

Manipulative experiments - overview

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Global Change Research Centre Academy of Science of the Czech Republic



October 21, 2013



Tato akce se koná v rámci realizace projektu COPPICE - Výmladkové lesy jako produkční a biologická alternativa budoucnosti – CZ.1.07/2.3.00/20.0267. Tento projekt je spolufinancován Evropským sociálním fondem a Státním rozpočtem ČR.



What are the aims of this presentation?

- be familiar with database of manipulative experiments "Climmani"
- show how to navigate in it and search
- present specific examples of experiments in Europe and CR

What are the benefits for you?

- when writing an article
- when preparing and writing a project
- when creating meta-analyzes
- to establish contacts with persons engaged in similar issues







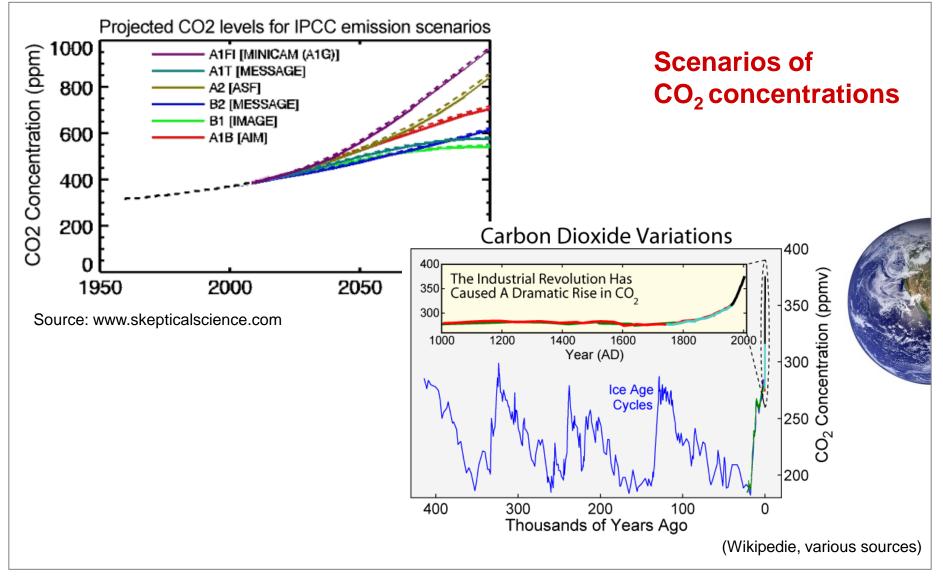
Outline of the presentation

- Introduction to the topic of climate change
- Climmani project ESF and database of manipulative experiments
- Examples of various types of experiments from Europe
- Examples of manipulative experiments from CR
- Options for the future





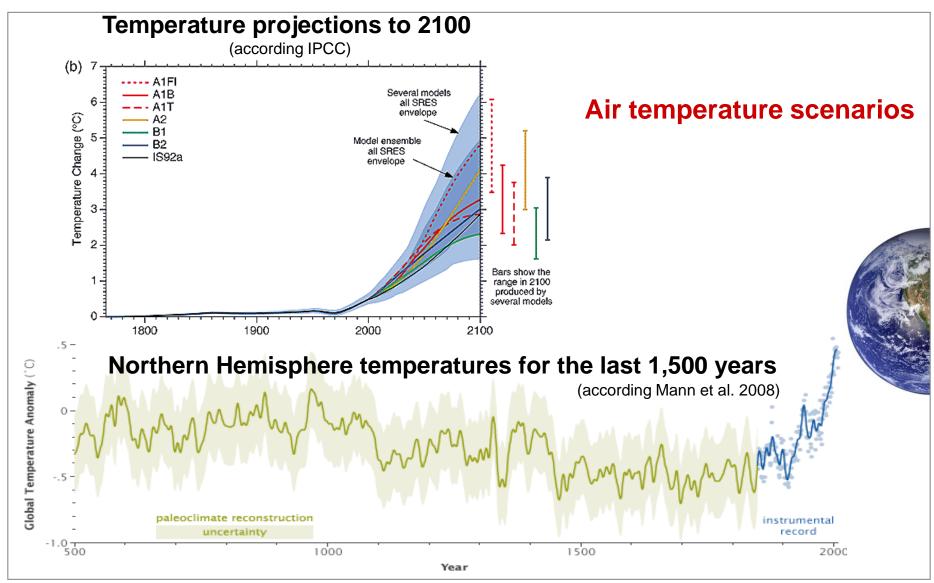
<u>1. Introduction to the topic of climate change</u>







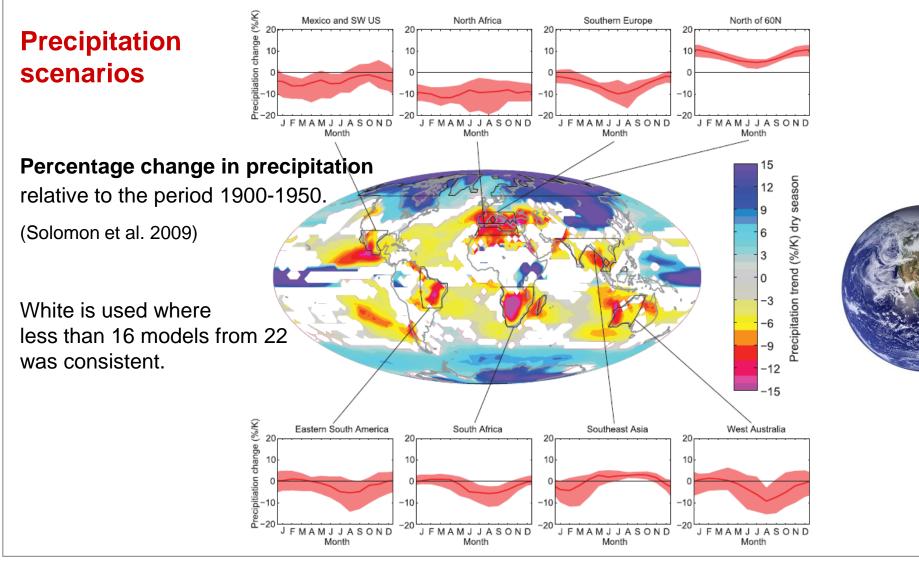
1. Introduction to the topic of climate change







