

Project Number 282910

ÉCLAIRE

**Effects of Climate Change on Air Pollution Impacts and Response
Strategies for European Ecosystems**

Seventh Framework Programme

Theme: Environment

D10.1 Ecosystem and plant characteristic data for model application

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Organisation name of lead contractor for this deliverable :
DTU

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Dissemination Level		
PU	Public	<input type="checkbox"/>
PP	Restricted to other programme participants (including the Commission Services)	<input checked="" type="checkbox"/>
RE	Restricted to a group specified by the consortium (including the Commission Services)	<input type="checkbox"/>
CO	Confidential, only for members of the consortium (including the Commission Services)	<input type="checkbox"/>

1. Executive Summary

Application of ecosystem models to ecosystem experiments requires 3 types of data:

- Site characteristics: Variables describing key characteristics of plants, soils, atmosphere, water etc,
- Driving variables: Climate and management variables providing the “pressure” on the system
- Response variables: Measurements of various responses in the ecosystem as a consequence of the change in drivers.

Site characteristics are typically determined by the model structure and can have different degrees of site dependence. In order to apply the ecosystem models to the experimental sites in ECLAIRE, the site characteristics must be provided to the modellers based on measurements or literature values where site measurements are not available.

The site characteristics are uploaded to the ECLAIRE database.

Objectives:

Providing site characteristics data for modellers

2. Activities:

Upload site characteristic data from all ecosystem experiments

3. Results:

Data in database

4. Milestones achieved:

Data uploaded

5. Deviations and reasons:

Delay because of delays in experimental setup and in database setup

6. Publications:

None

7. Meetings:

None

8. List of Documents/Annexes:

ECLAIRE Database

Site	Importance score 0 - 2)	Frequency	Units	Bangor, UK		Italy (UNICATT)	Copenhagen, Denmark		Madrid, Spain		FDEA-ART	Edinburgh, UK	CNR, Italy	Germany
Vegetation				Trees (silver birch)	Ombrotrophic bog (Whim)	Trees (oak, hornbeam)	Shrubland	Crops (barley, oil seed rape)	Leafy crop	Mediterranean grassland	Sub-alpine grassland	Ombrotrophic bog (Whim)	Oaks, poplars, wheat	Scots pine, beech, sunflower
Establishment period/age of vegetation					3 years old	3 years old	>10 years	< 1 year	growing season	annual plants 2 growing seasons	?	> 10 years	> 10 years	pine: 3 years, beech: 2 years, sunflower: 2-4 months
Experimental design				Solardomes	cores from Whim in solardomes	Open-top chambers	Open-top chambers	Phytothron	Open-top chambers	Open-top chambers	Field	Field	?Controlled Environment Chambers	Controlled Environment, ventilated greenhouses, chambers
Treatments				7 x O3, 4 x Wet N dep, AA + 4 x wet N	O3 x 4 treatments	4 x O3 2 x Wet N dep	O3, soil moisture, CO2, Temperature	CO2, ToC, soil moisture, O3	O3 x 4 treatments, N x 3 treatments; n=3 per treatment	O3 x 4 treatments, N x 3 treatments; n=3 per treatment	O3, N dep	Wet and dry, NOx/NHy dep, O3 (soil moisture + ToC)	BVOCs, O3, NO, ToC, water, CO2, aerosol	Aerosol dep on gsto
open field				no		NO	Yes	No	an additional AA (ambient air treatment without chamber)	an additional AA (ambient air treatment without chamber)				no
Pot or container				yes	yes	YES	No	Yes	2013: yes 2014: no	no				yes

