

18th ICP Forests Expert Panel on Foliage and Litterfall

The 18th ICP Forests Expert Panel on Foliage & Litterfall meeting took place on 30th March 2023 online and in Vienna, Austria.

Minutes

The chair Pasi Rautio and the co-chair Liisa Ukonmaanaho opened the meeting

Expert panel (EP) members gave presentations about the ongoing European foliar and litterfall data assessments.

1. Pasi Rautio gave an overview of ongoing activities in the EP Foliage & Litterfall. Pasi presented the background for the foliage part in the Ecological Studies Book (ESB), where the EP has been involved in the articles by Mathieu Jonard et al. in 2015 and Ulrike Talkner et al. in 2015, as well as in the chapter in the WGE Trends report in 2015. Pasi also presented some background to the selection of years to be included in the ESB on the basis of monitoring activities in different countries especially in the early 1990's. Other points to discuss was the unsynchronized sampling in even vs. uneven years in the beginning of the programme. Also, the sampling of the European wide Level I sampling in 1995 was discussed.
2. Liisa Ukonmaanaho gave an overview of the current work status of the litterfall ESB core group. Most of the data that can be used for the ESB analysis is from the period 2009 – 2019. However, there are still a lot of errors in the database, that have to be addressed.
3. Radek Novotný presented time series of nutrition levels for foliage and litterfall on Czech Level II Plots. For spruce, pine and beech, foliar phosphorous concentration decreased over time with longest time series dating back until 1995. Concentrations of other nutrients (nitrogen, magnesium, calcium, potassium) fluctuated with some differences between highlands (> 800 m a.s.l.) and lowlands. The amount of litterfall fluctuated with climatic conditions (mainly temperature, air humidity and precipitation over the growing season) and mast years.
4. Lena Wohlgemuth presented preliminary results of foliage trend analysis for the ESB. Linear mixed model outputs revealed, that most trends of foliar nutrient concentrations (N, P, S, Ca, Mg, K) follow corresponding trends of ICP Forests data until 2009 found by Mathieu Jonard et al.. There are a few exceptions, where concentration time series do not follow the same trends up to 2009, which will be interesting to investigate. The trend analysis for the ESB foliage chapter is still at an early stage. Pending tasks include foliage data quality control and integrating a corrected ICP Forests dataset with foliage data until 2009 into the ICP Forests database.
5. Till Kirchner presented database developments in the Foliage Survey focusing on the following main topics:
Foliage Level I Survey: The Data Unit of the PCC implemented the Foliage Level I

Survey (F1) two years ago. The Structure of F1 is identical to the Level II Survey (F0). Data in F0 had been identified as Level I by comparing coordinates and was transferred to F1. An additional Level I dataset (with data until 1998) is included in the “adds” folder of F1 and was previously stored at the Forest Foliar Co-ordinating Centre at BFW. The question was raised how many EP members knew about the possibility to submit to F1, to which only a few EPM participants responded positively. This is why, information on F1 will be included in an email to be sent to all partners.

Existing ICP Forests foliage dataset outside of the database: Pasi Rautio has a foliage dataset with ICP Forests data until 2009, that includes corrections provided by partners. The PCC compared this external dataset to the contents of the database, but found that 50% of data in the database has been resubmitted and a lot of data does not match the external dataset. The PCC Data Unit plans to implement corrections of data, that has not been resubmitted, into the database. The goal is to avoid any shadow database such that all data can be obtained centrally from the official ICP Forests database for any foliage analysis.

Structural issues of the Litterfall Survey in the ICP Forests Database:

- a) The PCC had been informed by one partner that there are missing sample (sub-) categories for the case that different litterfall fractions were pooled to one sample (e.g. fruits and twigs). A possible solution to this problem could be to introduce more samples categories. The PCC would like to know if this problem affects other partners as well and will send around a survey on this topic to all partners.
- b) The descriptions of fractions 14.1 (fruiting/seeds) and 14.2 (fruit capsules) call for a separation of seeds and capsules. However, in the case of deciduous tree species (particularly oak), it is not always possible to separate nuts from cupulas, because in some cases the nuts may be tightly attached to a cupula even after drying. The PCC and the ESB core group tries to come up with a viable solution to this problem like introducing a new litterfall fraction and welcomes all suggestions on this issue.
- c) Before 2010, the sample code for the foliar litterfall fraction was 11.0 for both main and other tree species, which is why these samples cannot be distinguished for tree species and crucial information is lost. The solution was suggested to ask partners to resubmit their data of foliar litterfall fractions before 2010. Where this is not possible, a new code will be introduced: 11.9 – species mixture unknown.
- d) It is unclear if a foliar litterfall sample of code 11.0 should be allowed to be submitted along with 11.1 and 11.2 for the same collection period. Since the sum of 11.1 and 11.2 should equal 11.0, there will be redundant information if all codes exist in the dataset for the same collection period, which makes data analysis sensitive to errors. For this reason, a database test is planned to be implemented to deprecate submission of all three codes 11.0, 11.1, 11.2 for the same collection period.
- e) The question was raised if a new attribute should be introduced to the lfm file with a code specifying how the dry weight of sample 11.0 was evaluated (“c” – calculated as sum of dry weight 11.1 and 11.2; “m” – measured in the lab; “u” – unknown). As co-existing samples 11.0, 11.1, 11.2 are deprecated for the same collection period in future data submissions (see previous issue), this could potentially provide relevant information on the nature of the 11.0 sample. However, it is currently unclear how big differences tend to be between calculated and measured dry weights. This question will be included into a survey to be sent to partners.
- f) The sample codes 16.0 (twigs/branches (< 2 cm)) and 19.0 (other biomass (lichen, moss etc.)) are difficult/impossible to sort by tree species on mixed plots. For mixed plots tree species should be set to -9.