1. Introduction to the topic of climate change





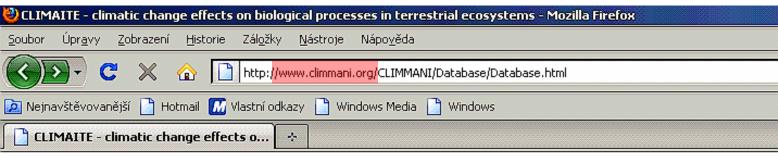


2. Climmani – database of manipulative experiments

Project ESF (2008-2013)

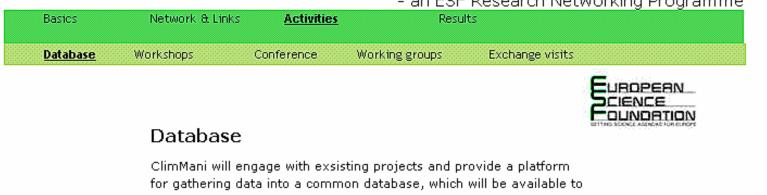
ClimMani

www.climmani.org



Climate Change - Manipulation experiments in terrestrial ecosystems

- an ESF Research Networking Programme



research communitees and modellers on request.

A new web-based metadatabase has been developed - see here.









2. Climmani – database of manipulative experiments

ClimMani experim

Climate Change - Manipulation experiments in terrestrial ecosystems

			- an ESF Research Networking Programme
Basics	Network & Links	Activities	Results
Aim and objective	es Description	Steering committee	Contact

www.climmani.org



Project: 2008-2013.

The participating countries:

Austria, Belgium, Croatia, CR, Denmark, Finland, Italy, Netherland, Norway, Poland, Romania, Spain, Sweden, Switzerland, United Kingdom.

The main objectives: Workshops, exchanges for students, databases of projects creation of meta-analyses



Photo: Filip Moldan (IVL, SE)

> Quick links Iceland Workshop Meta database Young scientist workshop

The ClimMani project

ClimMani is a Research Networking Programme under the European Science Foundation (ESF). ClimMani involves at present 14 European countries and links more than 50 climate change related field scale experiments. ClimMani is networking with similar experiments and activities in US and Australia.

ClimMani aims to provide an umbrella for coordinated activities bringing together researchers, data and knowledge from past and ongoing European climate manipulation research projects in order to synthesise the knowledge and improve ecosystem models.

CLIMMANI/INTERFACE Workshop on "Nutrient constraints on the net carbon balance" June 15-17th 2011 in Keflavik, Iceland

Programme and student/postdoc application procedure here.

Young scientists Workshop on "terrestrial ecosystem responses to climate change" - September 2011. Apply to participate:

CLIMMANI will sponsor a two-week workshop focused on analyzing responses of terrestrial ecosystems to climate manipulation (week 1) and on writing a review based on these findings (week 2). This workshop will be held in Belgium in September 2011 and will be organized by Ivan Janssens. To foster knowledge transfer to younger generations, 5-10 early-career researchers will be invited to participate in this writing workshop. CLIMMANI is offering support in the form of travel grants. If you are interested in participating please send a one-page letter of interest and CV to Ivan Janssens (ivan.janssens@ua.ac.be) before May 1st 2011. Read more here.

New climate change experiments META-database:

A new meta database for climate change experiments are available here - please register your experiment. Site, project, treatments, response measurements, data status, site characteristics, key reference, contacts person etc. here

New call for short exchange grants: Will come in the spring of 2011





2. Climmani – database of manipulative experiments

ClimMani

Climate Change - Manipulation experiments in terrestrial ecosystems

- an ESF Research Networking Programme

Basics	Network & Links	<u>Activities</u>	Results	
Database	Workshops	Conference	Working groups	Exchange visits
				SUBOPERN_

Main activities

ClimMani will initiate a series of activities to obtain its goals. These are:

Database

ClimMani has developed a META DATABASE providing registration and search facilities for ecosystem experiments globally. You can register your experiment in the database in order for others to know your experiment and potentially to get access to your data for publications. Go to the data base, register your experiment and fill in the information about the experiment of the responses measured and references to your work DATABASE here

ClimMani will further establish a comprehensive integrated database that contains data on all manipulation experiments and from both ongoing and past EU research projects as well as from existing national databases. This will be conducted in close collaboration with major exsisting climate change-related projects and provide links to other databases. The database will be available to research communities and modellers on request.

