**Contract for the Open access to the FLIS Infrastructure**

**2407**

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**User**

|  |  |
| --- | --- |
| Name | **Swiss Federal Institute for Forest, Snow and Landscape Research WSL , hereinafter “the User”** |
| Registered office | Zürcherstr. 111, 8903 Birmensdorf, Switzerland |
| VAT No. | CHE-116.133.452 MWST |
| Represented by | Prof. Dr. Arthur Gessler (PI) and Dr. Christoph Hegg (Acting Director) |

**And**

**Provider**

|  |  |  |  |
| --- | --- | --- | --- |
| Name | **Ústav výzkumu globální změny AV ČR, v. v. i. (Global Change Research Institute CAS), hereinafter “the Provider”** | | |
| Registered office | Bělidla 986/4a, 603 00 Brno, Czech Republic | | |
| ID No. | 86652079 | VAT No. | CZ86652079 |
| Registered in | Register of Public Research Institutes | | |
| Represented by | Prof. RNDr. Ing. Michal V. Marek, DrSc., dr. h. c., Director | | |

together hereinafter “the Parties”

Pursuant to Section 1746 (2) of the Civil Code, The User and the Provider conclude a contract as follows:

**Preamble**

* 1. The Provider has obtained funds from the Operational Programme of Research and Development for Innovations (hereinafter only as the “OP RDI”), Priority Axis 1 – European Centres of Excellence for Project Implementation CZ.1.05/1.1.00/02.0073, CzechGlobe – Centre for the Study of Global Climate Impact (hereinafter only as the “CG Project”).
  2. Using the funds of the OP RDI, the Provider, among other things, has purchased elements of specialised infrastructure. One element is FLIS – Flying laboratory of imaging systems (hereinafter only as the “FLIS”).
  3. The FLIS includes the following equipment: hyperspectral imaging spectroradiometers CASI 1500, SASI 600 and TASI 600, laser scanner Riegl Q780, air carrier Cessna C208B, and additional equipment required for data collection and processing (IMU/GNSS units, gyrostabilization platform, navigation system, etc.).
  4. According to Chapter 5.3 of the technical description of the CzechGlobe Project, the specialised infrastructure may be used at three basic levels: a) Open access, b) Project cooperation, and c) Cooperation in contractual research.
  5. The Provider has published an Open Access Call for Submitting Projects on its website. The User has submitted the project entitled “HyPlant Data Acquisition 2024 – WSL” (project) to the Provider. The Project forms an annex to this Contract.
  6. Due to the nature of the Provider (a legal entity governed by public law whose main purpose is research) and the User (a legal entity governed by public law whose main purpose is research and dissemination of knowledge) and due to the research nature of the Project, the Provider has decided to make the FLIS available for the Project purposes.
  7. CzechGlobe performs regular maintenance and repairs of the FLIS according to plans, conditions of the manufacturers of infrastructure elements, and as needed.

1. **Purpose and the Facility of the Contract**
   1. The purpose of the Contract is to use the FLIS for Open Access science and research needs.
   2. The facility of this Contract is the Provider’s obligation to provide access to the FLIS infrastructure, including its service. The facility of this Contract is the User’s obligation to provide the Provider with cooperation (e.g. in obtaining the necessary permits, etc.) and to comply with the conditions for handling the access outputs specified in this Contract.
   3. Under this Contract, flights of a total duration exceeding 15 hours may not be conducted.
   4. Under this contract, total duration of campaign (data acquisition for project purposes) exceeding 10 days may not be conducted.
2. **Financial Arrangements on the Access Costs**
   1. No price or remuneration shall be paid in return for the access to the infrastructure. The User shall pay only the direct costs of the access to the infrastructure according to the actual scope of access on the basis of the calculation units specified in Annex No. 1 hereto.
   2. The direct costs will be paid on the basis of an invoice.
   3. VAT at statutory rate will be added to the direct costs.
   4. Bank fees related to payments shall be paid by the User.
   5. The invoice shall comply with the requirements of a tax document; the maturity will be 30 days from the date of issuing the invoice.
3. **Access to the Infrastructure**
   1. The data will be collected between 20/05/2024 and 30/10/2024.
   2. The outcomes shall be accessible to both Parties by 31/10/2024 at the latest.
   3. The outcome means raw non-georeferenced data captured over the User’s interest area defined in the Project.
   4. The scope of the outcomes is determined in the Project.
   5. The minimum accuracy of the outcomes necessary to fulfil the purpose of this Contract is specified in the Project.
   6. The User shall receive the data in the form and quality in which they will be collected.
   7. The User will provide a co-pilot for acquisition flights at its own expense.
4. **Handling the Outcomes**
   1. The outcomes may only be used for scientific and teaching purposes. Under no circumstances may the outcomes be used for commercial use. Under no circumstances may the outcomes be used for the User’s economic activity.
   2. The outcomes may be further processed using any method.
   3. The User shall not publish the outcomes in a form allowing further processing.
   4. The User may transmit the outcomes to a third party within the scope of the licence referred to in paragraph 1 of this Article.
   5. If the User publishes the outputs, the User shall indicate that the outcomes were made owing to the Provider.
   6. Both the User and the Provider shall receive the outcomes.
5. **Representatives of the Parties**
   1. The Provider’s representative is xxxxxxxxxxxxx. This Provider’s representative may act on behalf of the Provider in association with this Contract, but may not modify or terminate the Contract.
   2. The main User’s representative is xxxxxxxxxxx. This User’s representative may act on behalf of the User in association with this Contract, but may not modify or terminate the Contract.
6. **Contractual Penalties and Liability for Damage**
   1. In association with the possible amount of potential future damage, the User acknowledges that the damage in association with unauthorized handling of the outcomes may reach up to twice the acquisition price of the FLIS.
   2. The aggregate liability of User shall in all cases be restricted to the amount paid by it under the Contract, however, it shall not in any event exceed fifty thousand euro (EUR 50,000). The parties shall not be liable for indirect or consequential damages or losses.
   3. The limitations of liability defined herein shall not apply when the damage is caused wilfully or by gross negligence.

