

**EUROPEAN FOREST INSTITUTE**

**Grant submission guidelines**

**G-05-2024**

**Pilots of long-term climate impact forest monitoring sites:**

**Linking stand-level information and remote sensing**

## 1. ACTIVITY TO BE SUPPORTED BY THE GRANT

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### Introduction

European forests cover more than 1/3 of the land area and play a vital role in Europe's environment, economy, and society. Forests provide many benefits to society regarding climate regulation, raw materials, habitats for biodiversity, and many other services. Climate change is a significant challenge for European forests, as demonstrated by recent heat waves, extended drought periods and disturbances (storms, wildfires, insect outbreaks). Climate change may lead to shifts in tree species ranges, changes in forest productivity, tree mortality and increased disturbance damage. Hence, it is essential to assess the extent of the impact of ongoing climate change on the functioning of trees and forests.

Forest inventories are essential to assess the impact of climate change on forests over longer time periods. Past and recent changes in forest structures and functioning can be analysed with data from large long-term forest monitoring programs such as ICP Forests<sup>1</sup>, the national forest inventory (NFI) networks<sup>2,3</sup> or - in parts - networks such as ICOS<sup>4</sup> and LTER<sup>5</sup>. For example, the ICP Forests network with a high number and broad spatial coverage of plots, where many tree-related parameters are measured with yearly or sub-yearly resolution, is a perfect basis for such assessments. However, when these monitoring sites were established, they focused mainly on assessing the impact of air pollution. They were initially not meant to be linked to remote sensing (RS) information, which can also be critical to understanding the effects of climate change, including extreme events on the European scale. The same is also true for other forest monitoring networks.

With this call, we thus aim to increase the potential of forest monitoring sites, such as ICP Forests sites, to assess the impact of climate and climatic extremes on trees and forests by linking their ground-based assessments with remote sensing.

### Objectives and outcomes

FORWARDS is a Horizon Europe project that will prototype the ForestWard Observatory, a pan-European monitoring and evaluation tool that will help demonstrate climate change's impact on forests, guiding decision-making for practical forest management. As part of its activities, FORWARDS will establish a network of pilot monitoring plots/sites to assess the long-term impact of climate change on forest ecosystems. These pilot plots/sites must be linked to existing forest monitoring networks and provide spatial representativeness, as explained below.

The call for “pilots of long-term climate impact forest monitoring sites – (a) Linking stand-level information and remote sensing” is closely linked to work package 2 of FORWARDS, which is implementing drone- and aircraft-based proximate sensing to study tree and forest structure and function. The significant advantage of this approach is the high spatial resolution of the overhead imagery that can be directly linked to tree-level, ground-based assessments on the one hand and satellite products on the other. Tree and forest functional traits can be captured on the tree and stand scale with multi- and hyperspectral sensors, and detailed individual tree-matched ground truthing can be performed. Thus, a direct relationship between ground measurements and comparable information from satellite-based remote sensing (RS) (though with higher spatial resolution) makes such high-resolution proximate sensing a central technique for linking classical ground-based monitoring with RS.

The primary aim of this call for grants is to support activities engaging in linking ground-based information to remotely sensed data. Results and data from these measurements will contribute to the Europe-wide

ForestWard Observatory. Thus, the funded projects must allow for integrating the data and the results generated into the broader scope of WP2 of FORWARDS as described above.

### Supported projects and activities

Successful grant applications (and supported projects) must include activities that strengthen the linkage of ground-based monitoring information with satellite imagery for European forest monitoring.

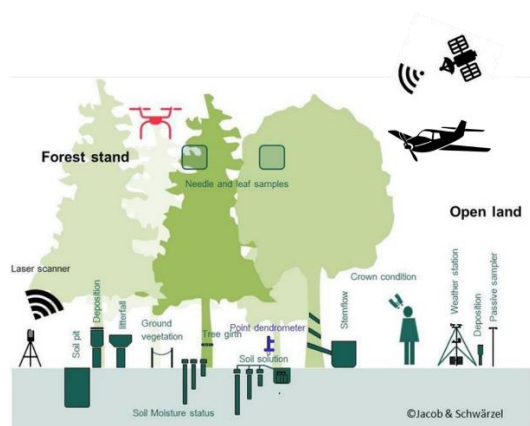
The projects supported by these grants are encouraged to follow the methods detailed below to provide information with novel and improved measurements and sensors to enable the validation and scaling of forest functional variables from the leaf to the tree-, plot- and landscape-level to link plot-level information and remote sensing products

Data and results from the supported activities must be available for open access at the latest upon project completion, and feed into the ForestWard Observatory that is being developed by the FORWARDS project.