Workshops

In order to analyse our present understanding of ecosystem processes and modelling ecosystem functioning under atmospheric and climatic changes, a series of workshops will be organised. Key researchers and working groups from different disciplines with experimental as well as modelling backgrounds will be invited to assess results from manipulation experiments, evaluate existing literature and databases and identify and discuss progress and developments within climate change research. Workshops will include collaborative meetings with the US networks TERACC and INTERFACE.

Conference

A conference on "Climate-Nutrient interactions – role of resources in controlling climate change responses in ecosystems. Experiments and modelling" in June 2011 held together with the American network TERACC/INTERFACE. If you want to participate or contribute, please contact us.

Working groups

A series of working groups may be initiated according to identified



www.climmani.org

Database of projects



Photo: Claus Beier

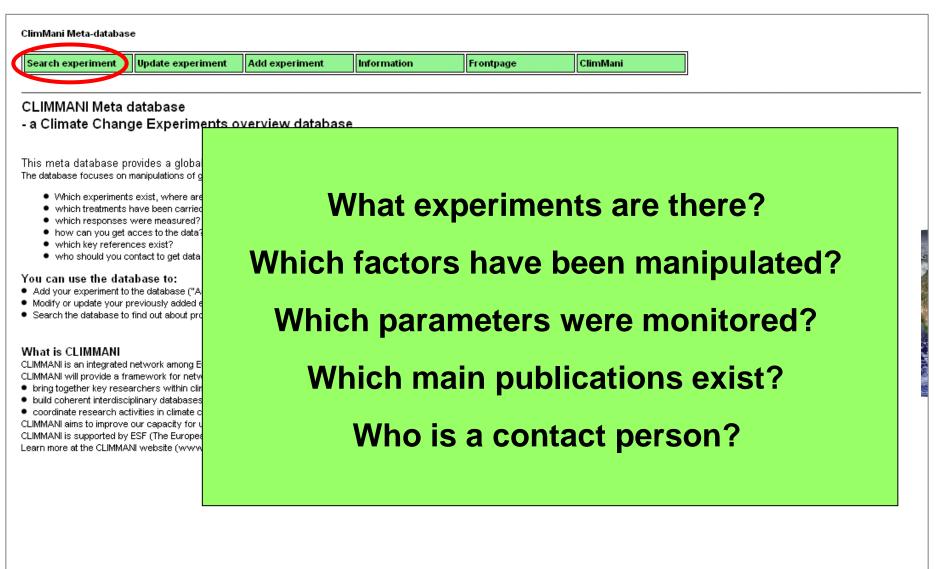
Quick links

Meta database













<u>2. Climmani – database of manipulative experiments</u>

Any Treatment					_	
Air pollutants Clear cut - forest	prmation	Fi	ontpage	ClimMani		
CO2 increase Control Fire Girdling	erson. Sele		tion of search criteria fr	<i>ta availabilit</i> y o <i>n all availat</i> rom the drop down boxes.	ole warming projects that measured soil re	spiration.
Grazing Litter addition Moving N addition	ic treatmen	its): Select r Respon Respon Respon Respon		e V e V	u are not looking for specific responses):	Leaving both Treatment and
N removal Nutrients +/- Ozone Shading						7
Snow removal Soil management Temperature						
Thinning - forest tillage UVB	- -	evropský sociální rody CB zvenesk				11



Search experiment pdate experiment	Add experiment	Information	Frontpage	ClimMani			
Search for experiment - treatments - respons	ses	An	y Respons	:e	_		
Here you can search for certain experiments/treatm	nents and responses			components			
Example You want to synthesise soil respiration data from w - make a search for "warming experiments" and "so	arming experiments oil respiration". The databa		sic climate)mass	variables			
You can further finetune the search by country, pro	pject, site, treatment and co	ntact person. Sel 🗄 🖽	rried baa s	oil processe	S		
Search for projects employing a number of specific							
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Treatment 3 Any Treatment Treatment 4 Any Treatment	-		position				rch
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INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

CzechGlobe 3. Examples of various types of experiments from Europe

			1	7	
Site name	Project name	Country		1	
Brandbjerg	CLIMAITE	DENMARK	Show details		
Flakaliden	Flakaliden		Show details		
Risdalsheia	CLIMEX	NORWAY	Show details		_
Artwe Furka Site name			Project name	3	
Brandbjerg			CLIMAITE		
Hofste Stillber	ofste Flakaliden				
Birmer Besky Risdalsheia	= Risdalsheia				
ILE				، ا	-
Czech_Multi	CzechTerra	CZECH REPUBLIC	Show details		
Linden	GIFACE	GERMANY	Show details		
Braunschweig	Braunschweig	GERMANY	Show details		
Munich	Munich CO2	GERMANY	Show details		
Hohenheim	MiniFACE	GERMANY	Show details		





CzechGlobe <u>3. Examples of various types of experiments from Europe</u>

ClimMani Meta-database			Flaka	aliden, Sweden
Search experiment U	pdate experiment Ad	d experiment	Information	
Site name	Project name	Country	Location	Altitude
Flakaliden	Flakaliden	SWEDEN	64o07 'N 19o27 'E	320
Site Description	Project Description	Landuse		
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Treatments			€⇒	ζ
CO2 increase			Vo Con	
Control			+ Trondheim	Umea Ornsköldsvik
Girdling				- Costersund
N addition				Sverige Sweden
Nutrients +/-			Contraction of the second s	Sundsval Gulf of Bothnia
Temperature			Norge Norway	
Thinning - forest				XG 1
Water addition				Borlange Gavle
Response name	response type		Oslo	Uppsala
Basic climate variables	site		South States	Istad Vasteras • • Norrtäje Orebro • Eskistuna • • Stockholm
Additional Information:				socenalje
Data Status:	Spreadsheets		Uddevalla	kovde Unköping Baltic Sea
Key References:			Cätoborn e	The second se
Web Link:			Aalborg Varberg	LANDERS AND AND
Person name	Contact detail	Institute	Randers	sd Växjö Kalmar Liep
Sune Linder	sune.linder@ess.slu.se	SLU	Aarhus Københar a. Danmark	vn Kristianstad Klai
Additional Persons:			Denmark	Kaliningr (Kanininingr

