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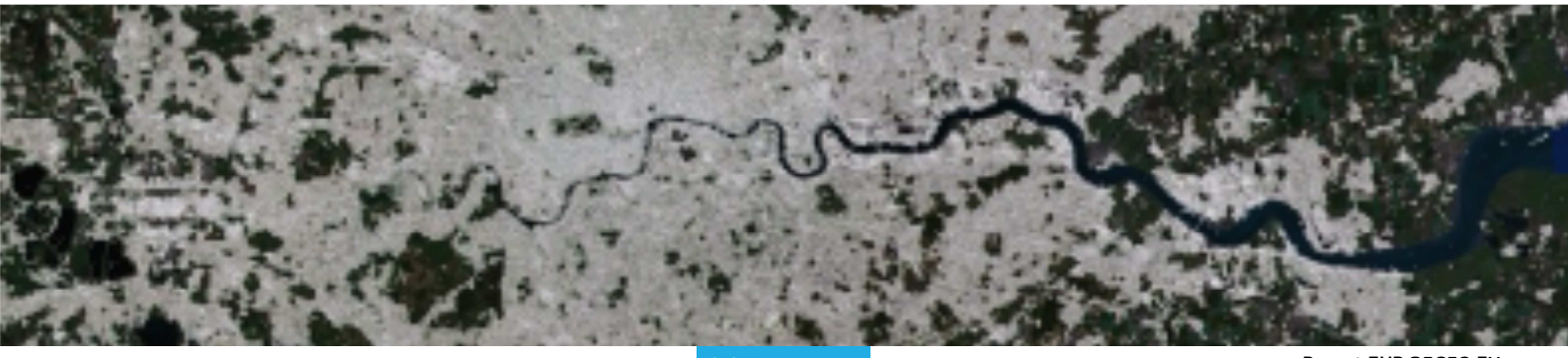
Visual collection of built up information from High Resolution satellite imagery

Procedure used within the Global Human Settlement Layer

D. Ehrlich, M. A. Marin Herrera, S. Ferri,
K. Kemper, M. Halkia, F. Haag, M. Pesaresi

2012



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ABSTRACT

The document summarizes the steps, procedures, information infrastructure used for collecting built up information from satellite imagery. The document is intended as a reference for visual interpreters. The document also summarizes the lessons learned by photo-interpreters for imagery covering Europe.

1. INTRODUCTION

This document addresses the visual analysis of satellite imagery that supports the development of the global human settlement layer (GHSL, Pesaresi et al 2012). GHSL aims to deliver information products in the form of digital human settlement maps, changes in settlements extent over time, and human settlements partitions based on the spatial arrangement of buildings and the building sizes. The GHSL is developed to support a number of research activities as well as projects of the international community including the Global Exposure Database (GED, GEM 2012) and projects in support of policies of the European Commission. GHSL Information system outputs are used to support crisis management including early warning, disaster risk assessments and population estimations. It is also constructed to quantify urbanization at national, regional and local level with focus on urban sprawl and thus contribute to address urban development issues.

This document is the first one of a series of protocols describing the collection of built up information from satellite imagery through visual inspection. The built up information is collected to a) benchmark automatic algorithms that extract built up information, b) to start testing validation procedures for built up information layers. The document focuses on imagery with spatial resolution of 2.5 x 2.5m as found in SPOT 5 panchromatic channels and Chinese Brazilian Earth Resource Satellite (CBERS). The protocol is linked to the resolution of the imagery. The collection of information from image with different spatial resolution will require procedures that may differ from those described herein.

This document is intended primarily as a reference document for photo-interpreters. The document is subdivided in two sections and three appendices. The background section outlines the assumptions and definitions. The method section summarizes the photointerpretation procedure. The work includes three appendices: 1) lessons learned that summarize the photo-interpreter acquired knowledge, 2) a representative collection of samples that can guide future work and 3) a quick introduction to the IQ system, the information platform used to collect built up information.

2. BACKGROUND

The human settlement information derived within the GHSL is based on the following assumptions and concepts and summarized below.

The information to be collected are referred as “built up” and defined as follows:

- Built up refers to the land occupied by buildings, roads and other man made artifacts and is related to that of human settlements.
- The characterizing element of the built up is the building defined as follows: “Buildings are enclosed constructions above ground which are intended or used for the shelter of humans, animals, things or for the production of economic goods and that refer to any structure constructed or erected on its site” (Pesaresi et al, 2012). For the purpose of this document buildings are broadly defined as a three-dimensional man-made structure used for shelter, recreation, economic activities, and other societal functions. It is assumed that most buildings are visible from satellite imagery at 2.5 x 2.5 m or finer.
- The **built up** (BU) **area** is a discrete area measurement that records the presence of **buildings** and **space–in-between buildings**. The space-in-between-buildings are defined by the spatial rule that defines the distance from the building (Ehrlich and Tenerelli 2012). That distance is either a 1) buffer built around the building footprint or 2) the grid cell size of the grid cell that intersect the buildings (Tenerelli and Ehrlich 2011).
- The built up area in this document uses the second definition of distances. The built up area is therefore made of the cells that intersect the building or fractions of a building.
- Human settlements are closely related to the built up (Pesaresi and Ehrlich, 2009). In GHLS we subdivide between fine scale human settlements as those derived from high or very high resolution imagery (including aerial photography). Coarse scale human settlements are those derived from imagery of medium or coarse resolution that cannot locate single building information as described by Gamba and Herold (2009).

The built-up information collection procedure relies on 1) an IT infrastructure – referred as IQ system (Pesaresi et al. 2012)– used to process imagery and to encode, store and process the visual interpretation, 2) a hierarchical tessellation of the globe in a number of hierarchical levels 3) a sampling scheme to select samples for photo-interpretation and 4) a set of image analysis rules. The following section summarizes the description of these IT components to provide background information to the photo-interpreter.

3.1. The IQ system

The IQ interface is part of the IQ system (Pesaresi et al. 2012). The IQ system provides the information infrastructure for the analysis of human settlements. It assembles a set of tools allowing for analysis, encoding of information and when information is collected the benchmarking of automatically generated BU areas. The IQ system is the workforce of the Global Human Settlement Information System. It makes sure that the image information is properly geo-referenced and displayed.

The **IQ reference collection interface** is another part of the IQ system which displays the areas to be visually photo-interpreted. It was developed for visual image analysis and rapid information encoding. The interface allows to: 1) display the images of interest and other information layers available within the system, 2) overlay grid cell samples to be visited and 3) encode the photo-interpretation based on a set of keys. The practical steps for encoding information are described in Appendix B.