The projects are expected to carry out aircraft-based **imaging spectroscopy flights** and **related physiology and biochemistry ground-truthing** (see details below).

### Guidance on approach and methods

One of the major aims of FORWARDS is to link ground-based assessments of trees and forests with information from remote sensing on the one hand and to develop a stress now-casting network on the other hand. To link ground-based information to remote sensing, sites selected for remote sensing assessments need to provide (a) direct ground-truthing measurements temporally linked to the remote sensing assessments and (b) focus on sites that have long-term monitoring information and (c) cover several forest regions of Europe. This can be achieved by assessing several sites in different biogeographical regions with different forest types. Moreover, proposals should consider the inclusion of **long-term monitoring sites where many different data are acquired**. Such forest monitoring sites with multiple information layers measured on the ground and for capturing canopy dynamics and water and carbon cycling with high temporal resolution and near-real-time data delivery will be the basis for the linkage with remote sensing (Figure 1). Highly equipped forest monitoring sites (e.g. long-term growth measurements, soil water availability, nutrient availability), where additional high temporal resolution tree functioning measurements (point dendrometers or eddy covariance) are carried out, are typical supersites that should be taken into account.



**Fig 1:** Highly equipped forest monitoring sites that are suggested to be used for the linkage between ground based and remotely sensed assessments.

To link ground assessments and remote sensing information of high spatial resolution (cm to m), successful projects are asked to arrange the acquisition of hyperspectral imagery from crewed aircraft from which continuous reflectance spectra and reflectance indices providing information on forest function can be obtained. During the remote sensing hyperspectral data acquisition, additional targeted ground-truthing for linking hyperspectral information to forest functioning (e.g., leaf sampling for pigment assessments chlorophyll fluorescence measurements) will be necessary.

Remote sensing of leaf/canopy reflectance information allows estimation of tree functional traits linked with forest health, acclimation and adaptation. Spectroscopy (i.e., reflectance acquired in many narrow continuous bands) can derive foliar biochemistry information through narrow spectral indices or machine learning modelling approaches. Among the most crucial foliar chemical constituents informing about tree function are element concentrations linked with the nutritional status of trees and pigments associated with the regulation of photosynthesis and photoprotection. Detection of changes in photosynthetic pigments via close-range remote sensing thus allows crown-specific assessments of tree stress responses along a stress severity axis, going from early *pre-visual* vulnerability symptoms (e.g., downregulation of photosynthesis) to visible damage (e.g., leaf discolouration and defoliation). This focus aims at linking and scaling foliar nutritional status and stress symptoms assessed at the leaf level to the tree, plot and landscape level using airborne imaging spectroscopy coupled with georeferenced ground-truthing information at highly equipped forest monitoring sites (see Fig. 1) and additional (less equipped) supporting sites (e.g., ICP Forests Level I sites).

The project should cover:

- ❑ **Imaging spectroscopy flights** of at least two sites that qualify for supersites in different biogeographical regions with different forest types are recommended to be carried out in 2025 during mid to late summer (peak greenness) via aircraft
- ❑ **Physiology and biochemistry ground-truthing**, consisting of measurement and sampling of foliar material simultaneously (i.e., on the same day or close in time under similar conditions) with imaging flights for at least the supersites. Leaf samples are intended for pigment analysis, ideally including Xanthophylls. At the same time, measurements could include chlorophyll fluorescence, gas exchange, leaf water potential and stationary continuous or contact measurements of reflectance spectra or indices, which will provide additional value to the aircraft-based information.

To acquire consistent information, the following data collection process is suggested:

- Coordinate and support imaging spectroscopy flights to be conducted by an airborne data provider in the frame of the FORWARDS project. The provider should conduct imaging data acquisition and processing according to standardised procedures<sup>1</sup> so that different sites and regions can be compared. Successful applicants/projects are recommended to equip their sites with portable radiometric targets (e.g., tarps) before an overflight needed for data radiometric calibration and validation.
- Imaging flights are typically performed under clear-sky conditions to reach optimal data quality. This means that in some cases, the exact overfly day for a particular geographic region can only be set a few days in advance due to uncertainties in weather patterns, requiring flexibility from the ground teams.