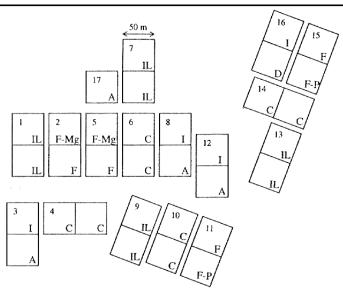
CzechGlobe <u>3. Examples of various types of experiments from Europe</u>





3. Examples of various types of experiments from Europe







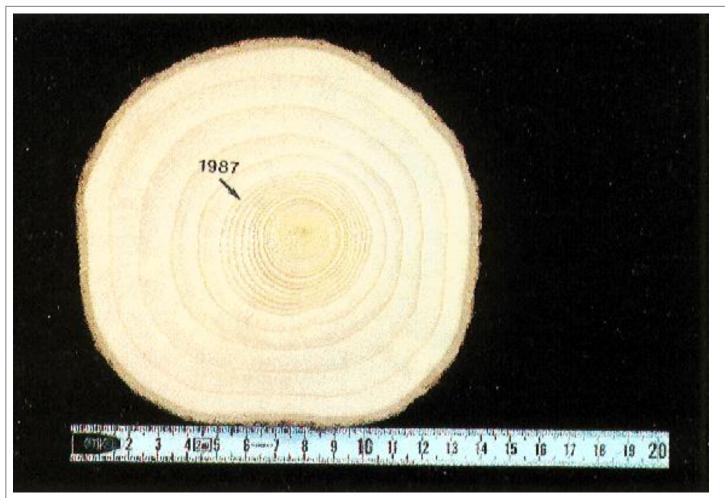
4 years after the establishing of the experiment (fertilized areas are darker, photo 1990) Schematic design: control plots (C), irrigated plots (I), fertlized plots (F), irrigated and fertilized plots (IL) (n = 4). Other experimental plots: Fertlized plots complemented by forest ashes (A), fertilized plots with all essential elements except phosphorus (F-P) or magnesium (F-Mg), variant where summer precipitation were reduced to 65% (D)

See Bergh (1997) and Bergh et al. (1998) for further details.



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3. Examples of various types of experiments from Europe





Growth rings *Picea abies* from irrigated and fertilized plots (IL) (significant expansion of rings after the experiment began in 1987) Photo 1992



CzechGlobe 3. Examples of various types of experiments from Europe

Search experiment Update experiment Add e	experiment Information Frontp	Garraf, Spain (CL	IMOOR-VULCAN)
Site name	Project name	Country	Location
Garraf	CLIMOOR-VULCAN	SPAIN	41.18N, 1.49E 210
Site Description	Project Description	Landuse	
MAT: 15.6; MAP: 580; N deposition 0.5 gN/m2/yr; Soil: Petrocalcic Calcixerepts 3.1 kgC/m2; vegetation: Erica multiflora, Globularia alypum	Project to investigate ecosystem responses (productivity, biogeochemical cycling, species change) to realistic changes in climatic variables (increased temperature and extended drought) in the long term using a newly developed and tested experimental approach. To investigate the interaction between climate change and other stress factors such as N pollution, management and land use practices in shrublands.	sh ↑ ← → ↓	Map Sat Ter Earth Montauban Albi Nîmes
Treatments		+	Toulouse
Control		Santander San Bilbao Sebastián	Pau Montpellier C Auto
Temperature		· · ··································	Carcassonne Béziers Marseill
Water removal		vitoria-Gasteiz	Perpignan
Response name	response type	Burgos	Andorra
Biomass	plant	A State of the second s	Girona
Ecophysiology	plant	Valladolid	
	plant	2	oza Lleida Barcelona
Litter production	plant		Tarragona
Phenlogy	plant	Inca	A State of the sta
Plant C pools	plant	Alcalá de	States and a los
Plant chemistry	plant	Madrid	Balearic Sea
Plant N pools	plant		Sea
Root biomass	plant	avera Toledo	Palma
Species composition	plant	Espana Valenc	
Basic climate variables	site Sirca, C.; Sowerby, A.; Spano, D. and Tietema, A. (2007) Response of plant species richness and primary productivity in shrublands along a north-south gradient in Europe to seven years of experimental warming and drought. Reductions in primary productivity in the heat and drought year of 2003. Global Change Biology, 13, 2563-2581.	Córdoba Jaén Lorca	licante urcia
Web Link:	http://www.creaf.uab.es	Cartage	na
Person name	Contact detail	In Cranada • Almaría	الحزائر (@2011 Goog
Josep Penuelas	josep.penuelas@uab.cat	CREAF	Universitat Autònoma de Barcelona Edifici C 08193 BELLATERRA (Barcelona) SPAIN www.creaf.uab.es
Additional Persons:			

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Garraf, Spain Experiment on the effects of increased temperature