3.2. Hierarchical tessellation of the globe and sample selection

The QI system uses the Tile Map Service (TMS) standard (TMS 2012) to partition the Earth surface. The TMS comprises a number, hierarchical and quad-tree compliant tessellation levels (Figure 1). Every tessellation level produces a global grid. The higher

the gird levels the small the grid cell size. The TMS encodes every cell and at every level based on three numbers: a) the TMS level, b) the column and c) the row of the grid covering the Earth for that given TMS level.

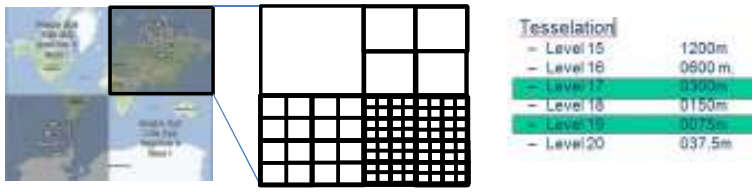

Figure 1 TMS tesselation

TMS subdivides the geographical space in nested grids at increasing spatial detail. The figure shows level 1 to 5. The levels considered in this document include Level 17 and 19 respectively displaying cells at 300 and 75 m.

This built up data collection protocol for this document uses TMS level 17 to locate the **samples.** The samples are referred herein as **sample blocks** and outline the area on the image that will be photo-interpreted. TMS-Level 17 grid cell covers approximately 300 x 300 m of the Earth's surface. Sample blocks are selected from the TMS level 17 grids using a stratified systematic sampling strategy (Gallego, 2005). The following procedure can be used to generate samples:

First, the TMS level 17 grid is subdivided in adjacent **super-regions** 20 x 20 TMS level 17 grid cells large. Within each **super-regions** a number of sample block cells are selected for photo-interpretation. The selection within the super region is systematic, it maintains the same location (same to rows and columns). One sample block within the super-region accounts of 0.25% of the area under study. More blocks within the super-region will increase the sampling density. Within every sample block, then 16 photo-interpretation cells – TMS Level 19 - are then selected for photointerpretation (Figure 2).

The size of the photointerpretation cells is related to the type of satellite image used and type of image processing (Ehrlich et al 2012) as defined within GHSL (Pesaresi et al 2012), and on building and space-in-between-buildings ratio as discussed in (Tenerelli and Ehrlich 2011).

The sample block contains 16 TMS Level 19 cells referred as photo **interpretation cells**. The interpretation cell identifies the smallest area that is photo-interpreted (see Figure 1).

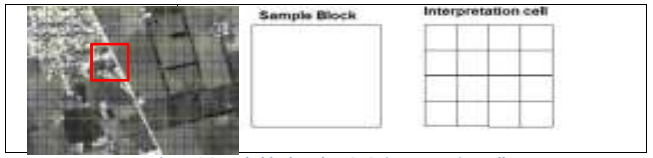

Figure 2 Sample block and PHOTO- interpretation cells

Figure 2 shows (a) SPOT image and TMS level 17 (yellow and Level 19 (black) with in red the sample block, (b) sample block, (c) sample block and interpretation cells.

The photointerpretation outcome include grid cells labeled as built up area or non-built up. However, to take into account no data and unknowns two more categories are included as listed and defined bellow. In summary, the cells may be coded as

Built up area: Grid cells that contain a building or fraction of a building (Figure 2).

Non-built up area: Grid cells that contain man-made objects other than buildings – i.e. roads, parking lots, airport runways- sport facilities. Non-built up include the space in-between buildings. Finally, all natural land covers outside of built up areas that include water, vegetation, agricultural land, pasture, forests, barren land, rock outcrop or snow and ice are considered non-built up.

No Data: Grid cells located at the margin of the dataset where non landscape spectral information is available.

Undecided: Grid cells may be coded as undecided when the photo-interpreter is not sure about the interpretation or when imagery is partly contaminated or degraded. Images can be either contaminated by clouds, haze, or incur in radiometric degradation due to high or low reflectance.

Empty: Cells are coded as "no data" that is the default value before the interpretation process is activated.

The photo-interpreter will interpret the image samples at the resolution provided by the IQ photo-interpretation interface. He is allowed to zoom out/in to better understand the context or the detail of the portion of the image analyzed. He is also allowed to visualize other datasets for the same area. For example, VHR imagery can be uploaded from the image repository. While the photo-interpreter can visualize and cross check any type of imagery to get the knowledge of the area, the final classification **must** be made based on the **target image** only.

Appendix A provides a set of examples that may guide the photo interpreter.

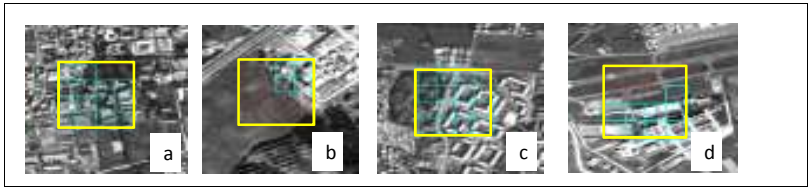

Figure 3 Images, sample blocks and photointerpretation cells

Figure 3 shows 300 x 300 m sample blocks (yellow). Images a-d show respectively 8, 15, 4 and 14 cells labeled as built up (blue) out of the 16 interpretation cells that make up the sample block.

The information that is visually interpreted is stored in a database. That database includes information on the image ID from which the information was digitized. The type of imagery, the acquisition date, the processing performed on the image and the interpreter that conducted the interpretation is thus recorded for every cell.

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4. APPENDIX A

A Collection of image samples to guide photointerpretation

The collection of images bellow provides examples of sample blocks and photointerpretation cells overlaid to the SPOT 5, 2.5 x 2.5 images used to collect built up information.

Figure 01 to 09 – Show examples of buildings and built up areas at different densities.

Figure 10 to 18 – Show example of land cover different than built up. The samples also show potential confusion with built up due to the spatial resolution of the sensor.

Figure to 19 -20 – Show examples of radiometric degradation that would prevent the interpretation.