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<sup>1</sup> EUFAR Good Practice Protocols: <https://www.eufar.net/cms/good-practices/>

- Successful applicants/projects are recommended to conduct foliar sampling and analysis for biochemistry ground-truthing according to ICP Level II protocols for foliar chemistry (see Part XII Sampling and analysis of needles and leaves, <http://icp-forests.net/page/icp-forests-manual>) and protocols for photosynthetic pigments (chlorophyll, carotenoids, xanthophylls) analysis as detailed in D'Odorico et al. (2021)<sup>9</sup>.
- Additional measurements on the days of flight (e.g., crown defoliation assessments, drone-based imaging, leaf-level photosynthesis and reflectance, and other foliar constituents) are encouraged, as well as measurements on additional surrounding sites (e.g., ICP Forests Level I sites) included in the flight line.
- The FORWARDS partner at WSL can provide central coordination of activities by grantees across Europe.

### **Available funding**

Proposals can request a contribution of max. 145,000 euro, which will allow to link ground and remotely sensed information at several sites.

A maximum of two projects will be funded under this call.

Projects are expected to start in April 2025 and last a maximum of 18 months. The activities must be completed at the latest by October 2026.

To ensure that all European regions are covered, proposals must indicate the European and biogeographic<sup>2</sup> region(s) targeted by the project. European regions follow country groups as defined by Forest Europe in its State of Europe's Forests reports<sup>3</sup>.

- Lot 1: North Europe, Central-East Europe and South-East Europe
- Lot 2: Central West and South West Europe.

Projects must include multiple biogeographical regions.

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<sup>2</sup> <https://www.eea.europa.eu/data-and-maps/figures/biogeographical-regions-in-europe-2>

<sup>3</sup> [https://foresteurope.org/wp-content/uploads/2016/08/SoEF\\_2020.pdf](https://foresteurope.org/wp-content/uploads/2016/08/SoEF_2020.pdf)

## References

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- 1 George, J.-P. *et al.* Long-term forest monitoring reveals constant mortality rise in European forests. *Plant Biology* **24**, 1108-1119, doi:<https://doi.org/10.1111/plb.13469> (2022).
- 2 Bontemps, J.-D., Bouriaud, O., Vega, C. & Bouriaud, L. Offering the appetite for the monitoring of European forests a diversified diet. *Annals of Forest Science* **79**, 19, doi:10.1186/s13595-022-01139-7 (2022).
- 3 Yu, Y. *et al.* Making the US national forest inventory spatially contiguous and temporally consistent. *Environmental Research Letters* **17**, 065002, doi:10.1088/1748-9326/ac6b47 (2022).
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- 5 Holmberg, M. *et al.* Modelling study of soil C, N and pH response to air pollution and climate change using European LTER site observations. *Science of The Total Environment* **640-641**, 387-399, doi:<https://doi.org/10.1016/j.scitotenv.2018.05.299> (2018).
- 6 Zweifel, R. *et al.* Networking the forest infrastructure towards near real-time monitoring – A white paper. *Science of The Total Environment* **872**, 162167, doi:<https://doi.org/10.1016/j.scitotenv.2023.162167> (2023).
- 7 Wilkinson, M. D. *et al.* The FAIR Guiding Principles for scientific data management and stewardship. *Scientific Data* **3**, 160018, doi:10.1038/sdata.2016.18 (2016).
- 8 Zweifel, R. *et al.* TreeNet–The Biological Drought and Growth Indicator Network. *Frontiers in Forests and Global Change* **4**, doi:10.3389/ffgc.2021.776905 (2021).
- 9 D'Odorico, P. *et al.* Drone-based physiological index reveals long-term acclimation and drought stress responses in trees. *Plant, Cell & Environment* **44**, 3552-3570, doi:<https://doi.org/10.1111/pce.14177> (2021).

