# Ecosystem Stations Labelling

# Step 1

## *ETC criteria, rational and information requested*

The Step 1 of the labelling process in ICOS has the aim to do a first evaluation of a proposed ICOS site in order to ensure that the best possible site is added to the ICOS network, both in terms of characteristics and contribution to the network. For ecosystem sites, the evaluation concerns technical aspects such as footprint characteristics, canopy homogeneity and history, the topographic and orographic conditions, the presence of elements that could potentially affect the measurements, the integration in the whole ICOS network, the scalability and flexibility for future potential development. However, the main scope of the Step 1 is to establish a strong link between the proposed site staff and the ETC in order to optimize the site construction and to help the ETC in the preparation for the Step 2 phase.

The complexity and heterogeneity of the ecosystem sites and the difficulties in estimating the real and final effect of the site characteristics on the measurements must be considered in the evaluation activity. It is currently impossible to develop a generally accepted analytical and quantitative method to evaluate a site. Nonetheless, it is of utmost importance to list all potential data quality issues and analyse how these could be remedied. This step is not intended to exclude sites, but instead to help constructing the best possible infrastructure. Exclusion will only be recommended when the proposed site is clearly violating the methodological requirements (that cannot be corrected or filtered).

**Evaluation criteria**

The ETC will perform an evaluation of the proposed site based on expert knowledge and discuss with the PIs directly about possible issues and improvements before writing the report and evaluation. In general, four different aspects are evaluated:

Network contribution: evaluation of the contribution of the site to the existing ICOS network with the aim to maximize the information gained with the establishment of the new site (network representativeness and duplication of sites)

Orography: evaluation of the general orographic and topographic characteristics of the landscape around the tower with the aim to highlight potential complex situations that could lead to high uncertainty in the measurements due to advection

Fetch uniformity: evaluation of the fetch uniformity in terms of land uses and land covers, including differences in the management with the aim to suggest the best orientation of the sonic and highlight potentially complex footprints that could lead to high uncertainty or in extreme cases violate the eddy covariance pre-requisites

Canopy conditions: evaluation of the characteristics of the canopy in terms of vertical planes distribution in order to check that no strong vertical discontinuities are present (e.g. grassland-forest borders) that would violate the pre-requisites for the eddy covariance.

**Issues classification**

For each of the four listed criteria, a comment and explanation is provided together with a classification according to the following scheme:

0 - COMPLIANT. No issues present

1 - SUGGESTION. The issue is not preventing the acceptance. A suggestion to improve the site compatibility with the network and quality criteria is provided.

2 - REMARK. The issue can be relevant and the ICOS network or the quality of measurements would benefit/improve if addressed. The site can be still accepted if not addressed but it is strongly encouraged to consider an action to reduce risks of high uncertainty in the measurements.

3 - CRITICAL. There are high probabilities that the issue will strongly affect the quality of the measurements with a negative impact on the ICOS network. The site cannot be accepted without solving the issue.

We expect that category 3-CRITICAL will be rarely used. A site will be classified as critical only if some of the basic assumptions for the eddy covariance technique are violated and there are no possible solutions to solve the situation or to estimate the uncertainty due to the sub-optimal conditions.

**Step 1 Ecosystem labelling process**

During the application, the PI will provide a set of information, documents and data about the proposed site through the Carbon Portal interface. The required data (listed here below) are related to the main site characteristics (including spatial information, maps and site selection motivation) and are transferred to the ETC. Once received the evaluation process starts and it includes the following steps:

1) ETC will evaluate all the aspects listed based on expert judgment;

2) ETC will prepare a draft report for the PI with the classification of the issues and explanation for points with a flag > 0;

3) PI is expected to answer and give additional info, motivations, changes applied etc. ETC will give all the additional explanations and support needed to find the optimal solution. It is an open and cooperative discussion phase between ETC and PI in order to build the best possible site and prepare ETC for the Step 2 phase in the best way

4) After this exchange phase, the ETC will prepare the final report that is sent to the DG

The whole procedure is expected to take between 10 and 30 days depending on the number of applications and reaction time from the PIs on point 3 above.