Container volume			Litres			10,00		9,00	2013: 6 l					7.5 litres
Year				2012, 2013	2014?	2012-2013	2012-2013	2009,00	2013, 2014	2011,20	2012, 2013	2012, 2013	?	?
Model simulation				DO ₃ SE, Forspace, VSD-N14C-MM, DNDC mobile, VSD+	DO3SE, VSD-N14C-MM, DNDC mobile, VSD+	DO3SE, Forspace, VSD-N14C-MM, DNDC mobile, VSD+	DO3SE, Forspace, VSD-N14C-MM, DNDC mobile, VSD+	DO3SE	DO3SE	DO3SE	DO3SE, VSD-N14C-MM, DNDC mobile, VSD+	DO3SE, VSD-N14C-MM, DNDC mobile, VSD+	DO3SE	DO3SE?
Data to be collected														
Meteorology	Importance score 0 - 2)	Frequency	Units											
Solar radiation (or derivatives) (hourly, daily or monthly)	1,00	(hourly (hr), daily (d))	W/m ²	hr	hr	hr	hr	hr	hr	hr		hr		n.a.
Precipitation	1,86	daily (d), annual (a)	m	n.a.	n.a.	d	day		day	day		hr		n.a.
Runoff	0,71	Annual	m	n.a.	n.a.	n.a.	n.a.	n.a.	n.a	n.a		n.a.		n.a.
Air temperature	1,50	(hourly (hr), daily (d), monthly (m)), annual (a)	°C	hr	hr	hr	hr	hr	hr	hr		hr		15 min
Leaf temperature	0,10		°C			n.a.	n.a.	n.a.	n.a	n.a		n.a.		during porometer measurements
Air pressure	0,29	Hourly	Pa	hr*	hr*	hr	hr	n.a.	n.a	n.a				n.a.

Wind speed	0,57	Hourly (hr), daily (d)	m/s	n.a.	n.a.	n.a.	hr		OTC	OTC		hr		occasionally (greenhouse with forced ventilation)
Vapour pressure Deficit (or derivatives, e.g. relative humidity)	0,57	Hourly	kPa	hr	hr	hr	hr	hr	hr	hr		hr		15 min
Soil temperature	0,57	Annual mean	°C			hr	hr	n.a.				hr		n.a.
Soil temperature at 20 cm depth	0,29	Monthly mean	°C			n.a.	hr	n.a.	hr	hr		hr		n.a.
Deposition														
Ozone concentration at leaf surface (l) or specified measurement height (sh)	1,30	Hourly (hr), daily (d), annual (a)	ppbv	hr	hr	hr		hr	hr	hr				n.a.
NH _y deposition flux	1,00	Annual	gN/m ² /year	[wet N applied]	[wet N applied]	[wet N applied]	[wet N applied]	n.a.	[wet N applied]	[wet N applied]		[wet /dry N applied]		n.a.
NO _x deposition flux	1,00	Annual	gN/m ² /year	[wet N applied]	[wet N applied]	[wet N applied]	[wet N applied]	n.a.	[wet N applied]	[wet N applied]		[wet N applied]		n.a.
S deposition flux	0,29	Annual	meq/m ² /year			n.a.	n.a.	n.a.	n.a.	n.a.		nearby		n.a.
CO ₂ concentration	1,14	Hourly (hr), daily (d), annual (a)	ppmv	a	a	n.a.	hr	hr	n.a.	n.a.		hr		n.a.
Cl deposition flux	0,29	Annual	meq/m ² /year			n.a.	n.a.	n.a.	n.a.	n.a.		nearby		during treatments
Ca deposition flux	0,57	Annual	meq/m ² /year			n.a.	n.a.	n.a.	n.a.	n.a.		nearby		n.a.

Mg deposition flux	0,57	Annual	meq/m ² /year			n.a.	n.a.	n.a.	n.a.	n.a.		nearby		n.a.
K deposition flux	0,29	Annual	meq/m ² /year			n.a.	n.a.	n.a.	n.a.	n.a.		nearby		n.a.
Na deposition flux	0,29	Annual	meq/m ² /year			n.a.	n.a.	n.a.	n.a.	n.a.		[wet Na applied]		during treatments
Soil														
Soil depth above which properties & stocks are recorded - e.g. solution sampling depth	0,70	Once	m			0,20	0,60	n.a.	0,2	0,2		0,10		n.a.
Organic horizon thickness	0,71	Once	m			n.a.	0,05	n.a.	0,00	0,00		>4		n.a.
Initial soil N stock	0,14	Once	g/m ²			yes	yes	n.a.	yes	yes		yes		n.a.
Soil porosity	0,14	Once	% vol			yes	yes	n.a.	yes	yes		no		n.a.
Soil bulk density	1,14	Once	g/cm ³			yes	yes	n.a.	yes	yes		yes		n.a.
Soil texture	0,86	Once	Text (e.g. coarse, medium, fine)			yes	yes	n.a.	yes	yes		n.a.		n.a.
Soil water content	0,86	Hourly (h), daily (d) or Annual (a)mean	g/g or m ³ /m ³ or mm/layer	h		hr	hr	n.a.	hr	hr		water table hr		n.a.
Soil water content at PWP	0,43	Once	g/g or m ³ /m ³ or mm/layer			yes	yes	n.a.	yes	yes		n.a.		n.a.
Soil water content at FC	0,29	Once	g/g or m ³ /m ³ or mm/layer			yes	yes	n.a.	yes	yes		n.a.		n.a.
Cation exchange capacity	0,80	Once	Meq/kg dry			yes	yes	n.a.	n.a.	n.a.		no		n.a.
Cation exchange co-efficients and model type	0,14	Once				n.a.	n.a.	n.a.	n.a.	n.a.		n.a.		n.a.