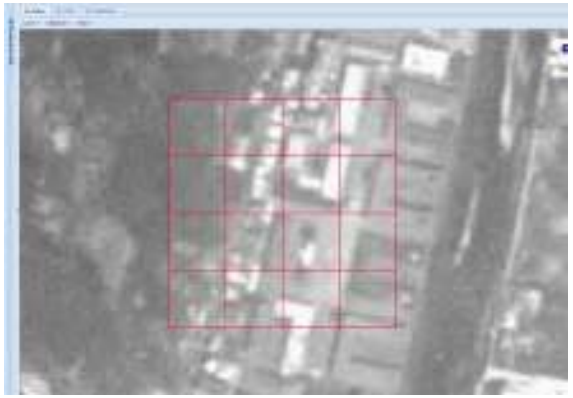

Figure 4 Buildings display sharp borders and regular shape (Italy)

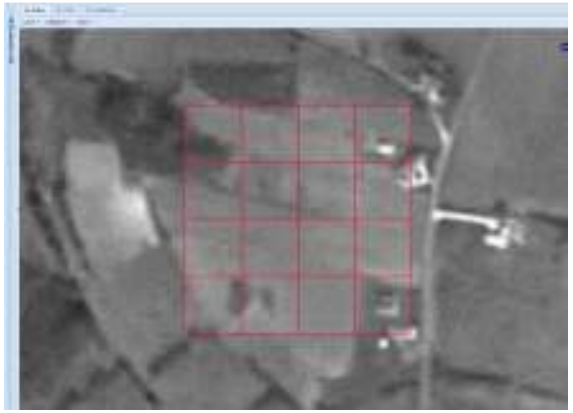

Figure 5 Isolated building in rural areas can also be detected on SPOT Panchromatic imagery (France)

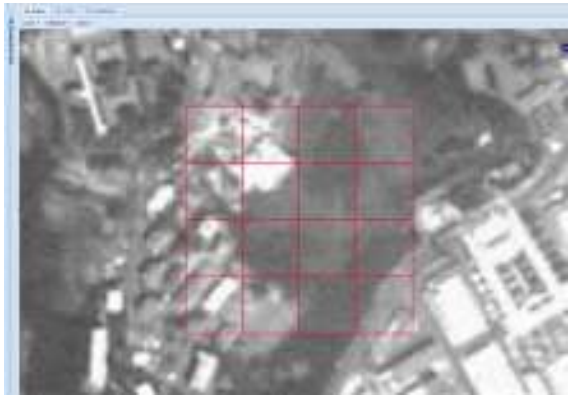

Figure 6 Buildings and BU areas are often associated with bright tones (Italy)

Figure 7 Low density and irregular spacing is associated with BU in rural areas (France)

Figure 8 Most dense BU areas –even that made of very small buildings - can be detected by SPOT imagery (Egypt)

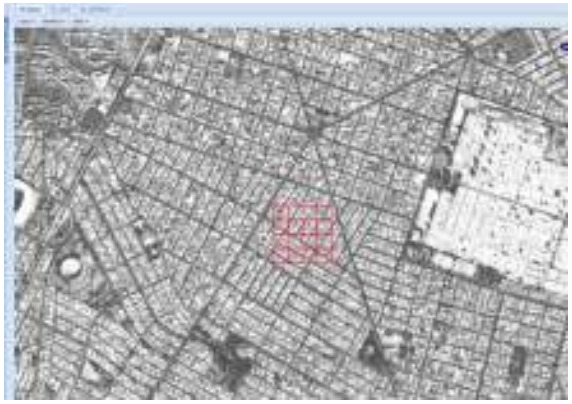

Figure 9 Buildings in dense BU areas are arranged regularly (Mexico)

Figure 10 Oil containers are to be considered BU (Egypt)

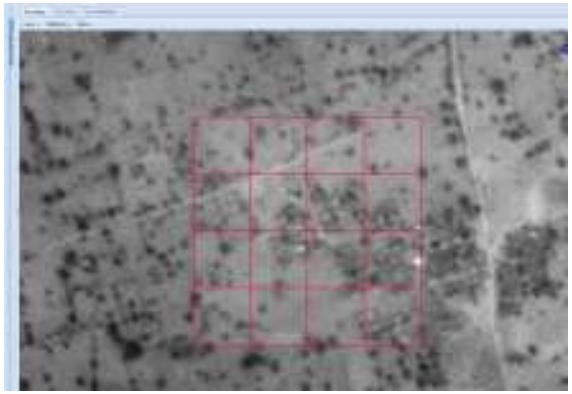

Figure 12 Low density built up in arid environment may be difficult to detect (Nigeria)

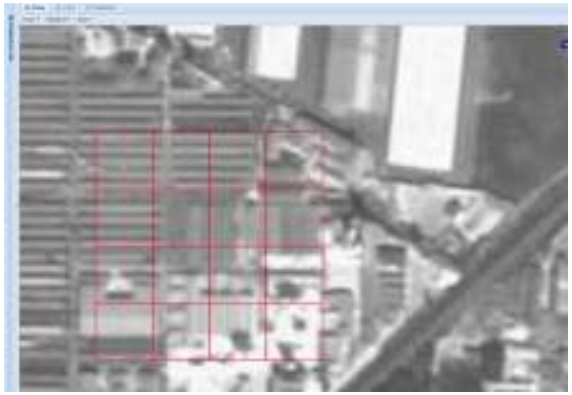

Figure 11 Semi-permanent construction with roof and internal working space are considered BU (China)

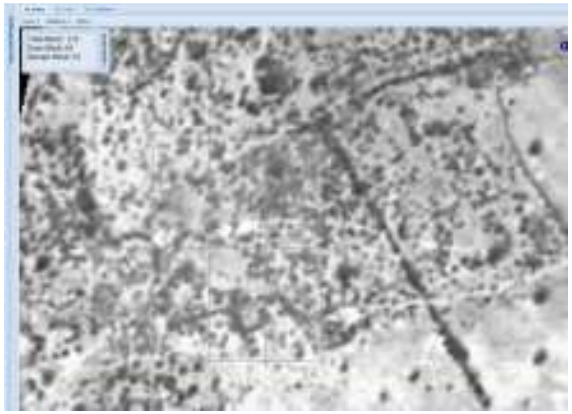

Figure 13 Vegetation patterns (non -built up) that may resemble rural settlements (Zimbabwe).