The limitations of liability defined herein shall not apply when the damage is caused wilfully or by gross negligence.

1. **Contract Termination**
   1. The Contract may be terminated by written agreement.
   2. Unless the data are not collected by 31/10/2024 due to the unfavourable weather conditions, due to safety reasons, due to the aircraft/sensors failure, or failure to obtain the required permits, the Contract shall set aside in its entirety.
      1. The Contract may be terminated by withdrawal from the Contract. The withdrawal shall be made in writing and efficiently served onto the other Party. The Provider may withdraw from the Contract in the case of breach of the terms of this Contract.
      2. The User may withdraw from the Contract in cases stipulated by law.
2. **Common and Final Provisions**
   1. Neither Party may assign a claim or debt from this Contract or this Contract to a third party without the written consent of the other Party.
   2. Should any of the provisions of this Contract prove to be unenforceable (non-existent), this shall not affect the validity of the remaining provisions. The Parties are obliged to replace the unenforceable provision with a valid provision that best achieves the intended result.
   3. The Parties acknowledge that the Provider is subject to Czech law. The Parties hereby agree that nothing in this Contract or any of its attachments or references shall be deemed to require either Party to breach any mandatory statutory law under which each Party is operating. All discussions about the Work and its performance shall take place in English.
   4. This Contract may only be amended in writing, by means of a mutually signed numbered amendment to this Contract.
   5. The following annexes form an integral part of this Contract:
      * 1. Annex No. 1: Calculation Units for the Quantification of Direct Costs
        2. Annex No. 2: “HyPlant Data Acquisition 2024 – WSL”
   6. This Contract has been drawn up in 4 copies, out of which each Party shall receive 2 copies.
   7. The Parties agree unconditionally to the publication of the full wording of the Contract so that this Contract may be the subject of the information provided in accordance with Act No. 106/1999 Coll., on Free Access to Information, as amended, and Act No. 340/2015 Coll., on Special Conditions for the Effectiveness of Certain Contracts, Publication of these Contracts and on the Register of Contracts (Act on Register of Contracts), as amended
   8. The Parties hereby declare that prior to its signature, they have read the Contract and agree with its content without reservation. The Contract is an expression of their true, actual, free and serious will, in witness whereof the authorised representatives of the Parties attach their own signatures.
   9. This Contract becomes effective upon its publication in the Register of Contracts.

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| In Birmensdorf on 29 May 2024 | In Brno on |
|  |  |
| Prof. Dr. Arthur Gessler | Prof. RNDr. Ing. Michal V. Marek, DrSc., dr. h. c. |
| Head of Research Programme | Director |
| Dr. Christoph Hegg  Acting Director WSL | Global Change Research Institute AS CR, public research institute |

**Annex No. 1: Calculation Units for the Quantification of Direct Costs**

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| --- | --- | --- | --- |
|  | Unit price | Estimated number of units per OA | Estimated price per OA (excl. VAT) |
| **Aircraft lease and operation** |  |  |  |
| FLIS lease | 0 EUR | 12 | 0 EUR |
|  |  |  |  |
| **Direct operational costs** |  |  |  |
| Direct operational costs of the aircraft per 1 hour of flight | 1 750 EUR | 12 | 21 000 EUR |
| Direct operational costs of the aircraft crew per 1 day standby | 350 EUR | 5 | 1 750 EUR |
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|  |  |  |  |
|  |  |  |  |
| **Total estimated costs of Open Access** |  |  | **22 750 EUR** |