# List of information and data needed

1) Basic site information (Ecosystem Type, management, recent disturbances, site description, history of previous measurements and available data, past land use changes if any) including reasons why it has been selected as candidate ICOS site.
   Format: free text, one page maximum. File name XX-YYY_Description.ext (Word, PDF and ASCII accepted) where XX-YYY is the official site code.

2) Coordinates of the tower, WGS84, Latitude-Longitude, 5 decimal degrees (XX.xxxxx, YY.xxxxx).
   Format: decimal numbers, negative for South and West. No letters. Online form on CP.

3) Power availability at the tower (source and kW available in total).
   Format: free text. File name XX-YYY_Power.ext (Word, PDF and ASCII accepted) where XX-YYY is the official site code.

4) Internet connection, system and capacity (speed, robustness).
   Format: free text. File name XX-YYY_Connection.ext (Word, PDF and ASCII accepted) where XX-YYY is the official site code.

5) Information about the actual sharing of the site and in particular the tower facility with other initiatives, networks, long-term projects. Characteristics of the tower (size, possibility to host additional sensors etc.).
   Format: free text, one page maximum. File name XX-YYY_Sharing.ext (Word, PDF and ASCII accepted) where XX-YYY is the official site code.

6) Wind direction distribution for each month, divided in day and night (if available, otherwise also a nearby meteorological station) or time series of wind direction (preferable).
   Formats (one of these):
   - Spreadsheet with wind sectors in rows (max 30 degrees width) and months on columns, values representing percentage of the times the wind came from the given direction during the months. Two separate table for night and day. File name XX-YYY_Wind.ext (Excel and ASCII accepted) where XX-YYY is the official site code.
   - Time-series of the wind direction at maximum hourly time resolution, one full year. Two columns one with timestamp (header TIMESTAMP) indicating the end of the averaging period and one with the wind direction (header WD) reporting degrees respect to North. File name XX-YYY_WindData.ext (Excel and ASCII accepted) where XX-YYY is the official site code.
   - For sites that already submitted sufficient data to the European Database just confirm that these data can be used. Online form on CP.

7) Proposed direction of the anemometer arm and eddy covariance system height.
   Format: degrees from north and meters above ground. Online form on CP.

8) Digital Elevation Model (DEM) of an area 3x3 km around the tower position. DEM must have the highest possible spatial resolution but not less than 25 meters horizontal and 1 meter vertical.
   Format: data in any exchange format but send specifications. In case of difficulties, contact the ETC to find a solution. File name XX-YYY_DEM.ext where XX-YYY is the site code and ext the extension. If the format requires multiple files (like in Idrisi for example), the files must have the same name and different extensions.

9) High resolution aerial or satellite colour image of an area 3x3 km around the tower. The image must show the actual site situation, so not older than the most recent important change (land use changes, buildings etc.). See example in the appendix.
Format: all images formats are allowed (jpg, png and giff best for the small size but also the other formats are accepted). File name XX-YYY_HIRES.ext where XX-YYY is the site code and ext the extension.

10) Vegetation map of the 3x3 km around the tower with information about the vegetation height, dynamic, type, past land use changes (see attached document). It is not needed a detailed map at this stage but a general contextualization of the site, where it is possible to retrieve the info needed to understand where vertical discontinuities (e.g. limit between a grassland and a line of trees) or local anthropogenic or geological emissions (houses, roads, geothermal emissions…) are present.
Format: all images formats are allowed (jpg, png and giff best for the small size but also the other formats are accepted). Map file name XX-YYY_VEGMAP.ext where XX-YYY is the site code and ext the extension. See examples in the appendix. Legend and info file name (free text): XX-YYY_VEGMAPinfo.ext (Word, PDF and ASCII accepted).