Figure 14 Roads distant from buildings are not considered built up (Egypt)

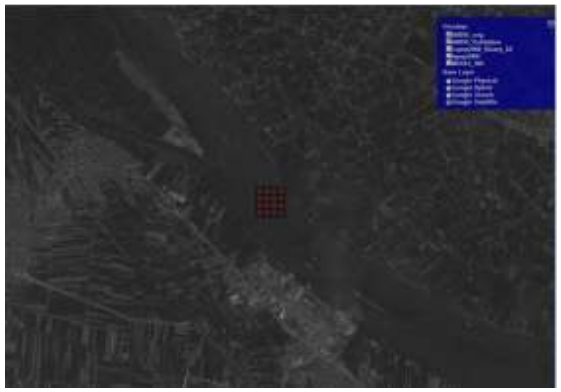

Figure 15 Water bodies are non-built up (Egypt)

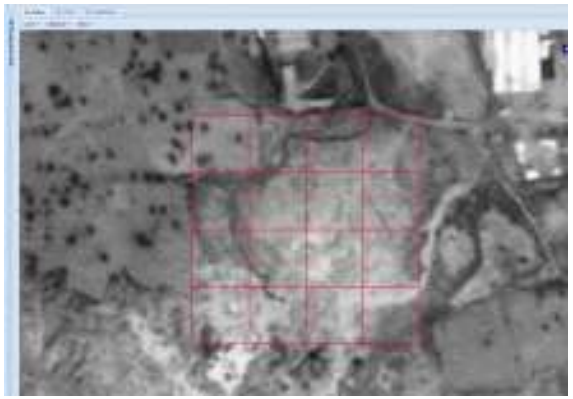

Figure 16 Large extraction sites (Nigeria)

Figure 17 Small extraction sites (Nigeria)

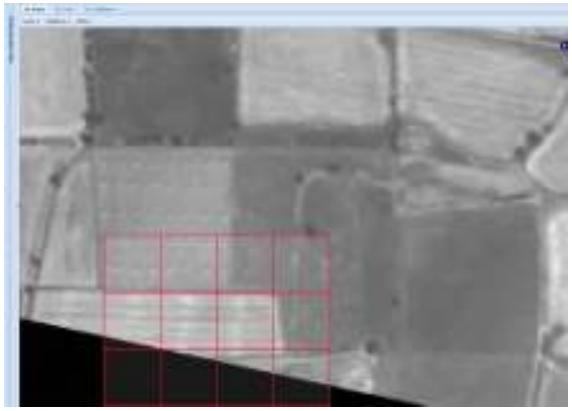

Figure 18 Bale of hay may be confused with rural settlements (Mexico)

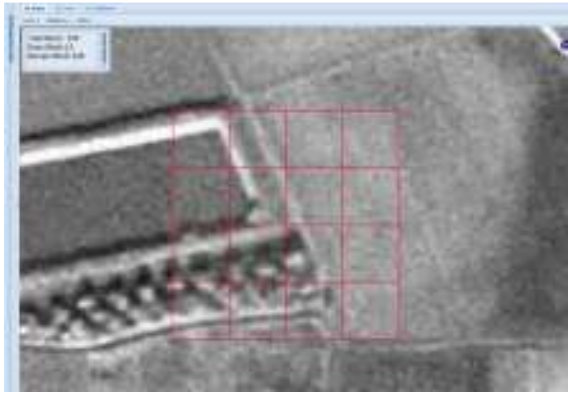

Figure 19 Linear of circular forms are seldom building or built up areas (England)

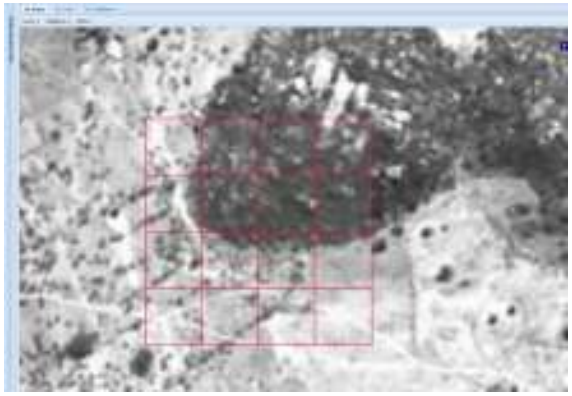

Figure 20 Rocks can be confused with buildings on SPOT imagery (Zimbabwe)

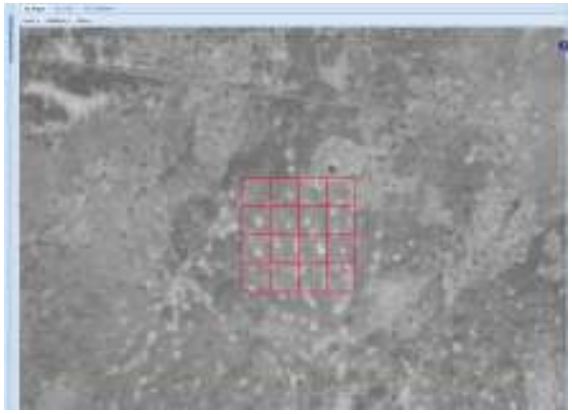

Figure 21 Circular gaps through the vegetation may be confused with buildings (Burkina Faso)

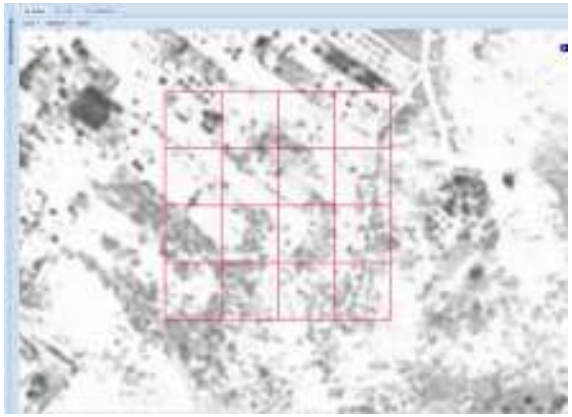

Figure 22 Imagery may by radiometrically degraded preventing a proper interpretation (Lybia)

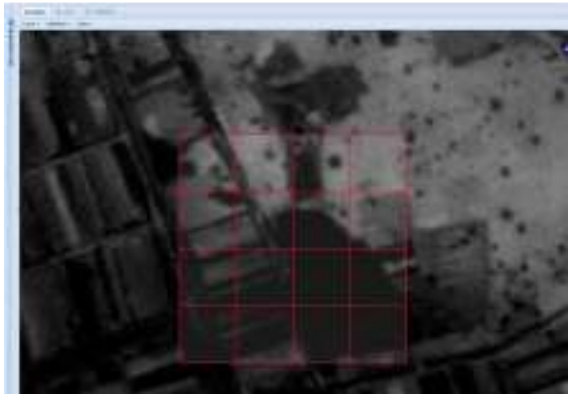

Figure 23 Dark reflectance may be difficult to interpret (Nigeria)

5. APPENDIX B

A Quick Start to Built up data collection procedure

Collection of Built up information from satellite imagery for the Global Human Settlement Layer

Marin Herrera M.A

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1. BUILT UP DATA COLLECTION.- A QUICK START TO THE VISUAL BUILT UP FIELD DATA COLLECTION PRACTICE

The IQ interface was developed to allow for fast photo-interpretation and automatic encoding of information.