**Annex No. 2: Project of “HYPLANT DATA ACQUISITION 2024 – WSL: ASSESSMENT OF SOIL AND ATMOSPHERIC DROUGHT RESPONSES OD SCOTS PINE”**

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**Application Form for Flying Laboratory of Imaging Systems (FLIS)**

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| --- | --- |
| **Project title** (characterising the scope of application) | **HyPlant Data Acquisition 2024 – WSL: Assessment of soil and Atmospheric Drought Responses od Scots Pine** |
| **Project acronym** (optional) | ***ASAP*** |
| **Start date** (expected) | **20.05.2024** |
| **End date** (expected) | **30.10.2024** |

**Project leader**

|  |  |
| --- | --- |
| **Title** | xxxxxxxxxxxx |
| **First name** | xxxxxxxxxxxx |
| **Last name** | xxxxxxxxxxxx |
| **Job title** | Head of group and programme |
| **Organisation name** | WSL |
| **Department** | Forest Dynamics |
| **E-mail** | xxxxxxxxxxxx |
| **Phone number** | xxxxxxxxxxxx |
| **Address** | Zürcherstr. 111 |
| **City** | Birmensdorf |
| **Postal code** | 8903 |
| **Country** | Switzerland |
| **WWW** | [www.wsl.ch](http://www.wsl.ch) |

**Contact person for all correspondence (if different)**

|  |  |
| --- | --- |
| **Title** |  |
| **First name** |  |
| **Last name** |  |
| **Job title** |  |
| **Organisation name** |  |
| **Department** |  |
| **E-mail** |  |
| **Phone number** |  |
| **Address** |  |
| **City** |  |
| **Postal code** |  |
| **Country** |  |
| **WWW** |  |

**Collaborators (if different)**

|  |  |
| --- | --- |
| **Title** | xxxxxxxxxxxx. |
| **First name** | xxxxxxxxxxxx |
| **Last name** | xxxxxxxxxxxx |
| **Job title** | Professor |
| **Organisation name** | University of Toronto |
| **Department** | UTM Biology |
| **E-mail** | xxxxxxxxxxxx |
| **Phone number** | xxxxxxxxxxxx |
| **Address** | 3359 Mississauga Road |
| **City** | Mississauga |
| **Postal code** | L5L1C6 |
| **Country** | Canada |
| **WWW** | https://ensminger.csb.utoronto.ca/ |

**Part 2: Instrument**

**1) What type of instrument would you like to use for data acquisition?**

(In case of more types of instruments please copy the following paragraph)

Specify the instrument:

Cessna 208B

Airborne hyperspectral data TASI-600

Laser scanner data Q780

**2) What kind of assistance by technical staff of CzechGlobe or related services (e.g. additional corrections) is needed? Data are not georeferenced and pre-processed to level of at-sensor radiance (L1).***(Please specify not only technical features but outline also the financial aspects).*

*Georeferenced at surface temperature and emissivity for TASI*

*Georeferenced point cloud*

**Part 3: Access to Data**

**If you need any CzechGlobe data acquired previously by FLIS, please specify** (e.g. area, type of data). Basic information about already acquired data is available on http://mapserver.czechglobe.cz/.

*None*

**Part 4: Project description (narrative)**

**4.1 Abstract of the project:** *If the project is accepted, it will be published on the CzechGlobe website. Please make this summary understandable to a general and non-scientific audience. (max. 400 words)*

The consortium of this project consists of researchers from the WSL and the University is interested to monitor photosynthesis, plant health and the progressive impacts of drought on forests. The goal of the project “HyPlant Data Acquisition 2024 – WSL” is to explore the use if SIF to study drought responses of trees in a cross-disciplinary experiment, and to improve quantifying carbon uptake and gross primary productivity (GPP) remotely. Our special focus is on understanding of the regulatory properties of photosynthesis, the mechanisms of leaf and canopy water content and transpiration as well as the impact of crown architecture in conifers in the experimental Pfynwald forest in Switzerland. To study the dynamics of photosynthesis in trees, the *HyPlant* airborne imaging spectrometer will be used. This system was developed and operated for the first time in 2012. This sensor retrieves the sun-induced fluorescence spectrum from plant leaves that could be used for an estimation of the photosynthetic rate of plants. Within the project “*HyPlant* Data Acquisition 2024 - WSL, the *HyPlant* airborne sensor shall record high-performance imaging spectroscopy data from the Pfynwald. The project will acquire data from two flight campaigns, one in June and one in August 2024. The data will be processed to calculate high quality fluorescence maps during early season non drought conditions and late season drought conditions to monitor and quantify the impact of drought on a natural alpine Pinus sylvestris forest.

