REDD+ FOR THE GUIANA SHIELD
Technical Cooperation Project

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Impact of Gold mining training session, 24-28 November 2014
Cayenne – French Guiana
MONITORING THE IMPACT OF GOLD MINING ON THE FOREST COVER AND FRESHWATER AT THE GUIANA SHIELD REGIONAL SCALE
Why and how establish a clear methodology/protocol?

1. Why?
   - The results of data processed by several operators will have to be compiled → need of comparability of results
   - To ensure comparability of results:
     - Operators need to do the exact same steps of process
     - A clear decision tool need to be developed for ensuring similar responses/decisions by all operators when they encounter a specific situation
   - A detailed methodology ensure the quality of data produced
     - Operators follow a protocol which guides them through the process. This will ensure that nothing has been omitted

2. How?
   - By defining the exact steps that the operator will follow
   - By providing guidelines and precise rules to the operator for all type of situation
Choices to be made

- Based on:
  - Results of the last study
  - Experience and knowledge of each forest services
  - Methods used by the different forest services
  - Available data in each country (roads, settlements, deforestation maps,...)

- Need of:
  - Update last results
  - Regional methodology
  - Comparability of results with the last study (2000-2007)
  - Use of open source software
  - Use of SPOT images (SPOT 5 – 10 m resolution) and additional data
Chronology of the methodology steps

1. Image ordering and acquisition
2. Quality check of all acquired images
3. Archive of data and production of raster catalogue
4. Image pre-processing
5. Quality check of pre-processed images
6. Image processing
7. Quality check of the processing results (internal national control)
8. Delivery of results
9. Compilation, validation and accuracy assessment of results (external regional control)
10. Final delivery with assessed uncertainty
Flowchart of the steps

1. Image acquisition and ordering
   - Quality check
     - NOK
     - OK
       - Archive

2. Image pre-processing
   - Quality check
     - NOK
     - OK
       - Archive

3. Image processing
   - Quality check
     - NOK
     - OK
       - Archive

4. Results delivery
Decisions to take: 1. Image ordering

1. What level of pre-processing?
   - 2A; Geoprocessed and radiometric corrections

2. Maximum cloud cover allowed for selection of image?
   1. < 20% 2014; 20% < 2014 < 60%; idem with 2013; 2012; 2011
   2. Then use Landsat if needed
   3. Automatic detection of clouds and cloud shadows will be tested for SPOT and Landsat images to be able to report accurately on extent and location of no data areas

3. Priority given to the most recent image for SPOT first and then Landsat
   - In order terms, we give priority to the resolution of data before time of acquisition?

4. As we fill the gaps with Landsat image, a clear methodology need to be established. Eg: Landsat images will be clipped to fill the gap of one SPOT
Decisions to take: 2. Quality check of acquired images

- Is the cloud cover mentioned in the metadata correct or is it underestimated, making the image not useful for the purpose of the study?
- Is the radiometric correction correct? Is the pixel resolution correct?
- Are all spectral bands present?
- Is the georeferencing within the limits of quality mentioned by the image provider?

A structure of Quality check table will be proposed in the protocol.
Decisions to take: 4. Image pre-processing

Based on the level 2A, the following pre-processing steps will be applied:

1. Define the projection system
2. Coregistration with last images of 2008 if the presence of a shift could lead to digitalization and surfaces errors
3. Automatic detection of clouds if possible, otherwise estimation of no data percentage
4. Contrast and histogram adjustment for highlighting of features
5. Use of Landsat images:
   - cloud free mosaic (share of SBB method?)
   - layer stack
Decisions to take: 5. Quality check of pre-processed images

Based on the steps identified for pre-processing, the points of control will be established, e.g:

<table>
<thead>
<tr>
<th>Tile_id</th>
<th>Acq_date</th>
<th>Projection y/n</th>
<th>Co-registration y/n</th>
<th>Radiance to TOA reflectance conversion</th>
<th>Resp.</th>
<th>Date</th>
</tr>
</thead>
</table>
Decisions to take: 6. Image processing (1)

1. Manual editing and updating method based on the original shape (gold mining activities in 2008)

2. What features do we digitalize?
   - Mining activities impacting forest areas and freshwater
   - Roads and settlements

3. How do we digitalize impacted forest by Gold mining?
   - MMU for Gold mining: 0.5ha
   - Scale of digitalization: 1/5000
   - Combination of bands to be used with SPOT: 4-1-2; 1-2-4; 3-1-2
   - The boundaries of digitalization should be at the edge of baresoil/water and forest with no overlap on forest. More details will be reported based on the results of the first test area digitalized by the different operators.
   - Base maps/ancillary data are very important for decision-making (You have already learnt how to create an hydrological network based on SRTM)
   - The structure of the attribute table has been presented (ID, source, Comment, surf_ha, type)
Decisions to take: 6. Image processing (2)

- Misclassified objects can be deleted but it should be clearly reported
- Roads and settlements of mining sites should not be included in mining but in roads and settlements

4. How do we digitalize settlements?
   - Points for all settlements we identify: MMU to be further discussed (number of houses?)
   - Link the points with density population estimation if the data is available in order to have an information about the size that could be linked to a potential bigger impact

5. How do we digitalize roads?
   - Polylines
   - 2 classes proposed (still need time to confirm this):
     - Main roads: >20m
     - Other roads and tracks: <20m
Decisions to take: 6. Image processing (3)

5. How do we digitalize impacted waterways by Gold mining?
   - This should be further discussed and detailed
   - Discussions will continue based on the creation of the hydrological network this afternoon
     - Appearance of flow directions
     - How ONF is updating this hydrological network
Decisions to take: 6. Quality check of the processing results (internal national control)

1. A quality control protocol will be described in the draft methodological protocol.
Conclusion of the week

- Interesting discussions and share of experiences which allowed us to better understand:
  - The different context of gold mining activities in each country
  - The different monitoring methods and data used
- More technical discussions allowed us to design a draft of the main methodology steps to carry out
  - We know where we are going, which type of data we will use and what are the steps we need to improve and/or detail
- We were able to use the QGIS software and started some more or less advanced processing (coregistration, digitalization, production of hydrological software)
- We understand the high interest and mandatory use of base maps and ancillary data to orientate the photo-interpretation
- First practical exercises showed that standardization of the processing method is mandatory
What next?

- Order images
- Share of detailed methodological protocol (remove borders of countries)
- Research about cloud detection
- Method to integrate Landsat and SPOT
- Next session:
  - processing practice and consolidation of the methodology
  - Training on method developed by the time of the next training
  - Operational production
  - Field mission on a gold mining site
- Give you a bit of more free time to enjoy Cayenne and go to another nice restaurant
Thank you for this pleasant week!

I am looking forward to meeting you again very soon !!!