It is accessible by logging on to two systems that should be available through Google Chrome.

1. The CID system is the JRC image repository
2. The IQ System is the JRC image Query System

Evaluators need to obtain first registration for both systems. The following workflow show the main basic steps in order to understand how to work with the data encoding system

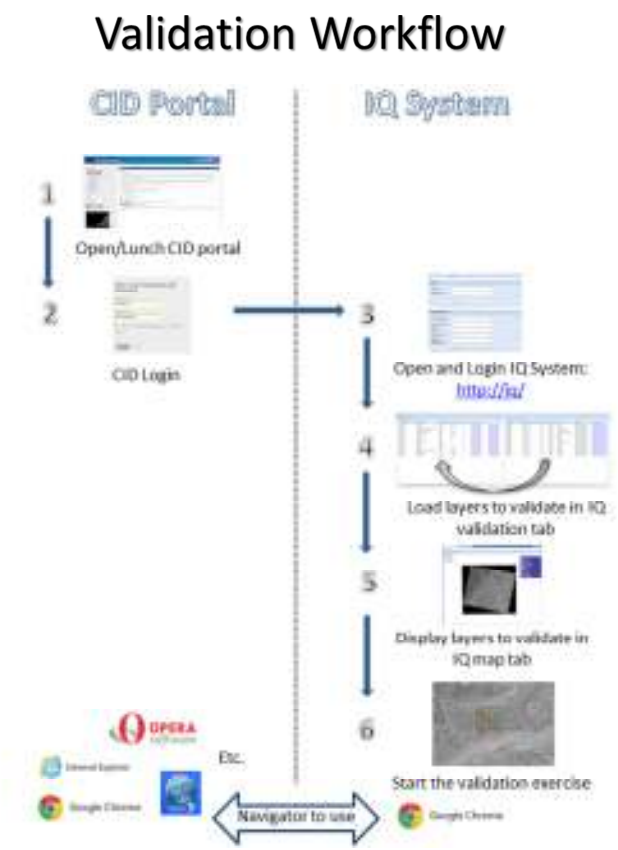

Figure 1: Encoding workflow is introduced

2. CID PORTAL.

2.1. INTRODUCTION

The CID Portal is a Web portal used for searching and accessing Remote Sensing data and derived products hosted at JRC. Search and preview is open to the public. Access to the image data via a variety of online services is limited to authorized and registered users.

Staff of institutions of the European Union can be granted access to most of the archive data after registration.

The main entry point to the image data archive is the CID Image Portal web application. Search and preview of image data and a listing of some common metadata is open to the public. More detailed data access functionalities require prior registration and authentication. Staff of institutions of the European Union can be granted access to most of the archive data after registration.

The application layout consists of three main panels: the map panel, search panel, and the portfolio and search management panel (the latter only visible to authorized users logged in to the application). The map panel offers a wide range of background (=base) layers that allow for orientation and navigation. The image locations (”image footprints”) are displayed on an overlay layer.

The application is based on several modern JavaScript libraries for mapping and interaction with the back-end database. The set-up ensures compatibility with all major browser types, namely Firefox, Internet Explorer (+6.x), Google Chrome, Safari, Opera. However, for best performance and interactivity, modern browser types are recommended.

2.2. IMAGE PORTAL WEB APPLICATION – FIRST STEPS

The CID system is presented in a web-based form. To get started into the validation process we must open the CID portal, log in and understand the user interface. These main steps are listed below:

1) Go to the portal by opening the following URL in your browser:

http://cidportal.jrc.ec.europa.eu/home/

Figure 2: Introductory CID Portal web site. In red color is highlighted the two ways to lunch CID portal

From the Web page shown in fig 1, navigate to the portal by clicking on the link ”Launch CID Portal” on the top left or the link ”CID Portal” (both marked in red).

2) Registration and log in.

Access to the image data in the archive via a variety of on-line services is limited to authorized and registered users. Staff of institutions of the European Union can be granted default access to most of the archive data after registration. Users outside of the EC can only be granted access to certain datasets after internal cross-checks with the JRC Action responsible for the data. For some cases additional documentation will be requested from the external users.

In order to register go the CID homepage as displayed in fig. 2 and navigate with the tabs” Image Data Portal *CID Portal, *Lunch CID Portal”. After accepting the privacy statement you need to fill in some personal data required for user registration and authorization and then press the ”Submit Query” button.

Your request will be processed by CID staff. Your account will be created and your permission and credentials set. Staff of the European Commission shall indicate their DG and Unit, JRC users shall indicate also their action. External users outside of the EC shall indicate a JRC contact person. This is required to check internally if the request is justified and to define to which data the user shall have access via which data services/protocols.

After insertion into the user database you will receive a mail that will notify how to proceed. Please follow the instructions and finalize your registration. After successful registration you can log in to the portal clicking on the ”login” link on the top right as displayed in fig. 3.

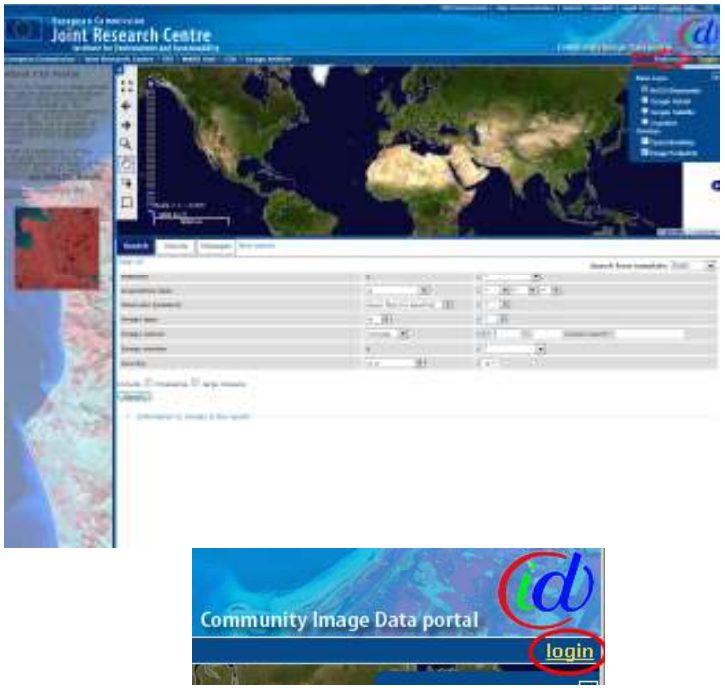

Figure 3: Up, CID portal is shown with one arrow pointing the “login” link. Down, the part of the CID portal to login is magnified.

