

## APPENDIX 2:

COST Action OPTIMISE affiliated potential ESA FLEX cal/val sites

Summary (details follow in section 8.2.)

Section	Name	Country	Ecosystem type	Additional networks
8.2.1	Majadas	Spain	Mediterranean Savanna (tree-grass ecosystem)	Phenocam, FLUXNET, European Flux Database; DENDROGLOB, OPTIMISE COST ACTION, CLIMMANI Cost Action
8.2.2	Hyttiala	Finland	Boreal Evergreen	ICOS, SpecNet, FluxNet, AeroNet, ACTRIS, SMEAR, INGOS, LTER, ANAEE, CLOUDNET
8.2.3	Rzecin	Poland	peatland	AERONET, FLUXNET DLR Sentinel-2 validation site
8.2.4	Tuczno	Poland	Conifer forest	FLUXNET
8.2.5	CESAR	Netherlands	Grazed pasture in a polder area	ICOS, BSRN, EALINET, GALION, CEOP, Cloudnet, GAW, GRUAN, E-Profile (EUMetnet), MWRnet
8.2.6a	Abisko-Stordalen	Sweden	Arctic peatland	ICOS, SITES, NordSpec
8.2.6b	Norunda	Sweden	Boreal coniferous forest	FLUXNET, ICOS, NordSpec
8.2.6c	Hyltemossa	Sweden	Coniferous forest	FLUXNET, ICOS, NordSpec
8.2.6d	Degero	Sweden	mixed mire system	FLUXNET, ICOS, NordSpe
8.2.7	Naivasha KWS	Kenya	Savannah	GEOSS
8.2.8	Neustift	Austria	Managed grassland	FLUXNET, LTER
8.2.9	Monte Bondone	Italy	Alpine grassland	ICOS, Specnet, Phenocam
8.2.10	Lavarone	Italy	Evergreen forest	FLUXNET Phenocam
8.2.11	Yatir	Israel	Pine forest	
8.2.12	Arid transition	Israel	Mediterranean to arid transition zone	
8.2.13	Laegeren	Switzerland	Temperate mountainous forest	CarboEuropeIP (CH-LAE)
8.2.14	Barbeau	France	Deciduous forest (oaks)	SOERE FORET ( <a href="http://www.gip-ecofor.org/f-ore-t/">http://www.gip-ecofor.org/f-ore-t/</a> ) – ICOS - SPECNET
8.2.15	Toulouse	France	grassland	
8.2.16	Hesse	Germany	deciduous forest	SOERE FORET ( <a href="http://www.gip-ecofor.org/f-ore-t/">http://www.gip-ecofor.org/f-ore-t/</a> ) – ICOS - SPECNET

8.2.17	Puechabon	France	Evergreen Broadleaf forest	SOERE FORET ( <a href="http://www.gip-ecofor.org/f-ore-t/">http://www.gip-ecofor.org/f-ore-t/</a> ) – ICOS - SPECNET
8.2.18	Eucflux	Brazil	Tropical forest Dominant species Eucalyptus	SOERE FORET ( <a href="http://www.gip-ecofor.org/f-ore-t/">http://www.gip-ecofor.org/f-ore-t/</a> ) – ICOS - SPECNET
8.2.19	Font-Blanche	France	Mediterranean forest	SOERE FORET ( <a href="http://www.gip-ecofor.org/f-ore-t/">http://www.gip-ecofor.org/f-ore-t/</a> ) – ICOS - SPECNET
8.2.20	Guyaflux	French Guiana	natural rainforest forest	SOERE FORET ( <a href="http://www.gip-ecofor.org/f-ore-t/">http://www.gip-ecofor.org/f-ore-t/</a> ) – ICOS - SPECNET
8.2.21	Bilos	France	Pine forest	SOERE FORET ( <a href="http://www.gip-ecofor.org/f-ore-t/">http://www.gip-ecofor.org/f-ore-t/</a> ) – ICOS - SPECNET
8.2.22	Grignon	France	Crops	ICOS
8.2.23	Lamasquère	France	Crops	ICOS
8.2.24	Garraf	Catalonia-Spain	Shrubland	
8.2.25	Nouragues	French Guiana	Tropical Forest	
8.2.26	Paracou	French Guiana	Tropical Forest	
8.2.27	Prades	Catalonia-Spain	Mediterranean forest	
8.2.28	Dahra	Senegal	Semi-arid savanna grassland	Net; fluxnet; International Soil Moisture Network
8.2.29	Bugacpuszta	Hungary	semiarid sand grassland (permanent)	FLUXNET

## Site Details

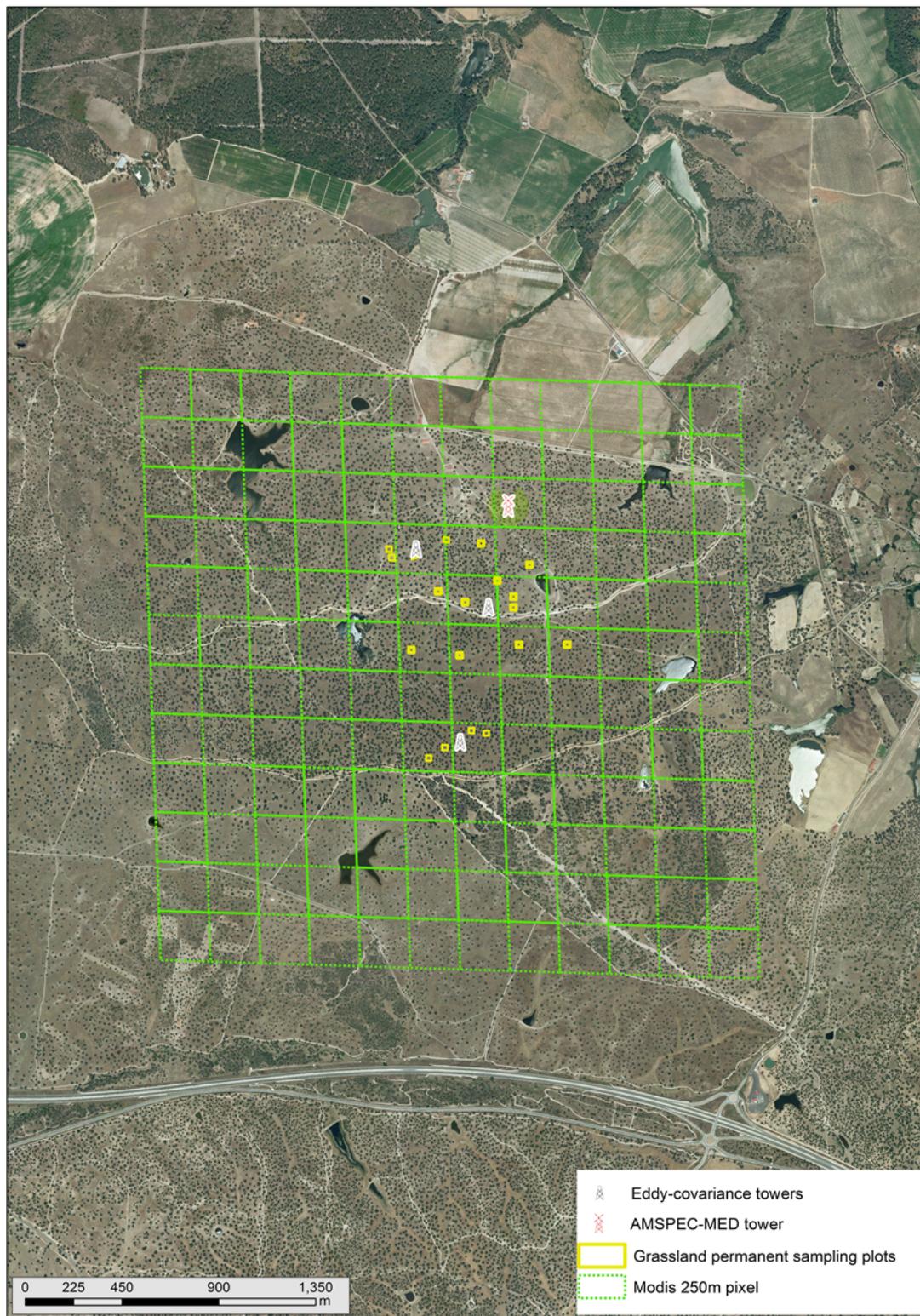
### 8.2.1 Majadas Site details

Site name	Country	Lat/Long	Length of operation
Las Majadas del Tietar	Spain	39.9415, -5.7734	2003 - present
Long term scientific objectives			
Site PIs	Institute	Contact details	
Dr. Arnaud Carrara (Central long-term Tower) Dr Mirco Migliavacca (North and South towers)	Fundación CEAM Max Planck Institute for Biogeochemistry	email: <a href="mailto:arnaud@ceam.es">arnaud@ceam.es</a> ; <a href="mailto:mmiglia@bgc-jena.mpg.de">mmiglia@bgc-jena.mpg.de</a>	

<p>Optical measurement Co- PIs Dr. Mirco Migliavacca</p> <p>Dr. M Pilar Martín</p>	<p>Institute</p> <p>Department Biogeochemical Integration. Max Planck Institute for Biogeochemistry</p> <p>Field spectroscopy and remote sensing Laboratory (SpecLab). Spanish Council for Scientific Research</p>	<p>Contact details</p> <p>email: mmiglia@bgc-jena.mpg.de</p> <p>email: mpilar.marti@cchs.csic.es Phone: (+34) 91 6022393</p> <p>Instituto de Economía, Geografía y Demografía (IEGD) Centro de Ciencias Humanas y Sociales (CCHS) Consejo Superior de Investigaciones Científicas (CSIC) Albasanz 26-28, 28037 Madrid (Spain)</p>	
<p>Site manager Dr. Arnaud Carrara</p>	<p>Institute Fundación CEAM</p>	<p>Contact details email: arnaud@ceam.es</p>	
<p>Intra-structure (EC tower/mast, CIMEL, weather stations, radiation monitoring etc)</p> <p>6 Eddy covariance flux towers (3 at 15.5 m and 3 at 1.8 m to measure grassland fluxes,) Network of soil temperature and soil water content. Meteorological station. Network of 9 net radiometers (CNR4). 6 automated weighing lysimeters. Network of sap flow sensor for tree transpiration (6 sensors for each tower). Digital cameras to monitor plant phenology.</p>		<p>Other associated networks (i.e. ICOS, AERONET etc)</p> <p>Phenocam, FLUXNET, European Flux Database; DENDROGLOB, OPTIMISE COST ACTION, CLIMMANI Cost Action</p>	
<p>Optical measurements made</p> <p>* Regular measurements of 25 x 25 m grass plots HCRF from 2009 - to present using ASD Fieldspec 3 instrument (400-2500 nm)</p> <p>* Regular measurements of trees leaves BCRF from 2009 - to present.</p> <p>*Spontaneous measurements of trees canopy HCRF from</p>	<p>Optical instruments</p> <p>* ASD FR3™ (ASD Inc.)</p> <p>* Unispec DC (PP Systems)</p> <p>* Manual system (2 Ocean Optics HR4000 for VIS/NIR and fluorescence measurements)</p> <p>*6 Decagon SRS (PRO and NDVI)</p>	<p>Optical measurements planned</p> <p>* Maintain regular measurements of 25 x 25 m grass plots HCRF</p> <p>* Maintain regular measurements of trees leaves BCRF</p> <p>* Regular measurements of trees canopy HCRF using UAV-mounted spectroradiometers</p> <p>*Automated – multi-</p>	<p>Instruments planned</p> <p>* ASD FR3™ (ASD Inc.)</p> <p>* Unispec DC (PP Systems)</p> <p>*FLOX System: Ocean Optic QE Pro and one Ocean Optics HR4000 VIS/NIR. One Automatic system for continuous measurements in the field. Test Phase November 2015 and May 2016. Installation October 2016.</p>