## 2. QUESTIONS

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Questions regarding the grant process must only be sent to the following address:

[forwards@efi.int](mailto:forwards@efi.int)

Questions can be sent until:

16 October 2024

Questions and answers for this grant process will be published at <https://efi.int/grants-training/grants/G-05-2024>

The following schedule will be followed for the publication of the Questions and answers:

- Answers for questions received during the call launch -1 September 2024 will be published on 11 September 2024
- Answers for questions received during the period 2 September 2024 - 2 October 2024 will be published on 14 October 2024
- Answers for questions received during the period 3 October 2024 - 16 October 2024 will be published on 24 October 2024

Individual questions will not be replied to separately.

Potential applicants are advised to visit <https://efi.int/grants-training/grants/G-05-2024> regularly before the deadline for the submission of applications for any Q&A, and updates or modifications regarding this grant process.

## 3. ELIGIBILITY CRITERIA

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Grant applications can be submitted by one legal entity or a consortium of legal entities.

Applicants must, by the deadline for submission of the Application, meet the following criteria to be eligible for the grant:

Criteria	Description of criteria	Clarification
E1	Applicant is a legal entity (legal person)	If the application is submitted by a consortium (grouping of legal persons represented by a coordinator), this criterion applies to all the participants This call is not open for applications from natural persons
E2	Applicant eligible for funding under the European Union Horizon Europe Research and Innovation Program	If the application is submitted by a consortium, this criterion applies to all the participants

Applications not fulfilling the above stated eligibility criteria will be rejected.

Furthermore, the following legal entities (legal persons) will not be eligible for funding:

- Beneficiary or associated partner of the FORWARDS project under the Grant Agreement No. 101084481
- Entities subject European Union restrictive measures

- Israeli entities due to activities in the territories occupied by Israel (European Commission Guidelines No 2013/C 205/05)
- Public interest trusts established under the Hungarian Act IX of 2021 or any entity maintained by such a public interest trust (Council Implementing Decision 2022/2506)

#### 4. ADMISSIBILITY REQUIREMENTS

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All applications shall apply the following structure:

- I. Administrative information
  - i) Application Form - Part A, using template provided in annex 1
- II. Technical Description
  - i) Application Form - Part B, following Template annex 2
  - ii) The length of the technical description must not exceed 12 pages and shall be submitted in one single PDF document (this does not include the instructions and guidance provided in annex 2).
  - iii) Technical Description must be written in English

Formatting rules for the documentation under subsections I. and II.

- Font: Calibri
- Minimum font size: 11 pt (except for tables and figures where it should be minimum 10 pt)
- Line spacing: 1
- Orientation: Portrait. For the tables or any Gantt/pert chart, landscape orientation can be used if necessary for the purpose of fitting of the tables or for legibility.
- Page size and margins: Page size A4, all margins (top, bottom, left, right) should be at least 2 cm (not including any footers or headers)

*All the documentation must be submitted in PDF format (Two separate pdfs for I. Administrative information and II. Technical Description).*

What procedures to follow for applying:

Grant application shall only be submitted by the applicant (coordinator as applicable) to:

[grants@efi.int](mailto:grants@efi.int)

Please note that it is not allowed to send the email to another recipient (i.e. not in the To: field, the cc: field, or the bcc: field)

The email with the application shall contain only the following heading in the subject line:

G-05-2024, Pilots of long-term climate impact forest monitoring sites: Linking stand-level information and remote sensing

The grant application must have been received by EFI by the following deadline at the latest:

31 October 2024 at 21:00 UTC

#### 5. AWARD CRITERIA

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Criteria that will be applied for awarding of the grant:

<b>A1</b>	<b>Excellence</b>	<ul style="list-style-type: none"> <li>▪ Clarity and relevance of the objectives in relation to the call topic.</li> <li>▪ Soundness of the proposed methodology, including the underlying concepts and assumptions.</li> </ul>
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		<ul style="list-style-type: none"> <li>▪ Spatial design that considers representativeness and scalability</li> </ul>
<b>A2</b>	<b>Implementation</b>	<ul style="list-style-type: none"> <li>▪ Quality, coherence, and effectiveness of the work plan, including extent to which the resources and tasks assigned are in line with the objectives of the activities.</li> <li>▪ Complementarity of the participants and extent to which the consortium brings together the necessary expertise.</li> <li>▪ Appropriateness of risk management.</li> </ul>

Applications will receive a score of 0-5 for each criterion. Scores can be given in half points.

Applications must receive a score of at least 3.5 points in each of the categories A1 and A2 to be considered for a grant award and a total score of at least 8 points overall.