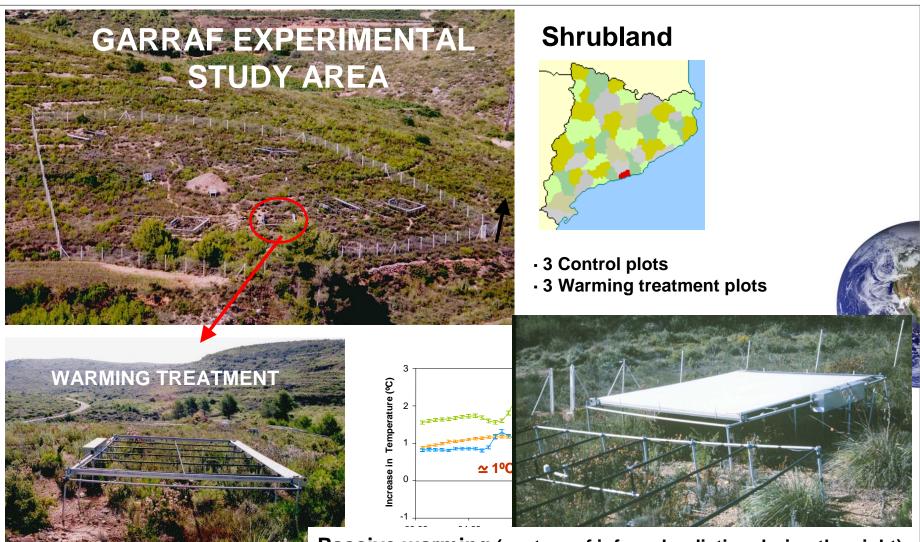


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Passive warming (capture of infrared radiation during the night)

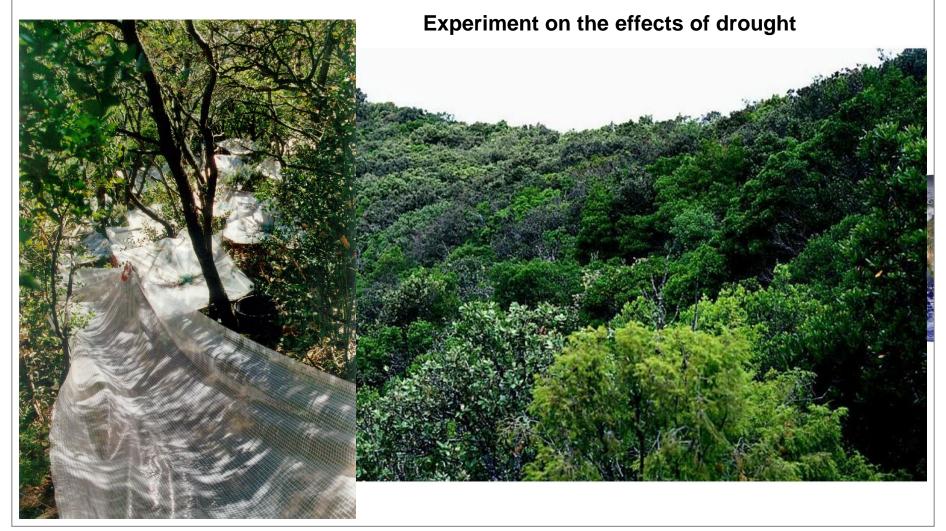


CzechGlobe <u>3. Examples of various types of experiments from Europe</u>

Search experiment	Update experiment	Add experiment	Information	Frontpage	F	Prades, Spain	(J. Penuelas	s)
Site name		Project name			Country	Location		Altitude
Prades		Prades			SPAIN	1		950
Site Description		Project Descript	ion		Landuse			
Mediterranean evergree	n forest	Experimental drou	ght simulating future wat forests induced by clima		Not Yet Assigned	Not assigned, select a Landuse from the list to assign		
Treatments							Map Sat	Ter E
Control					\leftarrow \rightarrow		map Sar	
Water removal							$) \rangle$	
Response name		response type			107 10	A CONTRACTOR	Montauban Albi	Nîme
Biomass		plant			+		Toulouse	
Ecophysiology		plant				ander San Bilbao Sebastián Par	Montr	bellier •
LAI		plant			5-	in in P		ziers M
Litter production		plant			Vito	nia-Gasteiz	Perpigr	an
Phenlogy		plant				Legrono	Andorra	1 4
Plant chemistry		plant				ingos o		
Species composition		plant					Girona	- Section
Basic climate variables		site			Valladolid	Zaragoza	Lleida	A THE SA
General soil characterist	tics	site					Barcelóná	
Plant productivity		site			TICER AND A	Part Stand K	Tarragona	
Plant species compositio	חמ	site				a second and a second as		
Soil respiration		site				Alcalà de	R Land	
Microbial genetics		soil			M	adrid Henares	Balearic Sea	Section of
Soil moisture content		soil			0	Toledo		-
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Stable isotope studies		soil			ESP	vaña Valencia		Se Pri
Additional Information	n:					Albacete	1 01 19	
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Key References:					C. TOR.	Alican	e la	
Web Link:		http://www.creaf /experimetal_sites	.uab.es/ecophysiology/si .htm	tes	Córdoba Ja	aén • Murcia	and a	
Person name		Contact detail			Institute	Corea •		
Josep Penuelas		josep.penuelas@u	Jab.cat		CREAF	a • Cartagena	The Martine Party	<mark>ചി</mark> ©2011 G