Figure 4: Up, login via CID authentication Service window. Username and password are requested to continue. Down, CID portal right corner window shows the option to "logout" which means we are authentified and then the IQ system can be called up.

3) Familiarizing yourself with the User Interface

The main window of the user interface is used for image search, definition of portfolios and personalized virtual file structure and is the starting point to access the image data. Fig. 5 delineates the various zones and elements of the user interface.

Map panel: Interactive map with various background layers that allows standard map navigation (zoom in/out, pan) and search related functions

1. Map tools panel for performing view or search actions on map
   - Zoom to Full Extent
   - Zoom to Previous Extent
   - Zoom to Next Extent
   - Zoom in
   - Pan
   - Select Images
   - Draw Area of Interest

   The first 3 tools are stateless, i.e. they just perform an action by clicking on it. The other 4 tools set the state of the mouse action related to the chosen tool.

2. Map layers panel selector for selecting base layer and overlay layers
   - To extend this selector panel with additional base layers and overlay layers see fig. 6
     - Right-click on the map and select "Select Layers for Display"
     - In "Select Layers for Display" window select layers to display
3. Overview map panel for fast orientation within whole map
4. Search, result and messages panels for performing a search with specific attributes and processing result of the search
5. Portfolios and searches panels for manipulation of portfolios and search history

Figure 5: User interface zones and elements

Figure 6: User interface. Right mouse click context menu [a] and select layers to be available in the layer selector [b]

2.3. SEARCH

Image search is briefly presented here in order to satisfy users who wish to check the image source or get extra information about the data implanted in the IQ interface.

Searches can be performed either by specifying criteria in the web form, selecting geographical areas on the map or loading a past search from the search history.

1. New Search

In the main form you can manually specify some search parameters (see fig. 5). If your search requires a customized set of return fields, you can select fields to be returned under link ”show fields” by ticking the respective check boxes. The figure below shows the default search form that can also be customized.

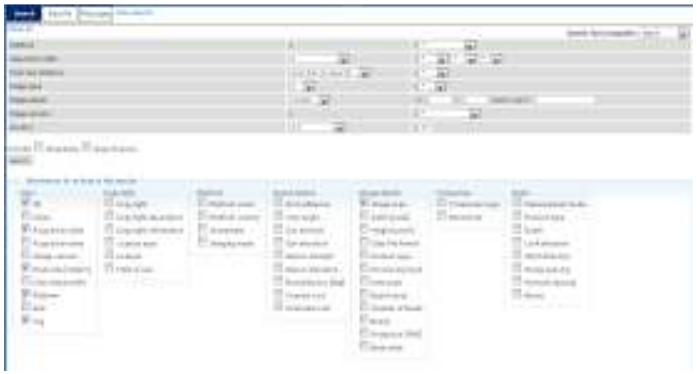

Figure 7: Search window. The information included in the results is set by default.

2. Geographical Search

Restricting the search to a user-defined geographical area has two possible input methods.

a. By location name

- From the combo box select the geographic constraints ”includes”, ”intersects” or ”lies within”.
- Type in the location in the text box ”location search:” and hit [RETURN].
- In the pop-up box select the location from the available list (see fig. 8).
- The coordinates are automatically inserted into the X and Y text boxes. You can also insert the geographic coordinates by hand.

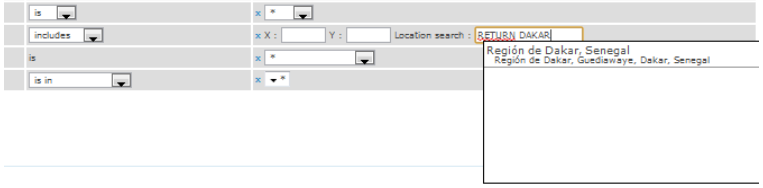

Figure 8: Location search. In this case, Region of Dakar is returned by CID database.

b. By extent

- From the combo box select the geographic constraints ”includes”, ”intersects” or ”lies within”.
- Choose the select tool ⬚ from map tools panel and draw the search area on the map (see fig. 9).
- The extent of this area is inserted into the Xmin/Xmax and Ymin/Ymax fields for the search bounding box (see fig. 3.5). The rectangle drawn on the map remains as a blue rectangle after the search. It can be removed via the right-mouse context menu and selecting the item ”Remove Area of Interest” (see fig. 9).

Figure 9: Image extent search. It is highlighted in blue the selection made with ”Select Images” tool. It is highlighted in red the image bounding box, defined by Xmin, Ymin, Xmax, Ymax

3. IQ INTERFACE

3.1. INTRODUCTION

The IQ interface has been developed by ISFEREA team as a tool to rapidly collect built up information from satellite imagery.

The first step in order to carry out this process and have access to the IQ interface is to login to the system. If it is your first access, a prior registration is needed. Basically, you will be asked for basic details such as name, email and password.

The complete procedure consists of the following major steps:

1. Type the URL into the browser: http://iq/

Figure 10: IQ interface login. The first window asks for login information and allows new user registration

2. Displaying and familiarizing yourself with the IQ interface

Once the session is started, a window will show the full database implemented in the IQ system under the IQ Run Log title. The various and large number of fields give us an idea of the database structure.