Applications are assigned into two lots according to region in which the project is implemented: North Europe, Central-East Europe and South-East Europe (Lot 1), Central West and South West Europe (Lot 2).

Subject to applications meeting or exceeding the thresholds, one grant will be awarded in each of the lots: the application receiving the highest total score A1 + A2.

In case of equal scores within a lot, the following will apply: applications will be prioritised according to score under criteria A1 and then A2. In case of equal scores under A1 and A2, applications will be prioritised according to gender balance with respect of the personnel that will primarily carry out the tasks in the project.

Should, if no application within a lot meets or exceeds the minimum threshold, overall call budget be available, the highest ranked application not selected for award of a grant will be selected (regardless of lot), and so forth, until overall call budget is no longer available.

## **6. GRANT DISBURSEMENT**

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EFI will disburse the grant in lump sum instalments (fixed sums):

- 35% entry into force of the grant agreement
- 25% upon approval of the interim technical report
- 40% upon approval of the final technical report

## **7. GRANT AGREEMENT**

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Template grant agreement is provided as annex 3.

Please note that the Grant Agreement is only signed by EFI and the successful Applicant(s) (all Participating organizations) following decision by EFI on award of the Grant(s).

## **8. NEGOTIATION PHASE**

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In respect of applications selected for funding, further documentation to validate the legal and financial capacity of the Applicant, provided by and signed by the Applicant, may be required before EFI can sign the grant agreement – as further instructed by EFI. If the requested documentation is not submitted within deadline set by EFI, EFI may in a new decision reject the application.

## 9. TERMS AND CONDITIONS FOR SUBMISSION OF AN APPLICATION

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- 9.1 In addition to what has been stated in the Call for grant and these Grant submission guidelines, EFI applies the EFI Grant rules which have been made available at <https://efi.int/grants-training/grants/efi-grant-rules>
- 9.2 By submitting an application for a grant, the applicant accepts all the terms and conditions set out in the Call for grant and these Grant submission guidelines (including its annexes) and waives all other terms.
- 9.3 EFI may reject an application that is not in compliance with the instructions in the Call for grant or the Grant submission guidelines.
- 9.4 No information communicated in this grant process, including the Call for grant and these Grant submission guidelines (including its annexes), bind EFI in any way to an award or a grant agreement. EFI shall only be bound by written grant agreements.
- 9.5 An applicant must be able to prove to the satisfaction of EFI, any information given as part of its application. Failure to do so, within a time limit set by EFI, may result in rejection of the application.
- 9.6 EFI may ask the applicant for clarifications regarding any information submitted as part of the application. EFI may reject any applicant from the grant process that fails to submit the requested clarification.
- 9.7 Only applications sent to [grants@efi.int](mailto:grants@efi.int) will be considered.
- 9.8 Applications submitted after the deadline for submission will not be considered.
- 9.9 An Applicant may only submit one application. In case of multiple applications from the same economic operator EFI will only consider the last one received.
- 9.10 Withdrawal of an application shall be done in writing.
- 9.11 Information provided by the applicants cannot be considered confidential, unless so designated by EFI
- 9.12 All applications shall be quoted in Euros.
- 9.13 Expenses incurred in the preparation and dispatch of an application will not be reimbursed by EFI.
- 9.14 Applications must be legible. EFI may reject applications that are not legible.
- 9.15 EFI will disregard any information given by an Applicant outside the format for submission as stated in the Call for Grant or Grant submission guidelines.
- 9.16 The application shall be complete when submitted. EFI will disregard additional documentation or information submitted separately from the application, where not requested by EFI.
- 9.17 EFI may at its own discretion disclose the contents of any application, as well as information on the Beneficiary awarded the grant as well as any other information of the grant awarded.
- 9.18 Unless otherwise stated in the Call for grant and these Grant submission guidelines, the Application and all correspondence related to it shall be in English. EFI retains the right to correspond in English with the Applicant even if the application may be submitted in a language other than English.
- 9.19 Applicants are not entitled to contact EFI staff members, or any other person referred to in the EFI grant rules after the closing date of the receipt of applications to ask for information on the evaluation. EFI may eliminate from the evaluation any Applicant contravening this provision.

### ANNEXES

- Annex 1: Application Form Part A
- Annex 2: Application Form Part B
- Annex 3: Grant Agreement Template