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Prades (Mediterranean forest, Spain)





Acta Physiol Plant (2010) 32:387–394 DOI 10.1007/s11738-009-0416-y

ORIGINAL PAPER

Annual and seasonal changes in foliar terpene content and emission rates in *Cistus albidus* L. submitted to soil drought in Prades forest (Catalonia, NE Spain)

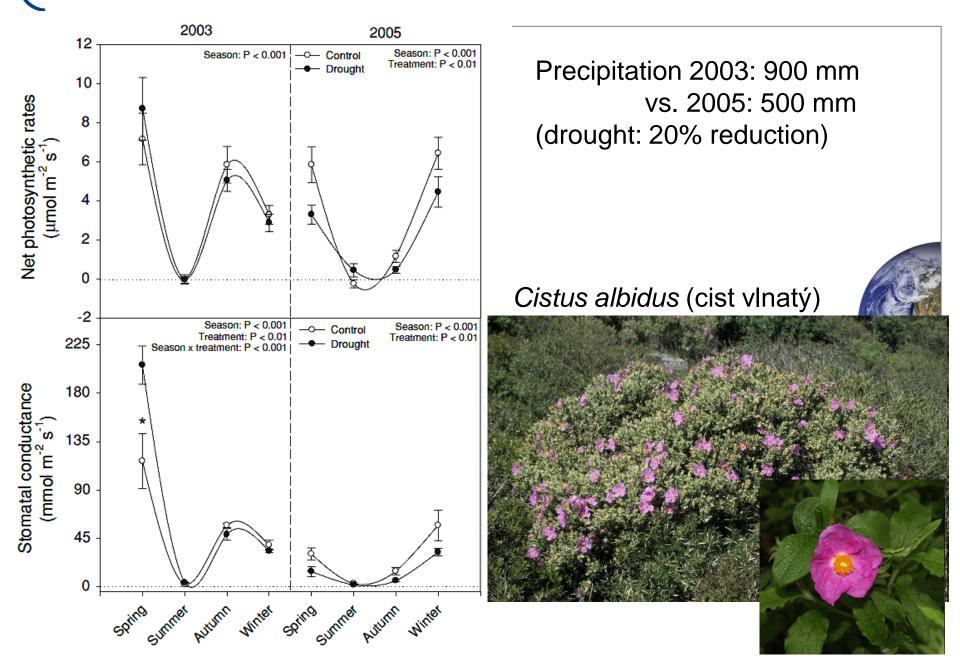
Joan Llusià · Josep Peñuelas · Giorgio Alessio

Received: 5 October 2009/Revised: 8 © Franciszek Górski Institute of Plan



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3. Examples of various types of experiments from Europe



CzechGlobe 3. Examples of various types of experiments from Europe

Search experiment Update experiment Add e	experiment Information From	ntpage	Brandbierg, D	enmark (CLIMAI	TE)
Site name	Project name	Count		Location	Altitude
Brandbjerg	CLIMAITE	DENM4	RK	55.53N 11.58E	25
Site Description	Project Description	Landu	se	1	
Sandy soil, calluna shrubland/deschampsia grassland, no management	Multifactorial climate change experiment (elevated C (FACE), T (passive night time warming)and H2O (su drought)). Measurements of responses at the speci- community and ecosystem level.	ummer Shruhl	ind		
Treatments		E	Aalbor	Map Sat 1	Ter Eart
CO2 increase		÷	→ Thisted		
Control			Nykøbing Svenstrup	Falkenbe	rg o 🖉 🧭
Temperature		Ē	Mors Aars		E6
Water removal			Rosley Hobro		0
Response name	response type		Skride Skride	-	Halms
Biomass	plant		Struer Tjele Rand	ders	La
Ecophysiology	plant		Holstebro Viborg	Grenaa	
Herbivory	plant		Awium	Arhus Ebeltott	Ängelh
LAI	plant		Silkeborg A		
Litter production	plant		and the second second		Helsingar
NEE	plant		Skjern Skanderb Horsens	Contract Contract	erød La
Phenlogy	plant		Grindsted	Frederikssund	1 132
Additional Information:	CO2 increase to 510 ppm by FACE (only daytime round) Temperature increase 1 oC by passive n warming Water removal (extended summer drou automatic rain out shelters Treatments include fu approach. 6 replicates. Started treatments in 200 ongoing.	night time ught) by ull factorial	Vele Varde Esbjerg_E20 - Kolding Hiddefart Fans Ribe	Odense Sigeland Stri Nyborg Slagelse Stri	• Købe eve Ma and T
Data Status:	Driving variables (meteorology etc) in database, responses in database and some in spreadshee		Haderslev	Belinge Næstved	
Key References:	Mikkelsen, T.N.; Beier, C.; et al. (2008) Experimen of multifactor climate change experiments with e CO2, warming and drought – the CLIMAITE proje Functional Ecology, 22, 185-195.	elevated	Syit Sanderborg	E55	
Web Link:	www.climaite.dk		Handewitt	E47 Nykøbin Falster	
Person name	Contact detail			Come I	
Claus Beier	clbe@risoe.dtu.dk		Husum Schleswig	ernförde Fehmarn	1000
Additional Persons: Teis Mikkelsen (site & ecophysiology) Leon G Linden (modelling)			Heide Rendsburg	Kiel E47 Ribnitz-Damgarte	Barth • St @2011 Goo

Examples of various types of experiments from Europe

Brandbjerg, Denmark

Experiment on the combined effects of temperature, drought and elevated CO2 (CLIMAITE)