11) Twelve photos (every 30 degrees starting from North) taken from the tower position. In forest sites 12 photos from outside the canopy (top of tower) and 12 below canopy (ground)
Format: all images formats are allowed (jpg, png and giff best for the small size but also the other formats are accepted). File name XX-YYY_PHOzz.ext where XX-YYY is the site code, zz is the direction (N, NNE, ENE, E, ESE, SSE, S, SSW, WSW, W, WNW and NNW) and ext the extension. For forest towers, photos ground level with name XX-YYY_PHOzz_G.ext

12) If the tower is already in place: for forest sites 4 photos from the top of the tower looking down, on the 4 sides, outside the tower; for not forest sites 4 photos of the tower from 4 directions.
Format: all images formats are allowed (jpg, png and giff best for the small size but also the other formats are accepted). File name XX-YYY_TOWERzz.ext where XX-YYY is the site code, zz is the direction (to be selected among N, NNE, ENE, E, ESE, SSE, S, SSW, WSW, W, WNW and NNW) and ext the extension.

# Appendix – example of high resolution image and vegetation maps

**High resolution image example**
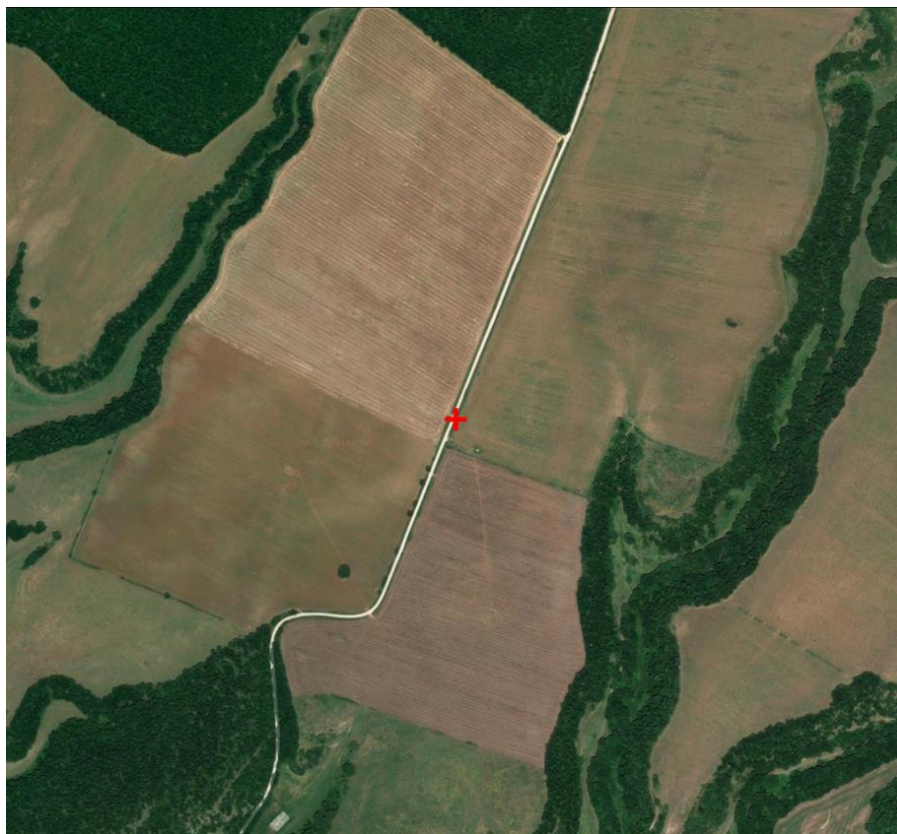


High-resolution colour image centred on the exact tower position, 3x3 km (the one above is smaller, only an example and tower clearly not there…). The image must be exactly 3x3 km because will be used to calculate the scale.