Al-hydroxide equilibrium constant	0,14	Once				n.a.	n.a.	n.a.	n.a.	n.a.		n.a.	n.a.
Cation weathering rates	0,14	Once	eq/m ³ /yr			n.a.	n.a.	n.a.	n.a.	n.a.		n.a.	n.a.
N fixation rate	0,14	Once	eq/m ³ /yr			n.a.	n.a.	n.a.	n.a.	n.a.		n.a.	n.a.
Soil temperature at 20 cm depth	0,29	Daily (d) or monthly (m)	°C			hr	hr	n.a.	hr	hr		hr	n.a.
Forest floor temperature	0,14	Daily (d) or monthly (m)	°C			n.a.	hr	n.a.				n.a.	n.a.
Soil solution major ion concentration (annual mean)	1,00	Annual	meq/m ³			n.a.	n.a.	n.a.	n.a.	n.a.		dipwell monthly HN rest 3 monthly	n.a.
Soil solution pH	0,71	Annual	pH units			n.a.	yes	n.a.	yes	yes		yes	n.a.
Soil slurry pH	0,14	Annual	pH units			n.a.	yes	n.a.	n.a.	n.a.		yes	n.a.
Base saturation (once)	0,71	Once	meq [Ca+Mg+K+Na] / 100meq CEC			yes (maybe)	yes	n.a.	n,a,	n,a,			n.a.
Soil C and N stock	1,00	Once	g C or N /m2		end	yes	yes	n.a.				yes	n.a.
Soil respiration C flux	0,57	Bi-weekly	g C/m ² /yr	see below		n.a.	yes	n.a.	yes	yes		yes	n.a.
Mineral N leaching	1,00	Monthly	g N/m ² /yr			n.a.	yes	n.a.	n.a.	n.a.		dipwell	n.a.
Dissolved organic N and C flux	0,57	Annual	g N or C/m ² /yr	monthly		n.a.	yes	n.a.				dipwell	n.a.
Soil evaporation	0,43	Daily	mm/day			n.a.	yes	n.a.	n.a.	n.a.		n.a.	n.a.
Vegetation													
Canopy height (annual)		Annual	m	Annual		Annual	annual	at harvest	yes	yes		annual	annual
Max rooting depth (annual)		Annual	m			0,20	annual	n.a.	yes	yes		n.a.	n.a.