<p>2010 to present using ASD Fieldspec 3 instrument (400-2500 nm).</p> <p>*Automated – multi-angular spectroradiometric VNIR measurements of tree and grass canopies from Aug-2013 to Oct-2015 (AMSPEC-MED system). The system is currently under maintenance and re-calibration.</p> <p>* Several airborne hyperspectral and thermal images acquired between 2010 and 2105 using the sensors CASI (ITRES) and AHS (SenSyTech)</p> <p>* Fine resolution hyperspectral imagery (Hyperspec VNIR+SWIR , Headwall Photonics ) (combined with thermal imagery (SC655, FLIR) in 2016</p>		<p>angular spectroradiometric measurements of tree and grass canopies</p> <p>* Airborne hyperspectral and thermal images</p>	
<p>Ecosystem type</p> <p>Mediterranean Savanna (tree-grass ecosystem)</p>	<p>Dominant species</p> <p>Open tree stratum (24.8 trees ha<sup>-1</sup>) is composed of holm oak (<i>Quercus ilex</i> ssp <i>ballota</i> Lam.) with occasional presence of <i>Q. suber</i> L. or <i>Q. faginea</i> Lam. (&lt;5%). Tree canopy fraction is around 20%.</p>	<p>Degree and scale of heterogeneity</p> <p>Information about spatial and temporal heterogeneity of the site can be found at</p> <p><a href="http://savs.eumetsat.int/html/ES-LMA_report.html">http://savs.eumetsat.int/html/ES-LMA_report.html</a></p>	

	<p>The herbaceous stratum is mainly composed of annual species (Vulpia bromoides (L.) SF Grey; V. geniculata (L.) Link; Trifolium subterraneum L., Ornithopus compressus L.). Herbaceous plants senesce by the end of May.</p>	
<p>Publications (approx. number of ISI per annum from site)  SpecLab CSIC: 7 papers ISI from 2013  MPI-BGC: 2 articles from 2014</p>		
<p>Any additional information.</p>		



### 8.2.2 Hyytiälä

Site name SMEAR-II/Hyytiälä	Country FINLAND	Lat/Long 61°51'N, 24°17'E	Length of operation Since 1995
Long term scientific objectives: SMEAR-II infrastructure focusses on continuous, comprehensive measurements of fluxes, storages and			

concentrations of key substances in the land ecosystem–atmosphere continuum. The long-term goal of the station is to characterize the physical and physiological processes that regulate the functioning of the ecosystem, the dynamics of the atmosphere above it, as well as their feedbacks.			
Site PIs Prof. Markku Kulmala	Institute UHEL	Contact details Department of Physics, Gustaf Hällströminkatu 2 P.O.Box 64. FIN-00014 University of Helsinki Finland. <a href="mailto:markku.kulmala@helsinki.fi">markku.kulmala@helsinki.fi</a>	
Prof. Jaana Bäck	UHEL	Department of Forest Sciences, Latokartanonkaari 7 P.O.Box 27 FIN-00014 University of Helsinki Finland. <a href="mailto:Jaana.back@helsinki.fi">Jaana.back@helsinki.fi</a>	
Prof. Timo Vesala	UHEL	Department of Physics, Gustaf Hällströminkatu 2 P.O.Box 64. FIN-00014 University of Helsinki Finland. <a href="mailto:Timo.vesala@helsinki.fi">Timo.vesala@helsinki.fi</a>	
Prof. Tuukka Petäjä	UHEL	Department of Physics, Gustaf Hällströminkatu 2 P.O.Box 64. FIN-00014 University of Helsinki Finland. <a href="mailto:Tuukka.Petaja@helsinki.fi">Tuukka.Petaja@helsinki.fi</a>	
Optical measurement PI Dr. Albert Porcar-Castell	Institute UHEL	Contact details Department of Forest Sciences, Latokartanonkaari 7 P.O.Box 27 FIN-00014 University of Helsinki Finland. <a href="mailto:joan.porcar@helsinki.fi">joan.porcar@helsinki.fi</a>	
Site manager Janne Levula	Institute UHEL	Contact details Department of Physics, Gustaf Hällströminkatu 2 P.O.Box 64. FIN-00014 University of Helsinki Finland. <a href="mailto:Janne.levula@helsinki.fi">Janne.levula@helsinki.fi</a>	
Infrastructure -128m Mast with atmospheric chemistry, physics and meteorology, and Eddy covariance flux measurements. -4 canopy scaffolding towers with flux and radiation measurements. -Continuous measurements of fluorescence and photosynthesis at the shoot level. -Permanent staff		Other associated Networks  ICOS, SpecNet, FluxNet, AeroNet, ACTRIS, SMEAR, INGOS, LTER, ANAEE, CLOUDNET	
Optical measurements  -Active PAM fluorometry (Monitoring PAM fluorometer ,Walz) -Leaf Fluorescence and Spectral reflectance (campaign wise, 2009,	Instruments	Optical measurements planned  -Canopy Spectral reflectance and fluorescence (Piccolo Doppio System).	Instruments planned

2014). ASD Field Spec + FluoWat clip -Canopy spectral reflectance (2011-2015) (Caroline Nichol, PI) -AOD -In-situ aerosol optical properties -LiDAR derived aerosol optical profiles		Tentative starting date: September 2016	
Ecosystem type Boreal Evergreen	Dominant species Dominated by Scots pine with birch and Spruce patches.	Degree of heterogeneity	
Publications On average >100 ISI publications annually			

### 8.2.3 Rzecin

Site name Rzecin, POLWET	Country POLAND	Lat/Long 16°18'34.52"E 52°45'43.27"N	Length of operation <b>Since 2004</b>
Long term scientific objectives:			
Site PI Prof Janusz Olejnik	Institute Poznan University of Life Sciences	Contact details <a href="mailto:olejnikj@up.poznan.pl">olejnikj@up.poznan.pl</a>	
Optical measurement PI Dr Radoslaw Juszczak	Institute Poznan University of Life Sciences	Contact details <a href="mailto:radjusz@up.poznan.pl">radjusz@up.poznan.pl</a>	
Site manager Dr Radoslaw Juszczak Dr Bogdan Chojnicki	Institute Poznan University of Life Sciences	Contact details <a href="mailto:radjusz@up.poznan.pl">radjusz@up.poznan.pl</a>	
Intra-structure (EC (CO <sub>2</sub> /H <sub>2</sub> O/CH <sub>4</sub> ) tower /mast, CIMEL, weather stations, radiation monitoring, climate manipulation experiment)		Other associated networks (AERONET, FLUXNET) DLR Sentinel-2 validation site	
Optical measurements made Reflectance, multispectral– tower based, Reflectance, hyperspectral – periodic, manual AOD	Optical instruments SKY SKR1860 ASD HH2  CIMEL sunphotometer	Optical measurements planned Fluorescence, hyperspectral reflectance	Instruments planned OO VIS-NIR (FLAME) OO QE-Pro-F With Piccolo Doppio  EMORAL ESA lidar (upgraded)
Ecosystem type <b>peatland</b>	Dominant species Mosses/carrex/Phragmites	Degree and scale of heterogeneity Site is rather heterogenous	
Publications (approx. number of ISI per annum from site)			

1. Chojnicki B. (2013) Spectral estimation of wetland carbon dioxide exchange. *International Agrophysics*, 27, 1-5
2. Juszczak R., Acosta M., Olejnik J. (2012). Comparison of daytime and nighttime ecosystem respiration measured by the closed chamber technique on a temperate mire in Poland. *Polish Journal of Environmental Studies*, Vol. 21, No. 643–658
3. Juszczak R., Augustin J. (2013). Exchange of the greenhouse gases methane and nitrous oxide at a temperate pristine fen mire in Central Europe. *Wetlands*, 33(5); 895-907
4. Kowalska N, Chojnicki BH, Rinne J, Haapanala S, Siedlecki P, Urbaniak M, Juszczak R, Olejnik J (2013). Measurements of methane emission from a temperate wetland by the eddy covariance method. *International Agrophysics* 27, 283-289
5. Juszczak R., Humphreys E., Acosta M., Michalak-Galczywska M., Kayzer D., Olejnik J. 2013 Ecosystem respiration in a heterogeneous temperate peatland and its sensitivity to peat temperature and water table depth. *Plant and Soil*, 366 (1-2), 505-520

Any additional information. SWAMP campaign took place on site (11.07.2015)

#### 8.2.4 Tyczno

Site name PL-Tcz (Tyczno)	Country POLAND	Lat/Long 16.09748333 E 53.19295 N	Length of operation <b>Since 2008</b>
Long term scientific objectives:			
Site PI Prof Janusz Olejnik	Institute Poznan University of Life Sciences	Contact details <a href="mailto:olejnikj@up.poznan.pl">olejnikj@up.poznan.pl</a>	
Optical measurement PI Dr Radoslaw Juszczak	Institute Poznan University of Life Sciences	Contact details <a href="mailto:radjusz@up.poznan.pl">radjusz@up.poznan.pl</a>	
Site manager Dr Marek Urbaniak	Institute Poznan University of Life Sciences	Contact details <a href="mailto:marek.urbaniak@up.poznan.pl">marek.urbaniak@up.poznan.pl</a>	
Intra-structure (EC (CO <sub>2</sub> /H <sub>2</sub> O) +tower 37 m height, weather stations, radiation monitoring,		Other associated networks (FLUXNET)	
Optical measurements made Reflectance, multispectral– tower based,	Optical instruments SKY SKR1850	Optical measurements planned Fluorescence, hyperspectral reflectance	Instruments planned OO VIS-NIR (FLAME) OO QE-Pro-F With Piccolo Doppio
Ecosystem type forest	Dominant species Scots pine	Degree and scale of heterogeneity Homogenous, and flet	
Publications (approx. number of ISI per annum from site) 1. Ziemblińska K.,Urbaniak M.,Chojnicki B.H.,Black T.A.,Niu S.,Olejnik J. (2016) Net ecosystem productivity and its environmental controls in a mature Scots pine stand in north-western Poland. <i>Agricultural and Forest Meteorology</i> (in printing)			
Any additional information.			