CzechGlobe 3. Examples of various types of experiments from Europe

+C0₂ H₂O

+00

CO2

H20

+C02

Shielding of precipitation (blind) ared radiation during the night)

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Global Change Biology

Global Change Biology (2011) 17, 1884–1899, doi: 10.1111/j.1365-2486.2010.02351.x

Reduced N cycling in response to elevated CO₂, warming, and drought in a Danish heathland: Synthesizing results of the CLIMAITE project after two years of treatments

KLAUS S. LARSEN*, LOUISE C. ANDRESEN†¹, CLAUS BEIER*, SVEN JONASSON†, KRISTIAN R. ALBERT*, PER AMBUS*, MARIE F. ARNDAL‡, METTE S. CARTER*, SØREN CHRISTENSEN†, MARTIN HOLMSTRUPS, ANDREAS IBROM*

JANE KONGSTAD‡, LEON VAN DER ANDERS MICHELSEN†, TEIS N. M HELGE RO-POULSEN†, INGER K. KAREN STEVNBAK†

*Risø DTU, Biosystems Division, Technical Univer of Biology, University of Copenhagen, Øster Farim University of Copenhagen, Hørsholm Kongevej 11, Environmental Research Institute, Aarhus Universi

Abstract

Field-scale experiments simulating realistic fut current and future climate changes on ecosyst

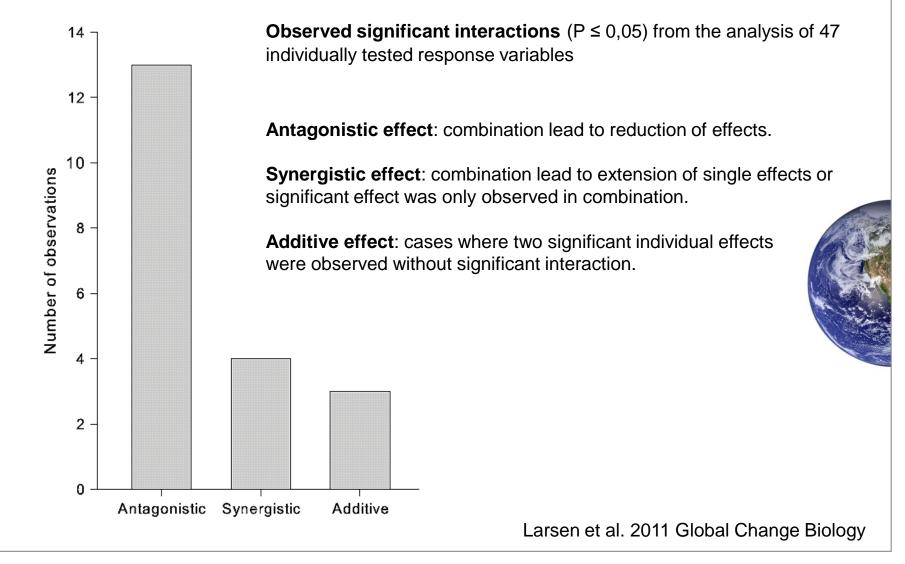


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Claus Beier (coordinator of project CLIMAITE)

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3. Examples of various types of experiments from Europe





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Search experiment	Update experiment	Add	Basel, S	witzerla	nd (Swiss Canc	py Cran	e)
							
Site name			Project name		Country		
Basel			Swiss canopy crane		SWITZERLAND		
Site Description			Project Description Rambe	rvillers	Lahr/ Schwarzwald Map	Sat Ter	Earth
1			0 ≥ Cospes	Saint-Dié-des-Vosge	Connartance	Schramberg	ingen A
Treatments			¥		Colman	Rottwei	Me3
CO2 increase			Remiremont	Gérardmer Vagney	Colmar Breisach am Rhein Denzlinger	• 4	rossingen Tuttlingen
Control			upt-sur-Moselle	Ed Dicade	Freiburg im Do	naueschingen	37
Response name			response type ougerolles	Le Thillot	E35 Breisgau	Geisingen	Engen S
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Key References:			Heric	• Belfort		nut-Trèngen	Frauen
Web Link:				éliard • Audincourt	Reinach	Búlach	• Winter
Person name			Contact detail	EEO	y Delémont	Kloten	bendorf
Christian Koerner			christian.koerner@unibas.ee.les-Dames	23	vOlten)	Manager	Uster Rapperswi SG
Additional Persons:			n	1 15	Solothum + Langenthal	Horgen	SG -
			aldahon La	Chaux de Fonds	• Biel/Bienne	Emmen	siedeln
			Morteau.+	• Le Locle	Lyss E25	AUD	chwyz 🗧
			Val-de Tr	avers Neuchatel	Bern +Work	E36	APC -
			ontarilier	rayenne"	Laupen	Samen (tdort -
			E23	Yverdon les Bains	Fribourg Stemsburg		
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3. Examples of various types of experiments from Europe



3. Examples of various types of experiments from Europe

Fagus 2.5 Ambient CO2 Elevated CO2 2.0 M Mass fruiting 1.5 1.0 0.5 - A: n = 14 Annual tree basal area increment (standardized by pre-treatment mean) E: n = 30.0 + CO2 Quercus 1.5 .0 0.5 A: n = 70.01 + CO₂ Carpinus 1.5 0.5 0.0 $+CO_2$ All trees (+ Tilia) 1.5 1.0 0.5 Drought 0.0 96 97 98 99 00 01 02 03 04

