PARCERIA PORTUGUESA PARA O SOLO
(Portuguese Soil Partnership)
Technical -Scientific Panel

Considerations on the "draft"
"Shaping LUCAS2018 – user needs"

INTRODUCTION

Taking into account documents supplied by EUROSTAT, recently available from INE (Portuguese LUCAS focal point), comments have been asked aiming to have a detailed analysis, concerning the topics related with a reviewed methodological approach for "LUCAS 2018", two modules and for the connection on the planning of *Copernicus Actions* till the end of 2015 (for that purpose three Thematic Workshops have been planned on November 2015), assuming that those proposals can be validated and tuned till the end of 2016.

Besides that, *Eurostat* will review in a critical way the basic implementation of "LUCAS" and the integrated experience is added value with results obtained during 2015 campaign that ended in October 2015. The setting-up of a Task Force, that covers national specialists from different countries, aims to supply inputs about the best way to made "LUCAS" data more useful, for different member states. It has been also suggested to the members of the Task Force to supply contacts of experts, owing their involvement on the development of specific modules and activities concerning soils, grassland and *Copernicus*.

This action is connected the *Task Force* "LUCAS 2018 and beyond" mandate, manly in what concerns, centring LUCAS operations and data to be obtained on political guidelines and governance.

It is assumed that the document is a start point for the organization of a base proposal regarding a soil monitoring system in the European territory, considering the evaluation needs of potential end-users (*stakeholders*). In our opinion this should be effectively the final objective of the present contribution for proposal work of "Lucas" 2018.

CONSIDERATIONS

1 – The proposed monitoring activities for "**LUCAS 2018 Soil module**", according to the reference document, will consider several land cover types and land uses (areas with crops, pastures, forest, urban zones, transport networks, etc.). It is mentioned that the sampling will comprise 10% of the "general LUCAS points" (it is presumed that they are 200 000), but what is the difference between "LUCAS points" and "soil points"?

(Are they 20 000?). What is the methodological and strategic meaning of the so-called "new sites"? Besides the different land use, the Programme LUCAS2018 should take into account the geological and physiographical units occurring throughout the country). Sampling density should be increased.

It is not clear the right meaning of the so-called "topsoil samples", terminology used in the activities LUCAS 2009 and LUCAS 2015 programmes.

2 – The indication that the foreseen monitoring system should simultaneously include the "**topsoil**" and "**subsoil**" characteristics is obviously desirable. In fact, it is admitted which is well known in the context of soil system functioning: the sub superficial horizons, as well as the non-consolidated parent material, are determinant for the expression of soil functions. In this way, the characteristics of soil profile, and the particularities of its different horizons and layers (non-consolidated parent material) are taken into account. In this context, the monitoring of "**topsoil**" characteristics may mostly express temporal variations associated with land cover, land use, and management practices, whereas the "**subsoil**" monitoring will mostly provide information related to soil type, the respective processes of formation and evolution, and parent material characteristics. In the one hand, the "**subsoil**" monitoring will match and benefit from soil mapping information (soil mapping legacy); on the other hand, the foreseen monitoring could be an opportunity to reduce information gaps and improve information quality regarding thematic mapping at country level.

3 – The statement "all basic properties but particle size distribution (……..) can be measured in these samples" needs to be clarified, in order to get the understanding of it does means, especially in what regards the criteria to particle-size classes, which are intended to be used. In the document "Soil module" is stated that: "Measurement of particle size distribution by the pipette method are only needed on new sites". We stress that in the former sampled sites (2009 e 2015) only the topsoil (up to 20 cm depth) was subjected to analysis. The limits for the soil particle size classes should be clearly specified. Also, we may emphasize that Laser diffractometry or x-ray absorption techniques show some limitations when applied in soils with coarse or medium texture.

4 – The proposed methodology foresees that sampling includes the "**topsoil**" and the "**subsoil**". We presume that "**topsoil"** corresponds to the layer up to 30 cm depth, and that "**subsoil**" is assumed as the layer between 30 and 100 cm depth. It should be emphasized that in our national conditions, soils in some cases may only show the so-called "**topsoil**", and "**subsoil**" can frequently show a depth less than 100 cm.

Another issue should be clarified: is if the "**subsoil**" only corresponds to soil horizons or also includes the non-compacted soil parent material, the so-called C horizon? In our conditions, the effective soil depth (rooting depth) is mostly associated with the soil parent material (C horizon), either in soils developed on sedimentary formations or developed on eruptive or metamorphic formations.

Frequently, some measurements or samplings, mainly the soil bulk density may be strongly affected by the soil stoniness!

As undisturbed samples will also be collected to measure bulk density, it could also be useful to take 3 to 5 undisturbed soil samples in some layers (i. e., 0-30 cm, 30-50 cm and 50-70 cm) to obtain water retention curves (complete curves or at least total porosity and soil moisture at -10kPa, -33kPa and -1500 kPa), in each sampled horizon/layer.