#### 8.2.5 CESAR

Site name CESAR Observatory	Country The Netherlands	Lat/Long 51.971°N, 4.927°E	Length of operation Since 1972
Long term scientific objectives Monitoring of long term tendencies in atmospheric changes, Studies of atmospheric and land surface processes for climate modelling Validation of space-borne observations The development and implementation of new measurement techniques			

Training of young scientists at post-doc, PhD and master level.			
Site PI Marcel Brinkenberg	Institute KNMI	Contact details Fred Bosveld <a href="mailto:Fred.bosveld@knmi.nl">Fred.bosveld@knmi.nl</a> , or <a href="mailto:marcel.brinkenberg@knmi.nl">marcel.brinkenberg@knmi.nl</a>	
Optical measurement PI Wouter Knap	Institute KNMI	Contact details Wouter.knap@knmi.nl	
Site manager	Institute	Contact details	
Intra-structure Main mast: 213m with platforms and arms, two extra masts of 20 m. Remote sensing field at 300 m from main mast. EC at several heights, Optical measurements, Radar, Lidar, synoptic meteorology, soil physics.		Other associated networks ICOS, BSRN, EALINET, GALION, CEOP, Cloudnet, GAW, GRUAN, E-Profile (EUmetnet), MWRnet	
Optical measurements made Aerosol Particle Sizer, Baseline Surface Radiation, Network station, Cavity Ring-Down Spectroscopy for CO2 and CGH4 (Picarro), Ceilometer CT75, Ceilometer LD40, Digital Sky Camera, Fast response H2O/CO2 LICOR 7500, Fourier Transform Infrared Spectrometer for CO2,CH4, N2O and CO, Infrasond array, Integrating Nephelometer, Multi Filter Rotating Shadow Band Radiometer, PAR Photosynthetically Active Radiation, Precision Filter Radiometer, Pyranometer CM11, Pyranometer CM22, Pyranometer CMP22, Pyranometer K&Zn CM11, Pyranometer K&Zn CM22, Pyrgeometer CG4, Pyrgeometer CGR4, Pyrgeometer Eppley PIR, Pyrgeometer K&Zn CG4, Pyrheliometer CH1, Pyrometer (scanning) NubiScope, Radon monitor, Raman Lidar CAELI, Scanning Mobility Particle Sizer, Sun Photometer CIMEL, Sun Photometer SPUV Sunshine duration sensor CSD3, Suntracker Total Sky Imager, UV A(315-400nm) Radiometer, UV B(280-315nm) Radiometer, UV-Lidar, Visibility BIRAL 100, 2x XLAS Scintillometer K&Zn	Optical instruments  See left	Optical measurements planned  Instruments planned	
Ecosystem type  Grazed pasture in a polder area	Dominant species Mixed forage grasses	Degree and scale of heterogeneity Typical 'polder' grassland 10 km in all directions. Limitations close to the tower: A river 1 km South (200 m wide), a village 1 km East (low residential), some fields in some years are planted with maize (~50x300m) close to the tower (< 500 m), ditches between grass fields	
Publications (approx. number of ISI per annum from site) Appr. 30 per year (152 in last 5 years, 387 in total since start of the site)			
Any additional information. <a href="http://www.cesar-observatory.nl/">http://www.cesar-observatory.nl/</a>			

#### 8.2.6a Abisko-Stordalen OPTIMISE Network proposed FLEX science and cal/val sites

Site name Abisko-Stordalen	Country Sweden	Lat/Long 68.3534, 18.9967	Length of operation Since 1970s
Long term scientific objectives Biosphere—atmosphere interactions			
Site PI Thomas Friborg	Institute: U. of Copenhagen, Øster Voldgade 10, 1350 København K, 6., Building: 1.649	Contact details tfj@ign.ku.dk	
Optical measurement PI	Institute Lund University	Contact details Tel: +46 (0)46 222 96 55	

Lars Eklundh		Lars.Eklundh@nateko.lu .se	
Site manager	Institute:	Contact details	
Intra-structure Mast with atmospheric chemistry, physics and meteorology, and Eddy covariance flux measurements. Manned station with power and internet		Other associated networks (i.e. ICOS, AERONET etc) ICOS, SITES, NordSpec	
Optical measurements made PRI, NDVI, SWIR, red-edge bands, PAR & solar radiation	Optical instruments Skye sensors Campbell radiometers	Optical measurements planned possible reflectance and fluorescence	Instruments planned Piccolo with Flame and QEPro from both tower and UAV
Ecosystem type Arctic peatland	Dominant species Dry ombrotrophic parts are dominated by crowberry <i>Empetrum hermaphroditum</i> , lingonberry <i>Vaccinium vitis-idaea</i> and cloudberry <i>Rubus chamaemorus</i> ; semi-wet ombrotrophic parts by the sedge <i>Carex rotundata</i> and the cottongrass <i>Eriophorum vaginatum</i> ; and wet minerotrophic areas by the cottongrass <i>Eriophorum angustifolium</i> .	Degree and scale of heterogeneity Species rich mire landscape but homogeneous at 300m scale	
Publications (approx. number of ISI per annum from site)			
Any additional information, web site URL etc <a href="http://www.icos-sweden.se/measurements_stordalen.html">http://www.icos-sweden.se/measurements_stordalen.html</a>			

#### 8.2.6b Norunda

Site name Norunda	Country Sweden	Lat/Long 60°05'N, 17°29'E	Length of operation Since 1994
Long term scientific objectives Biosphere—atmosphere interactions			
Site PI Meelis Mölder	Dept. of Physical Geography and Ecosystem Science,	Contact details Tel. +46.46.222 03 78 meelis.molder@nateko.lu.se	

	Lund University		
Optical measurement PI Lars Eklundh	Institute Lund University	Contact details Tel: +46 (0)46 222 96 55 Lars.Eklundh@nateko.lu.se	
Site manager	Institute:	Contact details	
Intra-structure Mast with atmospheric chemistry, physics and meteorology, and Eddy covariance flux measurements. Manned station with power and internet		Other associated networks (i.e. ICOS, AERONET etc) FLUXNET, ICOS, NordSpec	
Optical measurements made PRI, NDVI, PAR & solar radiation	Optical instruments Skye sensors	Optical measurements planned fluorescence	Instruments planned Piccolo with Flame and QEPro from both tower and UAV
Ecosystem type Boreal coniferous forest	Norway Spruce ( <i>Picea abies</i> ) and Scots pine ( <i>Pinus sylvestris</i> ) forest	Degree and scale of heterogeneity Varied forest landscape, homogenous at 300 m scale	
Publications (approx. number of ISI per annum from site)			
Any additional information, web site URL etc <a href="http://www.icos-sweden.se/station_norunda.html">http://www.icos-sweden.se/station_norunda.html</a>			

#### 8.2.6c Hyltemossa

Site name Hyltemossa	Country Sweden	Lat/Long 56°06'N, 13°25'E	Length of operation Since 2014
Long term scientific objectives Biosphere—atmosphere interactions			
Site PI Michal Heliasz	Dept. of Physical Geography and Ecosystem Science, Lund University	Contact details Tel. +46.46.222 michal.heliasz@nateko.lu.se	
Optical measurement PI Lars Eklundh	Institute Lund University	Contact details Tel: +46 (0)46 222 96 55 Lars.Eklundh@nateko.lu.se	
Site manager	Institute:	Contact details	
Intra-structure Mast with atmospheric chemistry, physics and meteorology, and Eddy covariance flux measurements. Manned station with power and internet		Other associated networks (i.e. ICOS, AERONET etc) FLUXNET, ICOS, NordSpec	
Optical measurements made PRI, NDVI, PAR &	Optical instruments Skye sensors	Optical measurements planned fluorescence	Instruments planned Piccolo with

solar radiation			Flame and QEPro from both tower and UAV
Ecosystem type Coniferous forest	30 year old Norway Spruce ( <i>Picea abies</i> ) forest	Degree and scale of heterogeneity Varied forest landscape, homogenous at 300 m scale	
Publications (approx. number of ISI per annum from site)			
Any additional information, web site URL etc <a href="http://www.icos-sweden.se/station_hyltemossa.html">http://www.icos-sweden.se/station_hyltemossa.html</a>			

#### 8.2.6d

Site name Degerö Stormyr	Country Sweden	Lat/Long 64°11'N, 19°33'E	Length of operation 15 years
Long term scientific objectives Biosphere—atmosphere interactions			
Site PI Mats Nilsson	Swedish University of Agricultural Sciences	Contact details Tel. +46.90.786 8375 <a href="mailto:mats.b.nilsson@slu.se">mats.b.nilsson@slu.se</a>	
Optical measurement PI Matthias Peichl	Institute Swedish University of Agricultural Sciences	Contact details Tel: +46.90.786 8463 <a href="mailto:matthias.peichl@slu.se">matthias.peichl@slu.se</a>	
Site manager	Institute:	Contact details	
Intra-structure Mast with atmospheric chemistry, physics and meteorology, and Eddy covariance flux measurements. Manned station with power and internet		Other associated networks (i.e. ICOS, AERONET etc) FLUXNET, SITES, NordSpec	
Optical measurements made PRI, NDVI, PAR & solar radiation	Optical instruments Skye sensors Decagon sensors	Optical measurements planned fluorescence	Instruments planned Piccolo with Flame and QEPro from both tower and UAV
Ecosystem type Mixed mire system	3-4 m peat soil, mainly poor fen with carpet plant communities	Degree and scale of heterogeneity Very flat homogenous landscape	
Publications (approx. number of ISI per annum from site)			
Any additional information, web site URL etc <a href="https://fluxnet.ornl.gov/site/727">https://fluxnet.ornl.gov/site/727</a>			