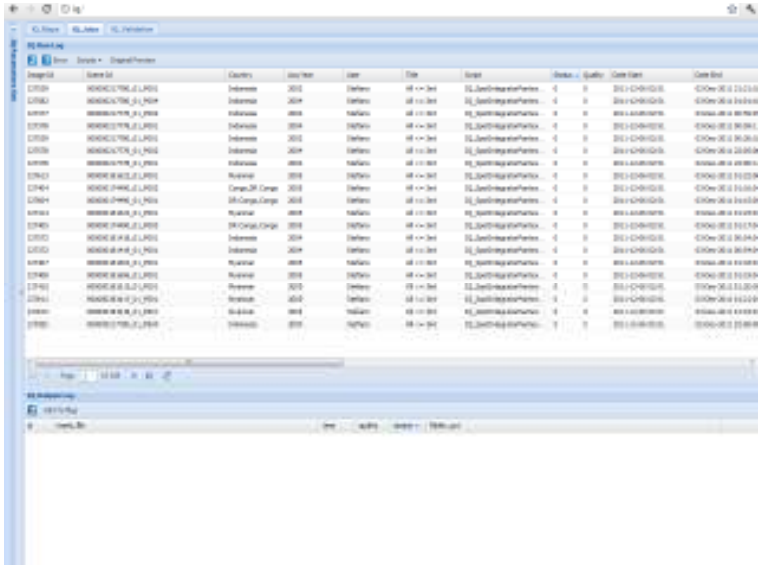

Figure 11: " IQ_jobs" is the first display after registration/login process.

The IQ interface is divided into four pages, which are available from the upper part of the application by simply clicking on them.

- IQ Jobs: Shows the image processing tasks completed
- IQ Validation: Displays the images hosted in the system and the images ready to validate in a second window.
- IQ Maps: Displays the available processed images and is used for the collection of visual information
- IQ WMS Services: Display the WMS services available

3.2. IQ VALIDATION TAB

The IQ photointerpretation page allows displaying the images selected for reference data production from the full range of images hosted in the system.

The IQ validation screen is divided into two parts. The list of images pre-processed (on the left) and, the ready to be interpreted from the list of available imagery in the system (on the right).

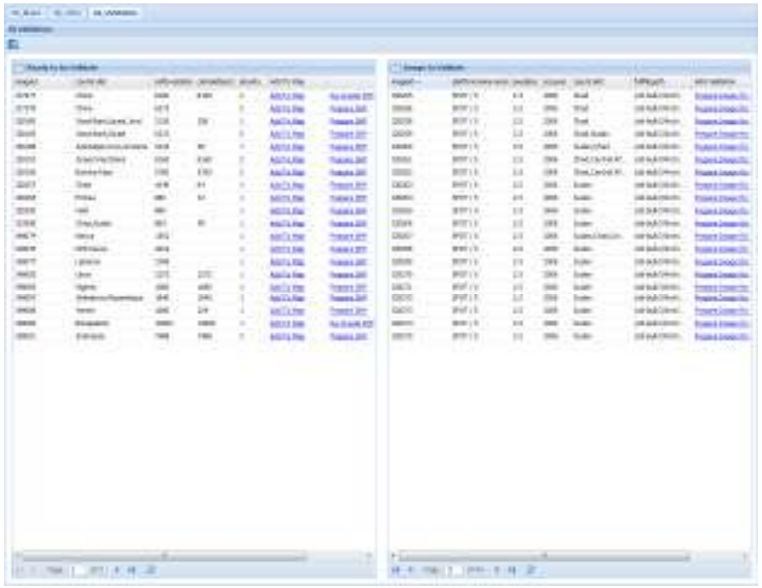

Figure 12: IQ validation tab. On the left, the images ready to be validated and on the right, the images to validate

The IQ validation window consists mainly of:

- a list of images hosted in the system for analysis and waiting to be preprocessed(right part of the window)
- a list of images being already pre-processed and ready for validation (left part of the window)
- Symbols to update the display and moving forward and back in the image list.

Continuing the numeration, the procedure to follow is:

3. Click the left mouse button on the graphic to refresh and update the last changes registered.

4. Place the mouse cursor on the right part of the screen. Select the image to validate by clicking on the *"Prepare Image for Validation"* link, which is under the "Add validation" field

5. Move the mouse cursor to the left part of the screen. Search the image clicked before, click on refresh button if necessary, and make the imagery ready to be validated by clicking the *"Add to Map"* link.

6. Move to the *"IQ_Maps"* tab.

Figure 13: IQ map tab. A, B and C corresponds to the three sub-tabs included in the IQ system

3.3. IQ MAP TAB

The IQ map represents the major tab in this step-by-step guideline to produce reference data for validating automated satellite image products.

IQ Map tab allows the superimposition of a 16x16 cells grid on top of satellite imagery data. More details about the methodology are found in the "SPOT 2.5 validation protocol"

IQ map tab contains three menu (See figure 13):

A. **Layers**: Has the main commands to add/remove data, change layer properties like transparency or applying zoom in/out or a data filter. The layer group contains:

   - Add Original. Call up the image selected in the IQ Validation display from the CID repository. If the layer has not been loaded, the following message appears: "*Attention! You have to select 1 layer*". This and other layers can be turned on/off from the "Overlays menu". This menu is placed on the right screen corner and minimized by default. Click once in the button and a list of available layers will be shown.
   - Transparency: Transparency can be used for any layer, but it is especially useful for drawing raster layers with other layers on your map. Adding transparency to the top layers allows you to see them while still viewing underlying layers. Click on the "*Transparency*" button and move the slider to a value. The transparency effect occurs while you move the slider. When you release the mouse button, the tool disappears, and the transparency effect stays at the value you left it at.
   - Remove Layer: Takes out one layer from overlay menu list and the display. Note: If it does not work then two layers are selected.
   - Zoom To: Zooms and center the view window to the validation grid.

- Date filter: A time interval selectable between 1990 to 2011 appears as slider to select different acquisition dates.

B. **Validation**: Tools to assist the reference data production:

- Go To Block: This tool gives you the possibility to navigate through the validation blocks, moving forward or backward. It is placed under the validation menu and by clicking on "*Go To Block*" a new window pops up. This function works by typing the validation block number and pressing subsequently the "Go To" button.

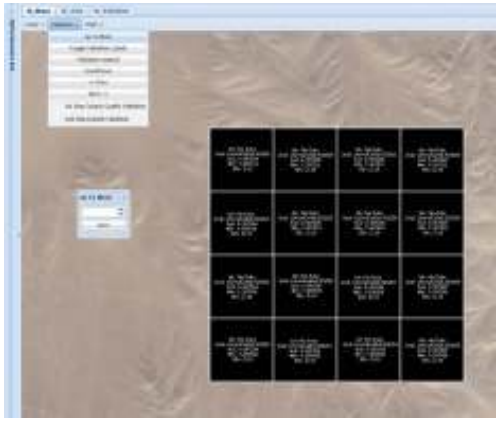

Figure 14: A small "Go To" Block window is displayed on the left part of the image.

