figure 5). Follow these steps in taking field photos:

- Take four (4) photos from the first GPS location (i.e. first corner) of the field and then moving clockwise at 90 degrees, (Figure 6).
 - 1st photo: straight ahead at the field of interest
 - 2nd photo: move 90 degrees to the right
 - 3rd photo: move 90 degrees to the right
 - 4th photo: move 90 degrees to the right
- Take one additional (fifth) photo, centered on the field of interest. Record the cardinal direction bearing the angle in the photo's file name.
- When taking photos, ensure to capture most of the field of interest, avoiding having photos where half of the photographs are clouds or sky.

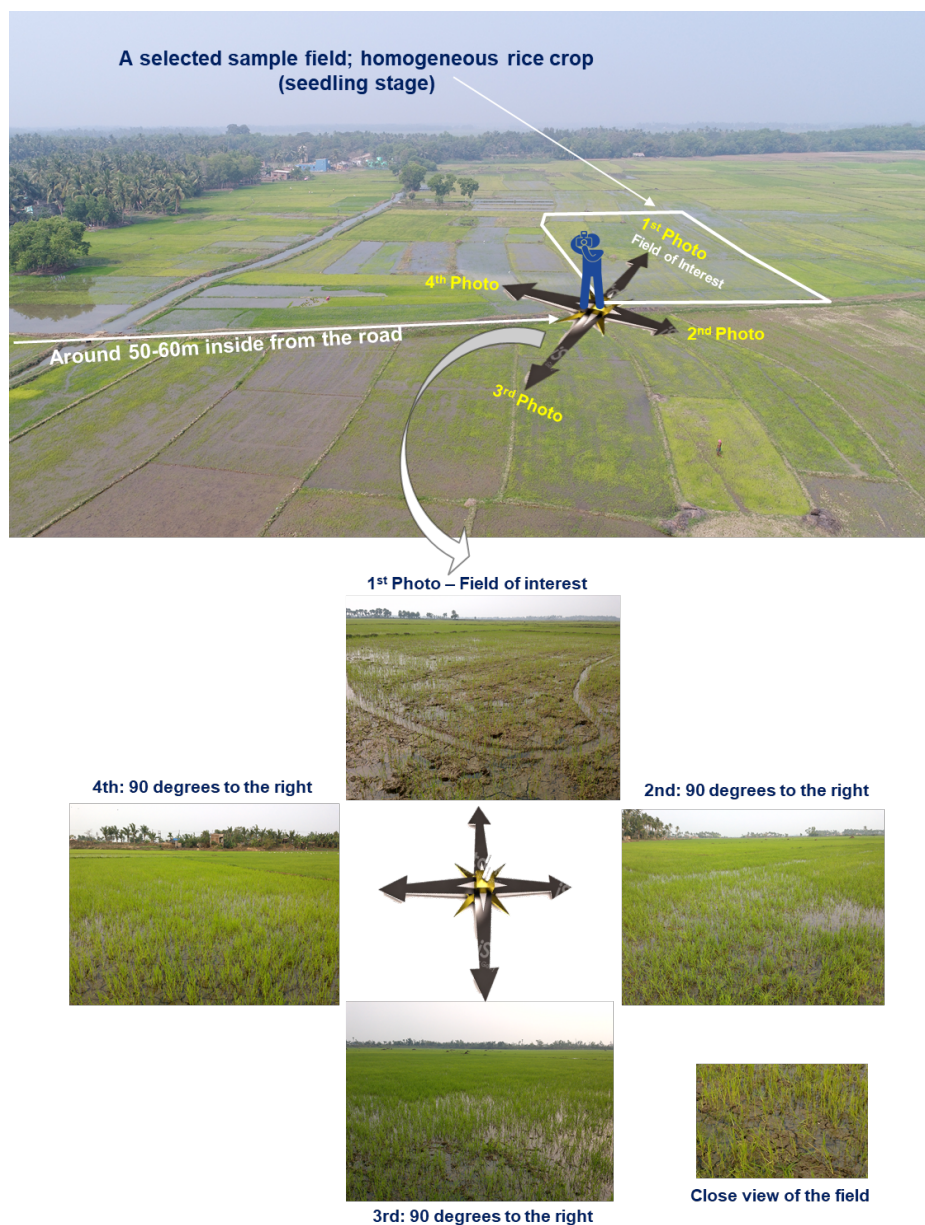


Figure 5. Detailed view of location where the photos should be taken in the four corners of the homogenous rice field.