LAI	1,14	monthly	m ² /m ²	monthly		Annual	monthly	n.a.		yes		possibly		annual
Litter C and N content	1,14	annual	%			n.a.	(yes)	n.a.	n.a.	n.a.		yes		n.a.
Litter production C and N flux	1,14	annual	g N or C/m ² /yr			n.a.	yes		n.a.	n.a.				n.a.
Whole plant biomass	0,29	Annual/end of expt	g C/m ²	end		Annual	annual low and peak	annual low and peak	harvest	3 harvests				annual
Leaf biomass	0,57	Annual/end of expt	g C/m ²	end		Annual	annual low and peak	annual low and peak	harvest	3 harvests		yes 2009		annual
Root biomass	0,86	Annual/end of expt	g C/m ²	end		Annual	Annual	n.a.		1 harvest				n.a.
Shoot total peak C & N stock	1,00	Annual/end of expt	g C or N/m ²	end		n.a.	Annual		yes	yes		n.a		n.a.
Crop yield	0,71	Annual	g C/m ² /yr	n.a.		n.a	n.a.	yes	yes	3 harvests		n.a		n.a.
Stem/Wood C & N	1,00	Annual/end of expt	g C/m ² /yr	end		maybe	n.a.	n.a.				yes 2009		n.a.
Leaf C & N	1,29	Annual/end of expt	g C/m ² /yr	end		maybe	Annual	n.a.	yes	2 harvests		yes by spp<		13C annually
Root C & N	1,29	Annual/end of expt	g C/m ² /yr	end		maybe	Annual	n.a.		yes				n.a.
Leaf C stock	1,29	Annual/end of expt	g C/m ² /yr	end		maybe	Annual	n.a.				yes 2009		n.a.
Relative growth rate		Annual/end	m ³ /ha/yr	annual and 4 weeks for controls		Annual	Annual	n.a.		yes		n.a		n.a.
Floristics														
Species present		Annual	Text	n.a.	beg & end		Annual	n.a.		mesocosm		every 2 yrs		n.a.
Cover of present species		Annual	%	n.a.	beg & end		Annual	n.a.		yes		every 2 yrs		n.a.
Mean Ellenberg N (fertility) score (not cover-weighted)		Once	Arbitrary	n.a.	beg & end		n.a.	n.a.		n.a.		once		n.a.

Tree type/composition		Once		n.a.	beg & end		n.a.	n.a.		n.a.		n.a.		n.a.
Process data for parameterisation														
leaf photosynthesis		frequency within season	$\text{g CO}_2 / \text{m}^2 / \text{s}$	monthly		monthly	campaigns	campaigns	several campaigns during the growing season	several campaigns during the growing season		2 spp occasional		campaigns
leaf A/Ci curve		frequency within season	$\text{g CO}_2 / \text{m}^2 / \text{s}$	monthly		campaigns	campaigns	campaigns		yes				campaigns
leaf A/Q(light) curve		frequency within season	$\text{g CO}_2 / \text{m}^2 / \text{s}$	monthly		campaigns	campaigns	n.a.		yes		in lab on Sphagnum		campaigns
leaf dark respiration		frequency within season	$\text{g CO}_2 / \text{m}^2 / \text{s}$	monthly		campaigns	campaigns	n.a.		no				campaigns
Canopy photosynthesis	1,00	frequency within season	$\text{g CO}_2 / \text{m}^2 / \text{s}$	monthly	monthly	next year	Modelled	n.a.		yes		yes occasional		n.a.
Canopy respiration	0,14	frequency within season	$\text{g CO}_2 / \text{m}^2 / \text{s}$	monthly	monthly	next year	Modelled	n.a.		yes		yes occasional		n.a.
Soil respiration		frequency within season		monthly		next year	bimonthly	n.a.		yes		yes occasional		n.a.
Stomatal conductance (esp for DO3SE)	0,29	frequency within season	$\text{mmol H}_2\text{O m}^{-2} \text{ PLA s}^{-1}$	many		biweekly	campaigns	? In O3	several campaigns during the growing season	several campaigns during the growing season		n.a.		campaigns
Evapotranspiration	1,29	frequency within season	mm/d or mm/yr			campaigns	campaigns	n.a.		yes		n.a.		n.a.
Sap flow data	0,30	frequency within season	mm/day			n.a.	n.a.	n.a.	n.a.	n.a.		n.a.		15 min

Leaf water potential	0,14	frequency within season	MPa			n.a.	n.a.	n.a.	n.a.	n.a.		n.a.		campaigns
Pre-dawn leaf water potential	0,29	frequency within season	MPa			n.a.	n.a.	n.a.	n.a.	n.a.		n.a.		campaigns
BVOC release		frequency within season				n.a.	n.a.	n.a.		end of exposure		yes occasional		n.a.
soil CH4 flux		frequency within season			monthly	n.a.	monthly	n.a.		weekly		yes occasional		n.a.
soil N2O flux		frequency within season				n.a.	monthly	n.a.		weekly		yes occasional		n.a.
Soil NO flux		frequency within season				n.a.	n.a.	n.a.		weekly		yes in lab once		n.a.