Site name Degerö Stormyr	Country Sweden	Lat/Long 64°11'N, 19°33'E	Length of operation 15 years
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Long term scientific objectives Biosphere—atmosphere interactions			
Site PI Mats Nilsson	Swedish University of Agricultural Sciences	Contact details Tel. +46.90.786 8375 mats.b.nilsson@slu.se	
Optical measurement PI Matthias Peichl	Institute Swedish University of Agricultural Sciences	Contact details Tel: +46.90.786 8463 matthias.peichl@slu.se	
Site manager	Institute:	Contact details	
Intra-structure Mast with atmospheric chemistry, physics and meteorology, and Eddy covariance flux measurements. Manned station with power and internet		Other associated networks (i.e. ICOS, AERONET etc) FLUXNET, SITES, NordSpec	
Optical measurements made PRI, NDVI, PAR & solar radiation	Optical instruments Skye sensors Decagon sensors	Optical measurements planned fluorescence	Instruments planned Piccolo with Flame and QEPro from both tower and UAV
Ecosystem type Mixed mire system	3-4 m peat soil, mainly poor fen with carpet plant communities	Degree and scale of heterogeneity Very flat homogenous landscape	
Publications (approx. number of ISI per annum from site)			
Any additional information, web site URL etc <a href="https://fluxnet.ornl.gov/site/727">https://fluxnet.ornl.gov/site/727</a>			

### 8.2.7 Naivasha

Site name Naivasha KWS	Country Kenya	Lat/Long -0.7409 / 30.447	Length of operation Since 2010
Long term scientific objectives <ul style="list-style-type: none"> <li>- Improving understanding of Eco-hydrological and climate feedback mechanisms in savannah ecosystem</li> <li>- Improving understanding of the hydrogeology of the Rift valley</li> <li>- Quantifying socio-economic and hydrology interactions in economically rapidly developing area in East Africa</li> </ul>			
Site PI Robert Becht	Institute ITC, Univ. Twente	Contact details r.becht@utwente.nl	
Optical measurement PI Christiaan van der Tol	Institute ITC, Univ. Twente	Contact details <a href="mailto:c.vandertol@utwente.nl">c.vandertol@utwente.nl</a>	
Site manager Vincent Odongo	Institute Egerton University &	Contact details v.o.odongo@utwente.nl	

	Univ Twente		
Intra-structure EC tower with sonic anemometer (Gill), 4-component radiometer (pyranometer and pyrgeometer pairs), Thermal Infrared (IR100) Large Eddy Scintillometer (Scintec BLS 450), soil temperature and soil moisture profile (Decagon). From end 2016: Cosmic ray CRS1000B (Hydroinnova), Licor7500A, 16 small weather stations elsewhere in the catchment.		Other associated networks (i.e. ICOS, AERONET etc) GEOSS	
Optical measurements made	Optical instruments	Optical measurements planned	Instruments planned
Pyranometer and pyrgeometer pairs.	CNR1	Hyperspectral reflectance and fluorescence from 2017.	Piccolo with QE Pro (2017)
Ecosystem type	Dominant species	Degree and scale of heterogeneity	
Savannah in wildlife protected area. Grazing by zebra	Psiadia panctulata, Ocimum gratissimum, Lippia kituensis, Digitaria scalarum, Cynodon dactylon.	Homogeneous shrubland with some grasses and scattered Acacia trees for 500 m around the flux tower. A few small buildings in the footprint belonging to the Kenyan Wildlife Service. At >500 m, two roads and low rise residential areas.	
Publications (approx. number of ISI per annum from site) Apr. 1-2 per year. Yihdego, Y., Reta, G. and Becht, R. (2016) Hydrological analysis as a technical tool to support strategic and economic development: a case study of Lake Naivasha, Kenya. In: Water and environment journal, (2016) IN PRESS, Odongo, V.O., van der Tol, C., van Oel, P.R., Meins, F.M., Becht, R., Onyando, J.O. and Su, Z. (2015) Characterisation of hydroclimatological trends and variability in the Lake Naivasha basin, Kenya. In: Hydrological processes, 29 (2015)15 pp. 3276-3293. Odongo, V.O., Mulatu, D.W., Muthoni, F.K., van Oel, P.R., Meins, F.M., van der Tol, C., Skidmore, A.K., Groen, T.A., Becht, R., Onyando, J.O. and van der Veen, A. (2014) Coupling socio - economic factors and eco - hydrological processes using a cascade - modeling approach. In: Journal of hydrology, 518 (2014)Part A pp. 49-59. van Oel, P.R., Mulatu, D.W., Odongo, V.O., Meins, F.M., Hogeboom, R.J., Becht, R., Stein, A., Onyando, J.O. and van der Veen, A. (2013) The effects of groundwater and surface water use on total water availability and implications for water management : the case of Lake Naivasha, Kenya. Odongo, V.O., Onyando, J.O., Mutua, B.M., van Oel, P.R. and Becht, R. (2013) Sensitivity analysis and calibration of the Modified Universal Soil Loss Equation (MUSLE) for the upper Malewa Catchment, Kenya. In: International journal of sediment research, 28(2013)3, pp. 368-383. Yihdego, Y. and Becht, R. (2013) Simulation of lake - aquifer interaction at Lake Naivasha, Kenya using a three - dimensional flow model with the high conductivity technique and a DEM with bathymetry. In: Journal of hydrology, 503 (2013) pp. 111-122. Mekonnen, M.M., Hoekstra, A.Y. and Becht, R. (2012) Mitigating the water footprint of export cut flowers from the lake Naivasha Basin, Kenya.			

<p>Georgiadou, P.Y., Bana, B., Becht, R., Hoppe, R., Ikingura, J., Kraak, M.J., Lance, K.T., Lemmens, R.L.G., Lungo, J.H., McCall, M.K., Miscione, G. and Verplanke, J.J. (2011) Sensors, empowerment and accountability : a digital earth view from East Africa. In: International Journal of Digital Earth, 4 (2011)4 pp. 285-304.</p> <p>Mutiga, J.K., Mavengano, S.T., Su, Z., Woldai, T. and Becht, R. (2010) Water allocation as a planning tool to minimise water use conflicts in the upper Ewaso Ng'iro north basin, Kenya.</p> <p>Becht, R. and Harper, D.M. (2002) Towards an understanding of human impact upon the hydrology of Lake Naivasha, Kenya. In: Hydrobiologia, 488(2002)1-3. pp. 1-11.</p>
<p>Any additional information.</p> <p>This site is located in the municipality of Naivasha, close to Lake Naivasha. The catchment area of the lake has been under study for over 20 years by ITC and Egerton University, with several operational meteorological stations around the catchment. Seven PhD students and a postdoc have worked in the area during the last 5 years on hydrological, socio-economic and ecological topics. Last year an investment in equipment of 100 kE has been made.</p>

### 8.2.8 Neustift

Site name Neustift (AT-Neu)	Country Austria	Lat/Long 47.116353, 11.320203	Length of operation 2001-
Long term scientific objectives Quantify and understand biosphere-atmosphere interactions under changes in climate and land use			
Site PI Georg Wohlfahrt	Institute University of Innsbruck	Contact details georg.wohlfahrt@uibk.ac.at	
Optical measurement PI Georg Wohlfahrt	Institute University of Innsbruck	Contact details georg.wohlfahrt@uibk.ac.at	
Site manager PI Georg Wohlfahrt	Institute University of Innsbruck	Contact details georg.wohlfahrt@uibk.ac.at	
Intra-structure (EC tower/mast, CIMEL, weather stations, radiation monitoring etc) EC tower, weather station (all relevant environmental parameters in air, canopy and soil), air-conditioned instrument container, line power, internet access,		Other associated networks (i.e. ICOS, AERONET etc) FLUXNET, LTER	
Optical measurements made Hyperspectral reflectance (2006), narrow-band NDVI/PRI (2015-), broad-band NDVI (2008-)	Optical instruments ASD HH fieldspec, Decagon SRS, Pyranometers and pyrgeometers	Optical measurements planned Yes, SIF	Instruments planned QEPro
Ecosystem type Temperate managed grassland (3x cut/year)	Dominant species A few forbs (Ranunculus acris, Trifolium repens, Trifolium pratense, Taraxacum officinale) and grasses (e.g. Dactylis glomerata, Poa sp)	Degree and scale of heterogeneity Relatively small within fields, fields are around 100-200m scale	
Publications (approx. number of ISI per annum from site) around 10/year (total >100)			
Any additional information. This site is one of the few world-wide where the concurrent ecosystem-atmosphere exchange of CO <sub>2</sub>			

and COS (carbonyl sulfide) is measured. The ecosystem uptake of COS is a proxy for gross primary productivity (GPP) and thus for this site an additional and independent (from the usual, ill-posed CO<sub>2</sub> flux partitioning is available for comparing/calibrating against SIF.