Figure 6. Location where the photos should be taken in the four corners of the field of interest.

C. Field observations

For each field, collect the following data using the Kobo form installed/saved on a mobile device or a tablet. If a farmer is available, interview a farmer to get other data that can not be observed on the field (e.g. transplanting or sowing dates). Be careful when gathering data when fields are flooded, to avoid falling of phone in flooded fields.

Data to be collected in the survey form for each field:

- Commune, village
- GPS point IDs
- Field location: lat/long coordinate of the GPS points taken (in case digital data from the GPS are lost)
- Field size: Indicate the field size by visually assessing the area (approximate area in ha, one ha = 10, 000 sqm)
- Radius (R), distance from border site (dist), direction (dir) (see Figure 3)
- Rice ecosystem (RE) or other crop/land cover (LC):
 - If field is planted to rice (or in preparation for rice planting) indicate if irrigated (I), rainfed upland (RU), rainfed lowland (RL), controlled submergence (CS)

- If field is planted to non-rice crops indicate the other crop (e.g, maize, banana) or land cover (e.g. water body, built up)
- Rice establishment method (REM): Transplanted (T), Wet direct-seeded (WDS), Dry direct-seeded (DDS)
- Rice field condition/crop growth stage (FC/CG): describe the general condition of the rice field:
 - If it is still in land preparation stage: flooded (F), plowed (PL), harrowed (HR), levelled (L)
 - If planted: emergence (EM), seedling (SD), tillering (TL), panicle initiation (PI), booting (BT), heading (HD), flowering (FW), milking (MK), grain filling (GF), maturity (MA)
- Flooding date: date when the field is flooded prior to transplanting
- Transplanting/sowing date: date when seedling were transplanted or field sown
- Age of seedling at transplanting: how old (in days) are the seedlings during transplanting
- Rice variety
- Maturity duration: period from time of planting to harvest of the variety planted
- Condition of water in the planted rice field (if there is standing water on the planted rice field)
- Additional important field observations: other types of information specific to the field, e.g. landmarks to help in locating the field, e.g. 3rd field from the road, near the school area.

II. Validation data for rice and non-rice map accuracy assessment

II-1 Aim

The main purpose of this field campaign is to collect locations of rice and non-rice fields to be used in the validation of the generated rice area maps of the region of interest. The team will visit a number of rice and non-rice fields towards the end of the season and collect a set of data following the criteria detailed in this protocol.

II-2 Timing

Ideally, the campaign should be planned towards the end of season; one to two weeks before crops get harvested (Figure 7). Each field is only visited once during the season.



Figure 7. Sample photo taken during field campaign towards the end of season in Mwea, Kenya.

II-3 Equipment needed

Refer to Section I - 3 for the list of materials needed and reminders.

II-4 Number of fields

Refer to Section I - 4 for the details on how to determine the number of rice (A) and non-rice fields (B). If there is an available or existing rice and non-rice maps, it could be used as a guide in the selection and distribution of sample fields.

II-5 Criteria for field selection

Refer to Section I -5 for the list of criteria for field selection. Ensure that the location of the sample fields for validation are different from the location of the sample fields collected for calibration.

II-6 Data to be collected

A. Field location using a GPS device

Refer to Section I – 6A for the details on how to collect field location data using a GPS device.

B. Photos of the field and surrounding areas

Refer to Section I – 6B for the details on how to take photos of the sample fields. Field photos will be used as supplemental information in the validation of the rice area maps.

C. Field observations

For each field, collect the following data using the Kobo form installed/saved on a mobile device or a tablet. Be careful when gathering data when fields are flooded, to avoid falling of phone in flooded fields.

Data to be collected in the survey form for each field:

- Commune, village
- GPS point IDs
- If field is rice, mention field condition whether there is standing crops in the field or harvested already
- If non-rice indicate the other crop or land cover

Additional important field observations: other types of information specific to the field, e.g. landmarks to help in locating the field, e.g. near to the school area.