Example of file name: FI-Hyy_HIRES.jpg

**Vegetation map example – Option 1**
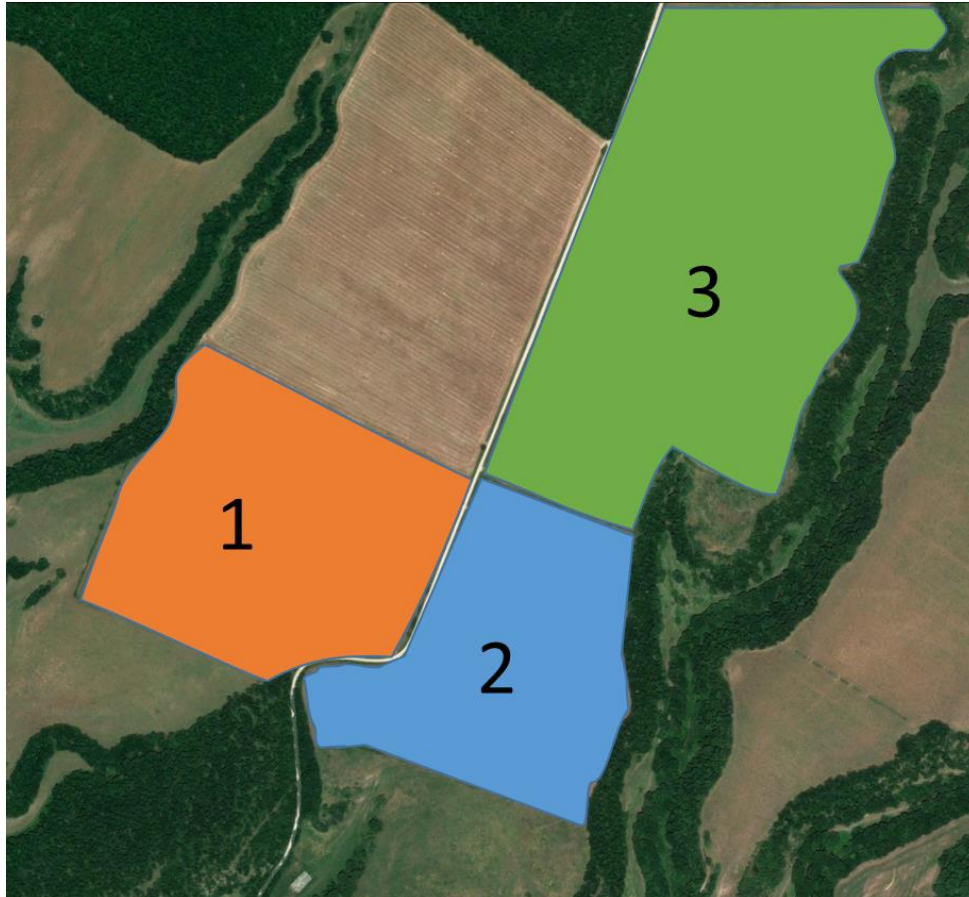


Identification on the image of the different vegetation type (including different crop types, management types etc., all the info needed to characterize the site). Report the vegetation high (min-max) for each homogeneous type.

Example of the legend content (image above), file name FI-Hyy_VEGMAPinfo.txt:
Sunflower, no rotation, height between 0 and 2.5 meters
Sunflower, rotation with wheat every year, height between 0-2.5m (sunflower), 0-0.7m (wheat)
Grassland grazed periodically, veg. Height 0-0.1 meters. It has been sunflower for 10 years until 2013

Example map file name: FI-Hyy_VEGMAP.png

**Vegetation map example – Option 2**



If the image allow easy identification of the different plots/vegetation type (e.g. because it is already a classification map), a simplified report can be also used (map and legend).

Example of the legend content (image above), file name FI-Hyy_VEGMAPinfo.txt:
1) Sunflower, no rotation, height between 0 and 2.5 meters
2) Sunflower, rotation with wheat every year, height between 0-2.5m (sunflower), 0-0.7m (wheat)
3) Grassland grazed periodically, veg. Height 0-0.1 meters. It has been sunflower for 10 years until 2013
4) Line of trees, deciduous (*Populus*), height 10-16 m
5) Small water stream, with water only in winter
6) Trees deciduous (*Quercus*), height 15-25 m

Example map file name: FI-Hyy_VEGMAP.gif