### 8.2.9 Monte Bondone

Site name Monte Bondone Grassland	Country Italy	Lat/Long 46,014678 11,045831	Length of operation From 2002, ongoing
Long term scientific objectives: GHG gas balance and links with remote sensing data			
Site PI : Damiano Gianelle	Fondazione Edmund Mach	Contact details	damiano.gianelle@fmach.it
Optical measurement PI: Loris Vescovo	Fondazione Edmund Mach	Contact details	loris.vescovo@fmach.it
Site manager : Roberto Zampedri; Mauro Cavagna	Fondazione Edmund Mach	Contact details	roberto.zampedri@fmach.it mauro.cavagna@fmach.it
Intra-structure: 6 m tall EC tower, with all "ICOS" meteorological variables measured		Other associated networks: ICOS, Specnet ( <a href="http://specnet.info/">http://specnet.info/</a> ), Phenocam ( <a href="https://phenocam.sr.unh.edu/webcam/">https://phenocam.sr.unh.edu/webcam/</a> )	
Optical measurements made	Optical instruments	Optical measurements planned	Instruments planned
Incoming global solar radiation (continuous measurements)	Pyranometer Licor LI200SZ	Continuation of measurements	
Incoming PAR (continuous measurements)	Quantum sensor Licor LI190SZ	Continuation of measurements	
Reflected PAR (continuous measurements)	Quantum sensor SKP215	Continuation of measurements	
Transmitted PAR (continuous measurements during the growing season)	Two Li-191 Line Quantum sensors	Continuation of measurements	
Incoming UV-A and UV-B (continuous measurements)	Kipp & Zonen UV-S-AB-T	Continuation of measurements	
Incoming total and diffuse PAR (continuous measurements)	BF3 sensor, Delta-T Devices	Continuation of measurements	
Net Radiation (continuous measurements)	Net Radiometer Kipp&Zonen CNR1	Continuation of measurements	
Incoming and reflected light at 550, 680, 750, 850 nm (bandwidth ~ 10 nm) (continuous measurements during the growing season)	Skye SKR 1850 - 4 channel sensor	Continuation of measurements	
Incoming and reflected light at 16 bands from VNIR range (continuous measurements during the growing season)	Cropscan MSR16R system	Continuation of measurements, if requested -	

		sensor available	
Reflectance between 350 and 2500 nm (continuous measurements during the growing season)	White-Ref system based on ASD FieldSpec Pro radiometer	Continuation of measurements, if requested - system available	
Incoming and reflected light at 630 and 800 nm	Decagon SRS sensor	Continuation of measurements	
Incoming and reflected light at 531, 570, (bandwidth ~ 5 nm) 710, 860 nm (bandwidth ~ 10 nm) (continuous measurements during the growing season)	Skye SKR1860 4-channel sensor	Continuation of measurements	
RGB IR images (continuous measurements)	StarDot NetCam SC 5MP IR - Multi-Megapixel Hybrid IP Camera	Continuation of measurements	
Ecosystem type: Grassland	Dominant species Nardus stricta, Festuca sp, legumes	Degree and scale of heterogeneity The grassland is located on a mountain plateau of an area of app. 2x2 km. The plateau includes mainly grassland ecosystems (with different species composition, management intensity) and a small wetland area.	
Publications (approx. number of ISI per annum from site) 5 (the site was used in many synthesis papers of the Fluxnet community)			
Any additional information. Main power available			

### 8.2.10 Lavarone

Site name Lavarone Forest	Country Italy	Lat/Long 45,956203 11,281323	Length of operation From 2002, ongoing
Long term scientific objectives: GHG gas balance and links with remote sensing data			
Site PI : Damiano Gianelle	Fondazione e Edmund Mach	Contact details	damiano.gianelle@fmach.it
Optical measurement PI: Loris Vescovo	Fondazione e Edmund Mach	Contact details	loris.vescovo@fmach.it
Site manager : Roberto Zampedri; Mauro Cavagna	Fondazione e Edmund Mach	Contact details	roberto.zampedri@fmach.it mauro.cavagna@fmach.it
Intra-structure: 42 m tall EC tower, with all "ICOS" meteorological	Other associated networks: Fluxnet, Phenocam ( <a href="https://phenocam.sr.unh.edu/webcam/">https://phenocam.sr.unh.edu/webcam/</a> )		

variables measured			
<b>Optical measurements made</b>	<b>Optical instruments</b>	<b>Optical measurements planned</b>	<b>Instruments planned</b>
Incoming global solar radiation (continuous measurements)	Pyranometer Licor LI200SZ	Continuation of measurements specified in the left column.	
Incoming PAR (continuous measurements)	Quantum sensor Licor LI190SZ	Continuation of measurements specified in the left column.	
Incoming total and diffuse PAR (continuous measurements)	BF3 sensor, Delta-T Devices	Continuation of measurements specified in the left column.	
Net Radiation (continuous measurements)	Net Radiometer Kipp&Zonen CNR1	Continuation of measurements specified in the left column.	
Incoming and reflected light at 530 and 570 nm (bandwidth ~ 10 nm) and 670 and 830 nm (bandwidth ~ 70 and 120 nm, respectively) (continuous measurements during the growing season)	Skye SKR 1850 - 4 channel sensor	Continuation of measurements specified in the left column.	
		RGB IR images (continuous measurements)	StarDot NetCam SC 5MP IR - Multi-Megapixel Hybrid IP Camera
		Fluorescence and reflectance (spectral range: 650-850 nm) (continuous measurements during the growing season)	WhiteRef system based on AvaSpec-ULS3648-USB2 High-resolution radiometer
		Incoming and reflected light at 11 bands (490,530,560,570,670,710, 750,780,860,900,970 nm; bandwidth ~ 10 nm) (continuous measurements during the growing season)	Cropscan MSR16R system
Ecosystem type:	Dominant species:	Degree and scale of heterogeneity: The forest covers a relatively big and homogenous area (2 x 3 km)	

evergreen forest	Abies alba, Picea abies	
Publications (approx. number of ISI per annum from site) 3 (the site was used in many synthesis papers of the Fluxnet community)		
Any additional information. Main power available.		

### 8.2.11 YATIR

Site name YATIR	Country ISRAEL	Lat/Long 31° 20' N; 35° 3' E	Length of operation 16 YEARS
Long term scientific objectives Biosphere—atmosphere interactions			
Site PI Dan Yakir	Institute: Weizmann Institute of Science	Contact details dan.yakir@weizmann.ac.il	
Optical measurement PI	Institute	Contact details	
Site manager Eyal Rotenberg	Institute: Weizmann Institute of Science	Contact details eyal.rotenberg@weizmann.a c.il	
Intra-structure (EC tower/mast, CIMEL, weather stations, radiation monitoring etc)  EC tower, weather station, carbon, water, radiation measurements, hydrology, phenology (camera), ecophysiology	Other associated networks (i.e. ICOS, AERONET etc)  Fluxnet, ICOS (associate member), iLTER,		
Optical measurements made  Tower-based NDVI, Phenocam, RGB phenology, Ceilometer	Optical instruments  Skye SKR1850 4-channels light sensors (NDVI) RGB camera of the Phenocm Network, Vaissla C51 ceilometer	Optical measurements planned  SIF	Instruments planned
Ecosystem type  Pine forest	Dominant species Pinus halepensis (Aleppo pine) dominated	Degree and scale of heterogeneity  ~90% single species and stand density	
Publications (approx. number of ISI per annum from site)			
Any additional information.			

### 8.2.12

Israel Mediterranean to arid transition zone

Site name Israel Mediterranean to arid transition zone	Country ISRAEL	Lat/Long North west corner: 31°50'34.69 N 34°38'13.54 E South east corner: 30°56'35.27N 35°36'38.02E	Length of operation 20 YEARS
Long term scientific objectives Biosphere—atmosphere interactions			
Site PI Maxim Shoshany	Institute: Technion, Israel Institute of Technology	Contact details maximsh@tx.technion.ac.il	
Optical measurement PI Anatoly Gitelson	Institute Technion, Israel Institute of Technology	Agitelson2@unl.edu	
Site manager Maxim Shoshany	Institute: Technion, Israel Institute of Technology	Contact details maximsh@tx.technion.ac.il	
Intra-structure Long-term monitoring of transition ecosystems: air-photographs, satellite images, GIS, field spectroscopy and ground truth.		Other associated networks (i.e. ICOS, AERONET etc)  Fluxnet, AMERIFLUX, OPTIMISED NETWORK	
Optical measurements made  Thermal multi-spectral flight, Close range SWIR and RGB&NIR images	Optical instruments  GER 2500 Spectroradiometer, Thermal Camera, SWIR camera	Optical measurements planned  Hyperspectral field measurements	Instruments planned
Ecosystem type Mediterranean Woodlands, shrublands, Dwarf-shrublands, desert fringe Bata	Dominant species Shrublands in areas with rainfall higher than 350 mm/year are populated by three associations: Quercus Calliprinos and Pistacia Lentiscus, Ceratonia Siliqua and Pistacia Lentiscus, and Rhamnus palaestinus. Highly disturbed shrublands are occupied by the mixing of the above described shrub associations with Herbaceous plants of the Hyparrhenia hirta community together with the batha of the Sarcopoterium Spinosium. The desert fringe batha in areas with less than 350 mm/year rainfall is dominated by the Sarcopoterium Spinosium and the Thymelaea hirsute dwarf-shrubs.	Degree and scale of heterogeneity Very high spatial heterogeneity	
Publications (approx. number of ISI per annum from site) 3			
Any additional information. <a href="http://www.maximshoshany.com/">http://www.maximshoshany.com/</a>			

8.2.13  
Laegeren

Site name Laegeren	Country Switzerland	Lat/Long 47 28 50 / 008 20 00	Length of operation 2005 – ongoing within University Research Priority Program
Long term scientific objectives: Global change monitoring, biodiversity, forest structure, phenology			
Site PI Nina Buchmann & Werner Eugster	Institute: ETH Zurich	Contact details nina.buchmann@usys.ethz.ch	
Optical measurement PI M. Schaepman	Institute: RSL, University of Zurich	Contact details michael.schaepman@geo.uzh.ch	
Site manager	Institute: Mainly ETH Zurich	Contact details nina.buchmann@usys.ethz.ch	
Intra-structure Flux tower, Soil respiration (CO <sub>2</sub> ), carbon stocks, temperature, moisture, forest inventory, phenology, biomass, LAI, tree physiology, tree growth		Other associated networks (i.e. ICOS, AERONET etc) CarboEuropeIP (CH-LAE)	
Optical measurements made  Irradiance, canopy reflectance, forest structure via LIDAR and UAV based 3d modelling	Optical instruments  PAR lite Kipp & Zonen, Phenocam, Unispec APEX airborne imaging spectroscopy data (2009-2013), airborne LIDAR, ebee UAV RGB	Optical measurements planned  -	Instruments planned  APEX successor within the ARES project in collaboration with NASA JPL
Ecosystem type Temperate mountainous forest	Dominant species:  Predominately European beech ( <i>Fagus sylvatica</i> (L.)), European ash ( <i>Fraxinus excelsior</i> (L.)), and sycamore maple ( <i>Acer pseudoplatanus</i> (L.)) at higher elevations and silver fir ( <i>Abies alba</i> (Mill.)),	Degree and scale of heterogeneity  Mixed temperate forest; paper on functional diversity of site to be submitted.	