**4.2 Description of the project** (aims, methodology, outcomes; max. 1000 words)**:**

**Background:** The “*HyPlant* Data Acquisition 2022 – WSL” aims at the acquisition of high-performance imaging spectroscopy data with the *HyPlant* sensor over the Pfynwald forest in the Upper Rhône Valley in Switzerland. The Pfynwald frequently experiences severe drought towards the end of the summer. In xxx a longterm experiment was established with an array of highly instrumented plots that either receive irrigation during the summer or remain non-irrigated control plots. The aim of this longterm experiment is to study the impact of water stress on coniferous forests and to understand tree responses to future drier climate.

**Aims:** HyPlant Data obtained from the Pfynwald will be processed to calculate high-quality fluorescence maps of the Pfynwald, to explore the use of SIF to study drought responses of trees in a cross-disciplinary experiment and to improve quantifying carbon uptake and gross primary productivity (GPP) remotely.

For this purpose we will pursue the following activities:

Activity 1: Obtain airborne SIF data from drought stress and non stressed forst canopies at the Pfynwald forest. Airborne SIF data collection will be paralleled by the collection of well-established ecophysiological measurements on the ground and the collection of multispectral data from a drone.

Activity 2: Integrate the different datasets to disentangle and better understand the relationship between drought as an environmental stressor and (i) leaf level chlorophyll fluorescence and photosynthetic CO2 uptake, and (ii) remotely sensed canopy sun induced fluorescence and modeled GPP.

**Methodology**: The project will combine collection of airborne remotely sensed solar induced fluorescence (SIF), and measurements of tree physiology and environmental parameters in a 100-y old Pinus sylvestris forest subject to 17-y of precipitation manipulation.

Data collection will take place take place at the Pfynwald forest, the largest Scots pine forest in Switzerland, located in the dry inner-Alpine valley of the river Rhone.

The Pfynwald experiment includes eight plots of 25x40m2, separated by a 5 m buffer zone. Overall size of the experimental site is 1.2 ha and it includes more than 800 trees. Since 2003 four of these plots have been irrigated with sprinklers between April and October. In 2013, irrigation was stopped in a fraction (subplots) of the formely irrigated plots. This resulted in three treatments: Control (not irrigated), corresponding to trees exposed to naturally dry conditions; irrigated, corresponding to trees released from soil drought for the entire duration of the experiment; and irrigation stop, corresponding to trees after having acclimated to well-watered conditions for 5 years.

Activity 1: We will use the HyPlant 3 airborne spectrometer to collect SIF data remotely from the Pfynwald experiment. We plan to obtain data during a flight early in the season (June) when trees do not experience drought stress in any of the treatments, followed by a second flight and data collection campaign in August, when drought impacts photosynthesis and tree performance due to lack of precipitation and low soil moisture in thee control and irrigation-stop treatments, and trees in the irrigation plots do not show any symptoms of water stress. SIF data collection will be paralleled by intensive ground measurements of photosynthetic gas exchange, handheld PAM fluorescence measurements and leaf spectral reflectance measurments.

Activity 2: In this activity we will first retrieve the SIF signal from airborne data using some standard products available from Uwe Rascher groups. However, we anticipate that multiple additional retrival steps are required to correct the data and remove errors due to the altitude and steep grade of the terrain. This includes e.g. work by Postdoc Sylvain Colomer who will test novel approaches to retrieve the SIF signal. We will then integrate the different datasets to disentangle and better understand the relationship between drought as an environmental stressor. This involves multiple interations to assess impacts of drought on leaf level PAM chlorophyll fluorescence and photosynthetic CO2 uptake, and to elaborate how these are related and can be used to validate the relationship between the remotely sensed canopy sun induced fluorescence. Finally we will use the data to infer GPP from SIF data and compare these data against modelled data from ground measurements.

Outcomes:

The project will improve understanding of the environmental controls and the response of the SIF signal to drought, which is needed to foster the next generation of plant physiological and Earth-system models.

**4.3 Is the project connected with / (co-)financed from a grant** *(e.g. EU grant, public subsidy)***?**

Connected to EU grant FORWARDS (WSL funding via Swiss State Secretariat Education, Research and Inovation SERI)

**4.3.1. Name of the grant** **and funding body:**

FORWARDS (EU and SERI)

**4.4 Do you see a potential for financing this proposed research cooperation from any research or similar funding and would you be interested in this kind of project cooperation with CzechGlobe?**

No

**4.4.1 If yes, please specify:**

**4.5 Is any part of the project covered by confidentiality?**

No

**4.5.1 If yes, please specify and give the reasons for confidentiality:**