5 – The detailed study foreseen for soil profiles corresponding to 5% of the monitoring sites is of great interest for the meaning and reference of different values of soil parameters measurements. Indeed, such study match (at least partially) the needs associated with the reorganization and updating of soil mapping in Portugal at a scale lower than 1:500 000, following the strategy and orientations regarding the Pillar 4 of the Global Soil Partnership, from FAO. In this context, it is necessary to know if those profiles correspond to soil units formerly delimitated and typified within the available soil mapping at the country scale or can correspond to the integration of new information aiming the improvement of the soil mapping basis to be provided to end-users.

It is considered very useful that the soil profile characterization can be based on a sampling according to the differentiation of soil horizons or layers, in parallel with the sampling based on the pre-established soil depths.

6 – The sampling up to 30 and between 30 and 100 cm depth have the good advantage to allow the integration of information regarding soil organic carbon content, matching with the needs to establish the reference of soil organic carbon "stock" in the country. Therefore, soil bulk density should be measured at the same sites as organic carbon for accurate carbon stock calculations.

In a meeting in the ICNF (with APA members) to define the reference terms for the evaluation of organic carbon stock, from the permanent plots associated with the forestry inventory, it has been established that such evaluation should take into account the 0-10 and 10-30 cm soil layers and, if possible, the 30-100 cm layer. Also, it

was considered pertinent the use of information obtained in the context of LUCAS 2009 and LUCAS 2015, although recognizing the lack of an exact correspondence for the considered soil depths.

7 – It is not evident if the assumed depth intervals for sampling in monitoring sites are the same for the soil profiles. In the case of soil profile characterization, sampling could be systematically done according to pre-established soil depths and simultaneously according soil horizons separation, following standard methodology.

Although agreeing with the monitoring programme goals, we emphasize that the intended sampling intervals (implying an enormous effort for sampling and analysis) may be far too difficult to manage, considering available information so far. The sampling programme could be alleviated, considering for example intervals of 10 cm down to 30 cm depth, and three intervals (30-50, 50-70 and 70-100 cm) in the profile layer between 30 and 100 cm. These layers could eventually represent greater matching with the soil profile horizon differentiation.

8 – Electric conductivity measurement in the suspension for pH measurement is obviously simple and cheap. However, it is necessary to know its correlation with the EC values measured in the extract of a soil saturation paste (standard methodology), which is indispensable for a rigorous assessment on the monitoring of status and risks of soil salinization (in our opinion, the EC measurement in the soil saturation paste should be assumed as the reference methodological approach). Therefore, the methodology regarding EC measurement should be clearly specified.

9 – The evaluation of soil resistance to penetration could be performed by using a penetrometer (static or dynamic), which allow registration of resistance variation along soil depth, and therefore the soil compaction. This evaluation needs to be based on the measurements of soil bulk density and soil moisture, as well as on soil texture. Such determinations should take into account the variability of soil moisture content in the different regions of the country and the possible occurrence of extreme meteorological events. Besides the soil type and characteristics, soil resistance to penetration depends on too many factors (like for example the hydrological year regime and management practices). We are not sure about the interest of a single measurement and how can we compare the results even in similar soils. The methodology should be clearly specified and the soil depth subjected to measurement (top soil or up to 100 cm depth?) identified.

In our opinion, it could be useful to assess soil aggregation stability index (using a standard technique) which could be linked to soil organic matter status and soil biological conditions. It could be an index for soil quality and resistance to degradation, especially in regions under desertification risks.

10 – We are aware that the methodology expected to be used for soil moisture and bulk density measurements is not sufficiently specified; for instance, measurement of soil bulk density (in large areas of Portugal) mostly is strongly dependent and affected by soil stoniness. In this context, seems to be necessary a clarification on the sampling methodology in order to optimize sampling strategies and accuracy of measurements/determinations.

11 – It is of great interest the use of physical techniques (*laser diffractometry*, *NIRS,…*) for measurement of soil characteristics. The NIRS, for example, is of great interest for organic carbon measurement, and the envisaged sampling programme may be an opportunity for calibration purposes at different spatial scales. For such achievement is necessary to create a spectral data base of samples ("spectral library") to be used as reference for other techniques and model adjustment. Such "library" may constitute an information source for development of new pedotransfer functions. **[***in the aforementioned meeting in ICNF this technique was considered a tool of great utility to manage a large volume of organic carbon measurements***]**.

12 – The setting up and organization of a soil sampling "Library" should be taken into account. Samples from each country should be kept and conserved by one local institution assuming the responsibility of such purpose, allowing a future institutional use of them for several goals, such as research and method calibration.

13 – In the draft under analysis it is not expressed and clearly identified the dissemination strategy regarding "LUCAS 2018" products, as well as the universe of users at national level. The dissemination strategy will be the same followed for the former as "LUCAS 2009" e "LUCAS 2015" operations?

Lisbon, 21th February 2016

The Technic-Cientific Panel from the Portuguese Soil Partnership