	Norway spruce ( <i>Picea abies</i> (L.)), and European beech at lower elevations.	
Publications (approx. number of ISI per annum from site) 2 - 3		
Any additional information, web site URL etc  <a href="http://www.fluxdata.org:8080/SitePages/siteInfo.aspx?CH-Lae">http://www.fluxdata.org:8080/SitePages/siteInfo.aspx?CH-Lae</a>		

#### 8.2.14 Barbeau

Site name Barbeau	Country France	Lat/Long 48.4764°/2.7801°	Length of operation
Long term scientific objectives Biosphere—atmosphere interactions The Barbeau forest site is one of the 15 French sites involved in the ICOS Ecosystem network ( <a href="http://www.europe-fluxdata.eu/icos">http://www.europe-fluxdata.eu/icos</a> ). ICOS, for Integrated Carbon Observation System, is a new European infrastructure dedicated to high precision monitoring of greenhouse gas fluxes for long term (20+ years) observatory. Description of Barbeau and data of the main variables in real time available on <a href="http://www.barbeau.u-psud.fr/index.html">http://www.barbeau.u-psud.fr/index.html</a> .			
Site PI Eric Dufrene	Institute: ESE - Ecology Systematics Evolution Laboratory CNRS University Paris Sud Orsay AgroParisTech.	Contact details eric.dufrene@u-psud.fr	
Optical measurement PI Kamel Soudani	Institute ESE - Ecology Systematics Evolution Laboratory CNRS University Paris Sud Orsay AgroParisTech.	Contact details Kamel.soudani@u-psud.fr	
Site manager Daniel Berveiller	Institute: ESE - Ecology Systematics Evolution Laboratory CNRS University Paris Sud Orsay AgroParisTech.	Contact details daniel.berveiller@u-psud.fr	
Intra-structure - flux tower (micrometeorology; H2O and CO2 fluxes; soil respiration, tree growth, Leaf area index, soil moisture... - leaf gas exchange		Other associated networks (i.e. ICOS, AERONET etc) - SOERE FORET ( <a href="http://www.gip-ecofor.org/f-ore-t/">http://www.gip-ecofor.org/f-ore-t/</a> ) - ICOS - SPECNET	
Optical measurements made - canopy radiometry in	Optical instruments	Optical measurements planned	Instruments planned

thermal band - continuous measurements of NDVI, PRI, Phenology Camera - continuous measurements of SIF and whole visible spectrum (functional)			
Ecosystem type Deciduous forest	Dominant species Oak	Degree and scale of heterogeneity	
Publications (approx. number of ISI per annum from site)			
Any additional information, web site URL etc <a href="http://www.barbeau.u-psud.fr/index-fr.html">http://www.barbeau.u-psud.fr/index-fr.html</a>			

## 82.15 Toulouse

Site name Toulouse	Country France	Lat/Long 43.572898° 1.374384°	Length of operation
<p>Long term scientific objectives Biosphere—atmosphere interactions Used for the validation of operational models of Meteo-France (SURFEX, ARPEGE, AROME), for the demonstration of new remote sensing techniques (e.g. GNSS-R), for the validation of airborne measurements (e.g. AHSPECT), for the CAL/VAL of satellite missions. Data are available in real time for in-house purposes but could be made available in real time to other partners.</p>			
Site PI Jean-Christophe Calvet	Institute: Meteo-France	Contact details jean-christophe.calvet@meteo.fr	
Optical measurement PI Jean-Louis Roujean	Institute	Contact details jean-louis.roujean@meteo.fr	
Site manager Soil and atmospheric observations: olivier.garrouste@meteo.fr  Data processing and quality monitoring: william.maurel@meteo.fr	Institute:	Contact details	
<p>Intra-structure</p> <ul style="list-style-type: none"> <li>- presence of water intercepted by vegetation (rain, dew)</li> <li>- soil moisture profile</li> <li>- soil temperature profile</li> <li>- surface temperature</li> <li>- surface albedo</li> <li>- transmissivity of PAR in vegetation canopy (0.1m, 0.2m, 0.3m)</li> <li>- destructive measurements of LAI, green/brown above-ground biomass, necromass</li> <li>- wind speed, air temperature, air humidity, atm. pressure, precipitation</li> <li>- aerosol optical depth (photometer)</li> <li>- turbulent fluxes (H, LE, CO<sub>2</sub>)</li> <li>- downwelling and upwelling solar radiation</li> <li>- downwelling and upwelling infrared radiation</li> <li>- downwelling and upwelling PAR</li> <li>- fraction of diffuse incoming PAR</li> </ul>		Other associated networks (i.e. ICOS, AERONET etc)	
Optical measurements made - GNSS reflectometry - Local multi-band	Optical instruments	Optical measurements planned	Instruments planned

surface reflectance using the aerosol photometer			
Ecosystem type	Dominant species Grassland	Degree and scale of heterogeneity	
Publications (approx. number of ISI per annum from site)			
Any additional information, web site URL etc <a href="http://www.cnrm.meteo.fr/spip.php?article874&amp;lang=en">http://www.cnrm.meteo.fr/spip.php?article874&amp;lang=en</a>			

## 8.2.16 Hesse

Site name Hesse	Country	Lat/Long 48.674120°N/7.06463 7°E Altitude:309m	Length of operation
Long term scientific objectives Biosphere—atmosphere interactions			
Site PI Bernard Longdoz	Institute:	Contact details longdoz@nancy.inra.fr	
Optical measurement PI Kamel Soudani	Institute ESE - Ecology Systematics Evolution Laboratory CNRS University Paris Sud Orsay AgroParisTech.	Contact details Kamel.soudani@u- psud.fr	
Site manager	Institute:	Contact details	
Intra-structure - flux tower (micrometeorology; CO <sub>2</sub> , H <sub>2</sub> O and sensible heat fluxes; soil respiration, tree growth, Leaf area index, soil moisture, t°, conduction and water table depth, APAR - leaf gas exchange		Other associated networks (i.e. ICOS, AERONET etc) - SOERE FORET ( <a href="http://www.gip-&lt;br/&gt;ecofor.org/f-ore-t/">http://www.gip- ecofor.org/f-ore-t/</a> ) - ICOS	
Optical measurements made - canopy radiometry in thermal band - NDVI, PRI, Phenology Camera and in situ observations	Optical instruments	Optical measurements planned	Instruments planned
Ecosystem type Deciduous forest	Dominant species Beeches	Degree and scale of heterogeneity	
Publications (approx. number of ISI per annum from site)			
Any additional information, web site URL etc			

### 8.2.17 Puechabon

Site name Puechabon	Country France	Lat/Long 43.7414°N/3.5958°E Altitude:270 m	Length of operation
Long term scientific objectives Biosphere—atmosphere interactions			
Site PI Richard Joffre	Institute:	Contact details richard.joffre@cefe.cnrs.fr	
Optical measurement PI Kamel Soudani Daniel Berviller	Institute	Contact details <a href="mailto:kamel.soudani@u-psud.fr">kamel.soudani@u-psud.fr</a> <a href="mailto:daniel.berveiller@u-psud.fr">daniel.berveiller@u-psud.fr</a>	
Site manager Karim Piquemal	Institute:	Contact details karim.piquemal@cefe.cnrs.fr	
Intra-structure - flux tower (micrometeorology; CO <sub>2</sub> , H <sub>2</sub> O and sensible heat fluxes; soil respiration, Leaf area index, soil moisture, etc.) - canopy radiometry in thermal band		Other associated networks (i.e. ICOS, AERONET etc) - SOERE FORET <a href="http://www.gip-ecofor.org/f-ore-t/">http://www.gip-ecofor.org/f-ore-t/</a> - ICOS	
Optical measurements made - continuous measurements of NDVI, PRI - continuous measurements of SIF and whole visible spectrum measurements (functional)	Optical instruments	Optical measurements planned	Instruments planned
Ecosystem type Evergreen broadleaf forest	Dominant species Holm oak ( <i>Quercus ilex</i> L.)	Degree and scale of heterogeneity	
Publications (approx. number of ISI per annum from site)			
Any additional information, web site URL etc			

### 8.2.18 Eucflux

Site name Eucflux, Sao Paulo	Country Brazil	Lat/Long 22.96683°S, / 48.72763°W	Length of operation
Long term scientific objectives Biosphere—atmosphere interactions			
Site PI Guerric Le Maire	Institute: CIRAD	Contact details guerric.le_maire@cira d.fr	
Optical measurement PI Kamel Soudani Daniel Berveiller	Institute	Contact details <a href="mailto:kamel.soudani@u-psud.fr">kamel.soudani@u- psud.fr</a> daniel.berveiller@u- psud.fr	
Site manager	Institute:	Contact details	
Intra-structure - flux tower (micrometeorology; CO <sub>2</sub> , H <sub>2</sub> O, Leaf area index, soil moisture, etc.)		Other associated networks (i.e. ICOS, AERONET etc) - SOERE FORET <a href="http://www.gip-&lt;br/&gt;ecofofor.org/f-ore-t/">http://www.gip- ecofofor.org/f-ore-t/</a> - ICOS	
Optical measurements made - canopy radiometry in thermal band - continuous measurements of NDVI, PRI - continuous measurments of SIF and whole visible spectrum measurements (functional)	Optical instruments	Optical measurements planned	Instruments planned
Ecosystem type	Dominant species Eucalyptus	Degree and scale of heterogeneity	
Publications (approx. number of ISI per annum from site)			
Any additional information, web site URL etc			

### 8.2.19 Font-Blanche

Site name Font-Blanche	Country France	Lat/Long 43.2408°N/5.6792 °E Altitude:436m	Length of operation
Long term scientific objectives Biosphere—atmosphere interactions			
Site PI Guillaume Simioni	Institute:	Contact details <a href="mailto:guillaume.simioni@avignon.inra.fr">guillaume.simioni@avignon.inra.fr</a>	
Optical measurement PI Kamel Soudani Daniel Berveiller	Institute	Contact details <a href="mailto:kamel.soudani@u-psud.fr">kamel.soudani@u-psud.fr</a> <a href="mailto:daniel.berveiller@u-psud.fr">daniel.berveiller@u-psud.fr</a>	
Site manager	Institute:	Contact details	
Intra-structure - flux tower (micrometeorology; H2O and CO2 fluxes; soil respiration, tree growth, Leaf area index, soil moisture...		Other associated networks (i.e. ICOS, AERONET etc) - SOERE FORET <a href="http://www.gip-ecofor.org/f-ore-t/">http://www.gip-ecofor.org/f-ore-t/</a> - ICOS	
Optical measurements made - canopy radiometry in thermal band - continuous measurements of NDVI, PRI	Optical instruments	Optical measurements planned - continuous SIF and whole visible spectrum measurements	Instruments planned
Ecosystem type Evergreen Needleleaf Trees	Dominant species	Degree and scale of heterogeneity	
Publications (approx. number of ISI per annum from site)			
Any additional information, web site URL etc			