- g) The description of code sample 19.0 is currently imprecise and will be changed from “other biomass (lichens/moss)” to “other leftover biomass (lichens/moss)” in the manual and the online documentation.
 - h) Since the start of the survey, there has hardly been any data submitted for fraction 17, “fines and frass (< 1 mm)”, so the question was raised if this sample category should be removed and integrated into category 19.0, which was denied by the audience.
 - i) The database has to be harmonized for litterfall nutrient values that had been derived from samples pooled over multiple collection periods, for which individual dry weight values exist. The information on nutrient values, that had been measured in a pooled sample over time is given in the lfm attribute “pooled” (y/n). In the case of pooled = y (i.e. nutrients were measured in a pooled sample over time), nutrient values should be repeated for each sample entry, for which a dry weight value is available for an individual collection period. This data structure was not followed by all partners in the past. The PCC plans to (re-)structure existing litterfall data accordingly and will contact partners if problems come up. In the discussion following this issue, the PCC perceived that the attribute term “pooled” requires cautious documentation to make absolutely clear that this variable describes values pooled over time (multiple collection periods) and not over multiple litter traps. A new explanatory item will be added to the database online documentation to describe the data structure and provide additional clarity on the “pooled” attribute.
 - j) The PCC proposes to refine the description of the trap_id attribute in lfm from “unique number of the trap...” to “unique id of the trap...” to avoid any potential misinterpretation with the term “number” being perceived as an amount. Unfortunately, the confusion of id with number of litter traps is a frequent data error in the litterfall survey.
 - k) The last date of one litterfall collection period has to coincide with the first date of the subsequent collection period in order to harmonize the litterfall data structure with the deposition survey. Accordingly, the PCC will add a description to the database online documentation.
6. Anita Nussbaumer presented a calculation procedure, that she developed for computing aggregated annual dry weight and nutrient values for foliar litterfall, total litterfall and fruiting/seeds for the purpose of the ESB analysis. The data aggregation is performed for *Fagus sylvatica*, *Quercus petraea* and *robur*, *Picea abies*, *Pinus sylvestris* and mixed stands with the afore mentioned species. (There might be enough data to also perform analysis for *Abies alba* and the Mediterranean oaks (*Quercus cerris*, *Q. frainetto*, *Q. pubescens*, *Q. pyrenaica*)). The aggregation is done for the fractions foliar litterfall, total litterfall and fruits/seeds, the latter only for deciduous species as cones in litterfall do not reliably represent the amount of fruits in a given year. The first step is to group the correct subfractions into the three fractions to be studied. This revealed the complexity of the data structure as already mentioned under point 5. The second step consists in the temporal aggregation. For this, the collection periods a) are cut so that they do not overlap monthly boundaries, b) are aggregated to monthly values, and c) are aggregated to (vegetation or calendar) years.
7. Lena Wohlgemuth presented a collection of specific litterfall dataset issues. Common errors in the litterfall survey involve e.g. overlapping collection periods, wrong attribution of main and other tree species, confusion of trap ids and number of traps and other problems. Furthermore, the ESB core team detected conspicuous peaks and dips of annual litterfall time series in the course of data analysis for the ESB. It is not always clear if

these peaks and dips represent erroneous outliers or true values. The PCC will send individual lists with dataset issues to all partners along with graphics of time series, so that partners can propose problem solutions, know which data(sub-)sets to resubmit and explain outliers.

8. Anita Nussbaumer introduced an opportunity for partners to get involved in a project on litterfall masting breakdown in beech by Andrew Hacket-Pain et al. from the University of Liverpool et al. They found that in the last 10 years on British beech sites beech mast events show lower annual synchrony and variability as well as fewer failure years. They are interested to spatially extend their study and are therefore looking for litterfall fruiting datasets which include at least 15 years. If you are willing to contribute please get in contact with Andrew Hacket-Pain directly (andrew.hacket-pain@liverpool.ac.uk). They further are looking for any masting data on any species and temporal and spatial range to enhance their database MASTTREE+. (Hacket-Pain, A., Foest, J. J., Pearse, I. S., LaMontagne, J. M., Koenig, W. D., Vacchiano, G., Bogdziewicz, M. et al. (2022). MASTTREE+: Time-series of plant reproductive effort from six continents. *Global Change Biology*, 28, 3066– 3082. <https://doi.org/10.1111/gcb.16130>)

9. Organizational issues and other business:

The chair Pasi Rautio informed members that he and the co-chair Liisa Ukonmaanaho are planning to step down from their positions at some point in the near future. Any expert who is interested to take over the position as chair or co-chair can get in touch with Pasi or the PCC to allow a smooth transition and knowledge transfer to coming chairs of the EP.

The chair Pasi Rautio closed the meeting.

The Expert Panel wants to warmly thank the organizers at BFW for their efforts to make this meeting possible.

Presentations of this meeting are available for registered users of a shared Nextcloud folder hosted by the PCC. To get access contact lena.wohlgemuth@thuenen.de.