- Toggle Validation Labels: This tool allows to hide or to show the validation cells labels. By clicking and re-clicking the Button "Toggle Validations Labels" the labels will be turn on/off.

  Note: It is advisable to turn labels off when a large scale is being used for display.

Figure 15: Toggle validation labels are activated and placed on the top of each validation cell.

- Validation Legend: This tool opens a Validation Legend window by "Validations Legend". The legend distinguishes the following categories: empty, non built-up, built-up, do not know and no data.

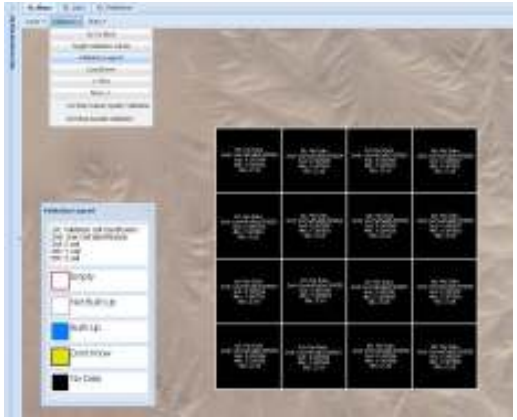

Figure 16: Validation legend is presented on the bottom left image corner.

- Add a note: To add a note into a validation cell, click the right mouse button on the cell of interest. A new window pops up and comments can be added to the data.

Figure 17: "Add a note" tool allows inserting comments and so, to have feedback for future works

C. **Stats:** Offers some statistical functions to perform on the data. These are: *Add Statistic* and *Statistic Threshold.* The utilities are under development and have limited functionality.

The last steps to fulfil and being in a position to start the photo-interpretation exercise are as follows:

7. From the IQ map menu bar, select *Layer>Add Original.*

8.From the IQ map menu bar, select *Zoom to.*

9. Click a validation cell 1, 2, 3 or 4 times to move through the Built-up, Non Built-up, I don't know and No data sequence. At this point, **the interpreter must assign values to each cell**.

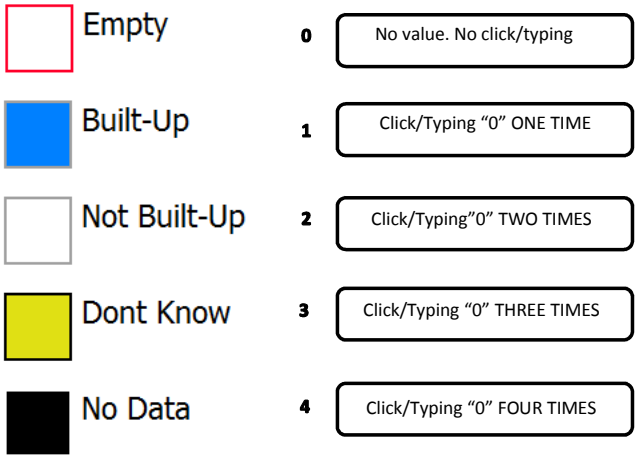

Figure 18: Validation legend sequence defined by ISFEREA Team. By clicking on the cells or by typing "0" on the keyboard, the validation cells change to one category or another.

In order to speed up the validation practice, some keyboard keys have been configured to perform some tasks. The numerical criterion fixed to validate is graphically explained:

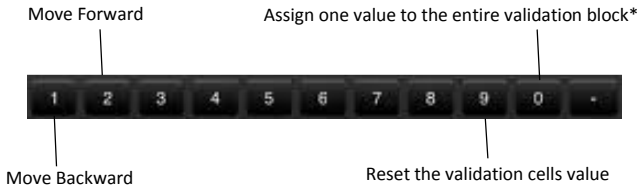

Figure 19: Keyboard configuration during the validation exercise.

Note *: If one cell has been already given a value and the key "0" is pressed, all the cells will move to the next category defined in the validation legend sequence. For example, if one cell is assigned as "Built up", blue colour, and the rest are categorized as yellow colour-or "I don't know", the first one will become "Not Built up" in blue, and the group of cells will move to "No Data" in black.

10. Press the button "2" after validating each block to move to the next one. The validation exercise will finish when no validation grid is shown

11. Go to *IQ Validation tab* and press the refresh button to save changes.

12. To clean up the session and initiate a new validation process, *Go to IQ Maps>Remove Layer* (labelled as ImageID_Orig and ImageID_validation). You must have previously selected only one layer from the overlays menu. Continue with the step three for reference data production.

4. SUMMARY

The main steps are summarized for reference below:

1. Go to the portal by opening the following URL in your browser: http://cidportal.jrc.ec.europa.eu/home/
2. Registration and login on CID Portal.
3. Type the URL on the Google Chrome browser: http://iq/
4. Click the left mouse button on the graphic to refresh and update the last changes registered.
5. Place the mouse cursor on the right part of the screen. Select the image to validate by clicking the left mouse button on the "Prepare Image for Validation" link, which is under the "Add validation" field
6. Move the mouse cursor to the left part of the screen. Search the image clicked before, click on refresh button if necessary, and make the imagery ready to be validated by pressing the left mouse button on "Add to Map" link.
7. Move to IQ Maps interface by clicking the left mouse button on the "IQ_Maps" tab, which is placed on the upper left corner of the interface.
8. From the IQ map menu bar, select Layer>Add Original.
9. From the IQ map menu bar, select Zoom to.
10. Place the mouse cursor on a validation cell and click 1, 2, 3 or 4 times to move from Built-up, Non Built-up, I don't know and No data value sequence. In this point, each interpreter must assign values to each cell on a cell by cell basis.
11. Press the button "2" after validating each block to move to the next one. (more information about the controls see above) The validation exercise will finish when no validation grid is shown
12. Go to *IQ Validation tab* and press the refresh button to save changes.
13. To clean up the session and initiate a new validation process, *Go to IQ Maps>Remove Layer* (labelled as ImageID_Orig and ImageID_validation). You must have previously selected only one layer from the overlays menu. Start now from the step 3 to continue the validation exercise.

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Abstract

The document summarizes the steps, procedures, information infrastructure used for collecting built up information from satellite imagery. The document is intended as a reference for visual interpreters. The document also summarizes the lessons learned by photo-interpreters for imagery covering Europe.

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