### 8.2.20 Guyaflux

Site name Guyaflux, Paracou	Country French Guiana	Lat/Long 5.27877187728882 N°/52.924861907959° WAltitude: 48 m	Length of operation
Long term scientific objectives Biosphere—atmosphere interactions			
Site PI Damien Bonal	Institute: INRA Nancy	Contact details bonal@nancy.inra.fr	
Optical measurement PI Kamel Soudani	Institute: Univ. Paris-Sud	Contact details kamel.soudani@u-psud.fr	
Site manager (Engineer) Benoît Burban	Institute: INRA Kourou	Contact details Benoit.burban@ecofo g.gf	
Infra-structure - Complete flux tower with eddy covariance CO <sub>2</sub> , H <sub>2</sub> O (Gill R3-50, LicorL Li7500), soil temperature, soil moisture (TDR sensors CS616 at 10cm, 20cm, 80cm, 160 cm, 260 cm), wind speed and directions (Young), CO <sub>2</sub> vertical profile (Li840), vertical profile of air temperature and relative humidity (HMP155A at 2m, 32m, 57m), air pressure, rainfall) - Litterfall production - Tree growth (3000 trees inventoried every 2 years)		Other associated networks (i.e. ICOS, AERONET etc) - SOERE FORET <a href="http://www.gip-ecofo.org/f-ore-t/">http://www.gip-ecofo.org/f-ore-t/</a> - ICOS [Level 2 site]	
Optical measurements made - global and net radiation (Kipp & Zonen CNR4) - PAR : direct, diffuse (Delta T BF5) - continuous measurements of NDVI, PRI	Optical instruments	Optical measurements planned - continuous SIF and whole visible spectrum measurements	Instruments planned
Ecosystem type Undisturbed natural rainforest forest - no known human perturbation for centuries except few, logged trees	Dominant species None	Degree and scale of heterogeneity  Highly complex and diverse forest structure	
Publications (approx. number of ISI per annum from site) 3-4			
Any additional information, web site URL etc			

### 8.2.21 Bilos

Site name Bilos	Country France	Lat/Long 44.4939 N°/0.9559°W Altitude: 38 m	Length of operation
Long term scientific objectives Biosphere—atmosphere interactions			
Site PI Denis Lousteau	Institute:	Contact details denis.Lousteau@bordeaux.inra.fr	
Optical measurement PI	Institute	Contact details	
Site manager (Engineer) Christophe Chipeaux Daniel Berveiller Kamel Soudani	Institute:	Contact details <a href="mailto:christophe.chipeaux@pierroton.inra.fr">christophe.chipeaux@pierroton.inra.fr</a> <a href="mailto:daniel.berveiller@u-psud.fr">daniel.berveiller@u-psud.fr</a> kamel.soudani@u-psud.fr	
Intra-structure - flux tower (micrometeorology; H2O and CO2 fluxes; soil respiration, soil moisture...		Other associated networks (i.e. ICOS, AERONET etc) - SOERE FORET <a href="http://www.gip-ecofor.org/f-ore-t/">http://www.gip-ecofor.org/f-ore-t/</a> - ICOS	
Optical measurements made - canopy radiometry in thermal band - continuous measurements of NDVI, PRI	Optical instruments	Optical measurements planned - continuous SIF and whole visible spectrum measurements	Instruments planned
Ecosystem type Evergreen Needleleaf Trees	Dominant species Pine	Degree and scale of heterogeneity	
Publications (approx. number of ISI per annum from site)			
Any additional information, web site URL etc			

## 8.2.22 Grignon

Site name Grignon	Country France	Lat/Long 48.84422/1.95191 Altitude: 125m	Length of operation
Long term scientific objectives Biosphere—atmosphere interactions			
Site PI Benjamin Loubet	Institute: ECOSYS, INRA	Contact details benjamin.loubet@grignon.inra.fr	
Optical measurement PI	Institute	Contact details	
Site manager Nicolas Mascher	Institute:	Contact details nicolas.mascher@grignon.inra.fr	
Intra-structure - eddy covariance CO <sub>2</sub> , H <sub>2</sub> O (Gill HS-50, LiCr Li7200, Gill R3-50, LicorL Li7500) - soil temperature (Pt100 x 20 at 5cm, 10cm, 20cm, 30cm, 60cm, 90cm) - soil heat flux ( HukseFlux HFP01SC x4 at 5cm) - soil moisture (TDR sensors CS650 x20 at 5cm, 10cm, 20cm, 30cm, 60cm, 90cm) - wind speed and 3D directions (Gill HS-50, Gill R3-50) - wind vertical profile (Gill WindSonic x5 at 0.3m, 0.7m, 2m, 3m, 5m) - vertical profil of air temperature and relative humidity (Vaisale HMP155A x3 at 1m, 3m, 5m) - air pressure (Young 61302V) - rainfall (Précis Mécanique 3029/2)		Other associated networks (i.e. ICOS, AERONET etc) - ICOS	
Optical measurements made - global and net radiation (Kipp & Zonen CMP22, CNR4) - PAR: incident, reflected, transmitted (Kipp & Zonen PQS1 x2, PQS1 x6) - PAR : direct, diffuse (Delta T BF5)	Optical instruments	Optical measurements planned - continuous SIF and whole visible spectrum measurements	Instruments planned
Ecosystem type crops	Dominant species maize, wheat, barley, oiseed-rape	Degree and scale of heterogeneity	
Publications (approx. number of ISI per annum from site)			
Any additional information, web site URL etc <a href="https://ecosys.versailles-grignon.inra.fr/icos/index-en.html">https://ecosys.versailles-grignon.inra.fr/icos/index-en.html</a>			

### 8.2.23 Lamasquère

Site name Lamasquère	Country France	Lat/Long 43.78°N 01.40°E	Length of operation
<p>Long term scientific objectives Biosphere—atmosphere interactions</p> <p>The Lamasquere crop site is one of the 15 French sites involved in the ICOS Ecosystem network (<a href="http://www.europe-fluxdata.eu/icos">http://www.europe-fluxdata.eu/icos</a>).</p> <p>ICOS, for Integrated Carbon Observation System, is a new European infrastructure dedicated to high precision monitoring of greenhouse gas fluxes for long term (20+ years) observatory.</p>			
Site PI Tiphaine Tallec	Institute: CESBIO Toulouse	Contact details tiphaine.tallec@cesbio.cnes.fr	
Optical measurement PI	Institute	Contact details	
Site manager	Institute:	Contact details	
<p>Intra-structure</p> <ul style="list-style-type: none"> <li>- flux tower (micrometeorology; CO<sub>2</sub>, H<sub>2</sub>O and sensible heat fluxes;</li> <li>- Leaf area index, soil moisture, t°, APAR</li> </ul>		<p>Other associated networks (i.e. ICOS, AERONET etc)</p> <ul style="list-style-type: none"> <li>- ICOS</li> </ul>	
Optical measurements made - canopy radiometry in thermal band - NDVI, PRI	Optical instruments	Optical measurements planned	Instruments planned
Ecosystem type Crops	Dominant species Corn, wheat	Degree and scale of heterogeneity	
Publications (approx. number of ISI per annum from site)			
<p>Any additional information, web site URL etc</p> <p><a href="http://www.cesbio.ups-tlse.fr/data_meteo/index.php?perma=1378391664">http://www.cesbio.ups-tlse.fr/data_meteo/index.php?perma=1378391664</a></p>			

### 8.2.24 Garraf

Site name Garraf	Country Catalonia-Spain	Lat/Long 1° 49' E 41° 18' N	Length of operation Since 1999
<p>Long term scientific objectives Biosphere—atmosphere interactions</p>			
Site PI Josep Penuelas	Institute: CREAF	Contact details <a href="mailto:josep.penuelas@uab.cat">josep.penuelas@uab.cat</a> +34935812199	CREAF UAB, Fac. Ciències E-08193 Barcelona SPAIN
Optical measurement PI Josep Penuelas	Institute CREAF	Contact details <a href="mailto:josep.penuelas@uab.cat">josep.penuelas@uab.cat</a> +34935812199	CREAF UAB, Fac. Ciències E-08193 Barcelona SPAIN
Site manager Romà Ogaya	Institute: CREAF	Contact details r.ogaya@creaf.uab.cat	CREAF UAB,

			Fac. Ciències E-08193 Barcelona SPAIN
Intra-structure		Other associated networks (i.e. ICOS, AERONET etc)	
Optical measurements made Chlorophyll fluorescence Reflectance	Optical instruments Fluorometer (walz) Reflectometer	Optical measurements planned	Instruments planned
Ecosystem type Mediterranean shrubland	Dominant species <i>Erica multiflora</i> <i>Globularia alypum</i> <i>Rosmarinus officinalis</i>	Degree and scale of heterogeneity	
Publications (approx. number of ISI per annum from site) 10			
Any additional information, web site URL etc <a href="http://globalecology.creaf.cat">http://globalecology.creaf.cat</a>			

#### 8.2.25 Nouragues

Site name	Country	Lat/Long	Length of operation
Nouragues	French Guiana	52° 41' W 4° 05' N	Since 2015
Long term scientific objectives Biosphere—atmosphere interactions			
Site PI Jerome Chave-Josep Penuelas	Institute: CNRS CREAF	Contact details <a href="mailto:josep.penuelas@uab.cat">josep.penuelas@uab.cat</a> +34935812199	CREAF UAB, Fac. Ciències E-08193 Barcelona SPAIN
Optical measurement PI Josep Penuelas	Institute CREAF	Contact details <a href="mailto:josep.penuelas@uab.cat">josep.penuelas@uab.cat</a> +34935812199	CREAF UAB, Fac. Ciències E-08193 Barcelona SPAIN
Site manager Aurèlie Dourdain	Institute: CIRAD	Contact details <a href="mailto:Aurèlie.Dourdain@ecofog.gf">Aurèlie.Dourdain@ecofog.gf</a> +594 594329217	CIRAD French Guiana
Intra-structure		Other associated networks (i.e. ICOS, AERONET etc)	
Optical measurements made Chlorophyll fluorescence Reflectance	Optical instruments Fluorometer (walz) Reflectometer	Optical measurements planned	Instruments planned
Ecosystem type	Dominant species	Degree and scale of heterogeneity	

Tropical forest	<i>Eperua falcata</i> and many other sp.	
Publications (approx. number of ISI per annum from site) 10		
Any additional information, web site URL etc <a href="http://globalecology.creaf.cat">http://globalecology.creaf.cat</a>		

#### 8.2.26 Paracou

Site name	Country	Lat/Long	Length of operation
Paracou	French Guiana	52° 53' W 5° 18' N	Since 2015
Long term scientific objectives Biosphere—atmosphere interactions			
Site PI Bruno Herault Josep Penuelas	Institute: Ecofog- CIRAD CREAF	Contact details <a href="mailto:josep.penuelas@uab.cat">josep.penuelas@uab.cat</a> +34935812199	CREAF UAB, Fac. Ciències E-08193 Barcelona SPAIN
Optical measurement PI Josep Penuelas	Institute CREAF	Contact details <a href="mailto:josep.penuelas@uab.cat">josep.penuelas@uab.cat</a> +34935812199	CREAF UAB, Fac. Ciències E-08193 Barcelona SPAIN
Site manager Aurèlie Dourdain	Institute: CIRAD	Contact details <a href="mailto:Aurèlie.Dourdain@ecofog.gf">Aurèlie.Dourdain@ecofog.gf</a> +594 594329217	CIRAD French Guiana
Intra-structure	Other associated networks (i.e. ICOS, AERONET etc)		
Optical measurements made Chlorophyll fluorescence Reflectance	Optical instruments Fluorometer (walz) Reflectometer	Optical measurements planned	Instruments planned
Ecosystem type Tropical forest	Dominant species <i>Eperua falcata</i> and many other sp.	Degree and scale of heterogeneity	
Publications (approx. number of ISI per annum from site) 10			
Any additional information, web site URL etc <a href="http://globalecology.creaf.cat">http://globalecology.creaf.cat</a>			

#### 8.2.27 Prades

Site name	Country	Lat/Long	Length of operation
Prades	Catalonia-Spain	1° 2' E 41°21' N	Since 1999
Long term scientific objectives Biosphere—atmosphere interactions			
Site PI Josep Penuelas	Institute: CREAF	Contact details <a href="mailto:josep.penuelas@uab.cat">josep.penuelas@uab.cat</a>	CREAF UAB,

		+34935812199	Fac. Ciències E-08193 Barcelona SPAIN
Optical measurement PI Josep Penuelas	Institute CREAF	Contact details <a href="mailto:josep.penuelas@uab.cat">josep.penuelas@uab.cat</a> +34935812199	CREAF UAB, Fac. Ciències E-08193 Barcelona SPAIN
Site manager Romà Ogaya	Institute: CREAF	Contact details <a href="mailto:r.ogaya@creaf.uab.cat">r.ogaya@creaf.uab.cat</a>	CREAF UAB, Fac. Ciències E-08193 Barcelona SPAIN
Intra-structure		Other associated networks (i.e. ICOS, AERONET etc)	
Optical measurements made Chlorophyll fluorescence Reflectance	Optical instruments  Fluorometer (walz) Reflectometer	Optical measurements planned	Instruments planned
Ecosystem type Mediterranean forest	Dominant species Quercus ilex Phillyrea latifolia Arbutus unedo	Degree and scale of heterogeneity	
Publications (approx. number of ISI per annum from site) 10			
Any additional information, web site URL etc <a href="http://globalecology.creaf.cat">http://globalecology.creaf.cat</a>			

#### 8.2.28 Dahra

Site name	Country	Lat/Long	Length of operation
Dahra test site	Senegal	15.40° N, 15.43° W	2002-present
Long term scientific objectives Biosphere—atmosphere interactions			
Site PI Rasmus Fensholt	Institute: Department of geosciences and natural resource management, University of Copenhagen	Contact details <a href="mailto:rf@ign.ku.dk">rf@ign.ku.dk</a>	
Optical measurement PI Torbern Tagesson	Institute: Department of geosciences and natural resource management, University of Copenhagen	Contact details <a href="mailto:torbern.tagesson@ign.ku.dk">torbern.tagesson@ign.ku.dk</a>	
Site manager	Institute:	Contact details	

Idrissa Guiro	Université Cheikh Anta Diop, Dakar, Senegal	<a href="mailto:idyguiro@yahoo.fr">idyguiro@yahoo.fr</a>	
Intra-structure: 3 towers; a meteorological tower with meteorological, hydrological and radiation sensors, a flux tower with an eddy covariance system for CO <sub>2</sub> , H <sub>2</sub> O and energy flux measurement, and a land surface temperature tower equipped with infrared thermometers (IRT).		Other associated networks; SpecNet; fluxnet; International Soil Moisture Network	
Optical measurements made: Various spectro-radiometers covering from 350-1800 nm	Optical instruments  Skye single channel PAR sensor setup (for FAPAR validation)  Skye 2 and 4 channel sensors (various spectral configurations covering visible wavelength including PRI configuration)  ASD fully automatic measurement setup for reflectance measurements (multi-angular to test importance of VZA)	Optical measurements planned  Continuation of existing measurement setup (future activities might depend on funding availability).	Instruments planned  Continuation of existing measurement setup  Any new instruments that would fit the specific purpose of ESA mission validation could be installed.
Ecosystem type: Savanna environment (herbaceous vegetation and app. 5% tree cover)	Dominant species Tree species: Balenites Aegyptiaca, Acacia tortilis and Acacia Senegal Herbaceous vegetation: Zornia latifolia, Cenchrus biflorus,	Degree and scale of heterogeneity Site selected due to the homogenous nature of the landscape, facilitating point to pixel comparisons (as documented in several research papers)	
Publications (approx. number of ISI per annum from site) Total of 26 ISI publications include data from the site			
Any additional information, web site URL etc Site and measurements described in: Global Change Biology (2015) 21 (1), 250-264. Ecosystem properties of semi-arid savanna grassland in West Africa and its relationship to environmental variability			

#### 8.2.29 Bugacpuszta

Site name Bugacpuszta (HU-BUG)	Country Hungary	Lat/Long 46.6911N/19.6013E	Length of operation eddy (CO <sub>2</sub> /H <sub>2</sub> O) fluxes + ancillary variables:
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			13 calendar years (operation from July, 2002), grazed grassland 5 calendar years (mowed grassland)
Long term scientific objectives Biosphere—atmosphere interactions Interannual variability (NEE GPP) and resilience of a (permanent) grassland ecosystem under frequent droughts. Background of microscale (0.1m -100m) spatial heterogeneity of fluxes and their drivers.			
Site PI Zoltán Nagy	Institute: Szent István University, Institute of Botany & Ecophysiology	Contact details <a href="mailto:nagy.zoltan@mkk.szie.hu">nagy.zoltan@mkk.szie.hu</a> +3628522075 (office) +36304662444 (mobile)	
Optical measurement PI Zoltán Nagy	Institute Szent István University, Institute of Botany & Ecophysiology	Contact details	
Site manager Krisztina Pinter	Institute: MTA-SZIE Plant Ecology Research Group at Szent István University, Institute of Botany & Ecophysiology	Contact details <a href="mailto:pinter.krisztina@mkk.szie.hu">pinter.krisztina@mkk.szie.hu</a> +3628522075 (office)	
<b>Infra-structure</b> <ul style="list-style-type: none"> <li>- 500 ha permanent (more than 40 years) grassland</li> <li>- Sampling grid (permanent over 3 years, 10m resolution, ~100*70m extension) for finer scale spatial studies</li> <li>- eddy covariance station (carbon exchange and evapotranspiration + auxiliary variables like soil water content, incoming and reflected rad. components, etc)</li> <li>- Devices for measuring leaf scale gas-exchange (CO<sub>2</sub>/H<sub>2</sub>O) and stand scale gas exchange (chambers)</li> <li>- soil CO<sub>2</sub> (N<sub>2</sub>O) fluxes</li> </ul>		<b>Other associated networks</b> FLUXNET <a href="http://fluxnet.ornl.gov/site/504">http://fluxnet.ornl.gov/site/504</a>	
Optical measurements made - incoming/reflected total solar and PAR	Optical instruments - multispectral camera on rotary wings UAVs	Optical measurements planned hyperspectral and thermal image	Instruments planned Hyperspectral (imaging)

<p>radiation (for broadband NDVI, continuous)</p> <ul style="list-style-type: none"> <li>- Multispectral imagery (~3cm spat. res.) acquired over the eddy flux footprint in campaigns (ground control: LAI (PAR ceptometer) and biomass measurements, species)</li> </ul>	<ul style="list-style-type: none"> <li>- spectrometer (Ocean Optics and Cubert, handheld types)</li> <li>- ceptometers (LAI estimation)</li> <li>- Instruments for measuring chlorophyll-fluorescence (also modulated)</li> <li>-</li> </ul>	<p>acquisitions from selected points on the permanent grid/ form UAVs (multicopters)</p> <p>leaf scale chlorophyll fluorescence measurements (Fv/Fm –Fs (steady state fluorescence))</p>	<p>camera</p>
<p>Ecosystem type semiarid sand grassland (permanent)</p> <p>treatments: grazed(13 site years)/mowed (5 site years)</p>	<p>Dominant species</p> <p>Grass species: <i>Festuca pseudovina</i>, <i>Poa trivialis</i>, <i>Elymus repens</i></p> <p>Forbs: <i>Salvia pratensis</i>, <i>Achillea collina</i>...</p> <p>Total species number over 80 on a hectare</p>	<p>Degree and scale of heterogeneity</p> <p>General:</p> <ul style="list-style-type: none"> <li>- the flux footprint is within the grassland (relatively large area)</li> <li>- high plant diversity (number of plant species ~80/ha)</li> <li>- slightly undulating surface (asl variation. 2m)</li> </ul> <p>Specific:</p> <ul style="list-style-type: none"> <li>- spatial autocorrelation lengths of soil CO<sub>2</sub> effluxes is below 1m under good water supply and is similar to 5m under droughts with psill% (“structured” variance) of similar to 70%. Similar data (geostatistics) are available for biomass and abiotic drivers of (CO<sub>2</sub>, N<sub>2</sub>O) fluxes.</li> </ul>	
<p>Publications (approx. number of ISI per annum from site)</p> <p>3</p>			
<p>Any additional information, web site URL etc</p> <p><a href="http://nofi.szie.hu/content/mta-szie-plant-ecology-research-group">http://nofi.szie.hu/content/mta-szie-plant-ecology-research-group</a></p>			