Year

3.0

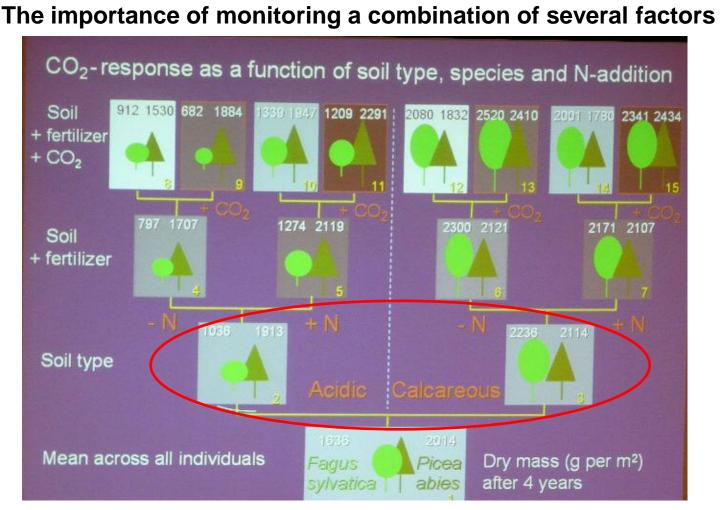
Carbon Flux and Growth in Mature Deciduous Forest Trees Exposed to Elevated CO₂

Christian Körner,^{1*} Roman Asshoff,¹ Olivier Bignucolo,¹ Stephan Hättenschwiler,^{1,2} Sonja G. Keel,³ Susanna Peláez-Riedl,¹ Steeve Pepin,^{1,4} Rolf T. W. Siegwolf,³ Gerhard Zotz¹

Whether rising atmospheric carbon dioxide (CO_2) concentrations will cause forests to grow faster and store more carbon is an open question. Using free air CO_2 release in combination with a canopy crane, we found an immediate and sustained enhancement of carbon flux through 35-meter-tall temperate forest trees when exposed to elevated CO_2 . However, there was no overall stimulation in stem growth and leaf litter production after 4 years. Photosynthetic capacity was not reduced, leaf chemistry changes were minor, and tree species differed in their responses. Although growing vigorously, these trees did not accrete more biomass carbon in stems in response to elevated CO_2 , thus challenging projections of growth responses derived from tests with smaller trees.



zechGlobe <u>3. Examples of various types of experiments from Europe</u>



Source: Ch. Körner (conference Lipsko)





3. Examples of various types of experiments from Europe

ClimMani Meta-database

Search experiment Update experiment Add experiment

Risdalsheia, Norway (CLIMEX, 1994-2000)

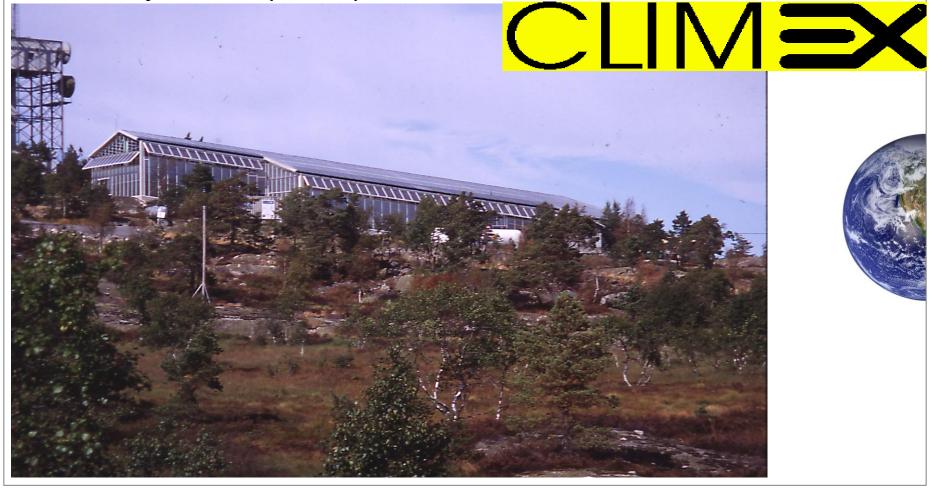
Site name	Project name	Country	Location	Altitude
Risdalsheia	CLIMEX	NORWAY	58.23N, 8.19E	300
Site Description	Project Description	Landuse	_	
1	0	Forest]	
Treatments]			
CO2 increase]		Map Sat	Ter Eart
Control]	\leftarrow		Site NA
Temperature]	↓		Sand I al
Response name	response type		LAND A SHEAR AND	11 3/00
Biomass	plant			E MAN
Litter production	plant		Norge	
Phenlogy	plant		Norway	
Plant C pools	plant	and the state	No. of the Party o	1
Plant chemistry	plant			14
Plant N pools	plant		ALC: NO	
Yield	plant			
Basic climate variables	site	the second second		
Deposition	site			A Company
General soil characteristics	site	Bergen		
Hydrology	site			The services of
C mineralistion	soil			Mark Mark
Soil water chemistry	soil		Sandvika Oslo	1
Water drainage	soil	S / Marine	Drammen	- 11 · · · · · · · · · · · · · · · · · ·
Additional Information:	Extension of the Norwegian acid removal project RAIN. Started in 1995 - ended in 1999. Full catchment "roof" project with "elevated CO2" (as chamber) combined with elevated temperature (air +5/+3), and compared with elevated soil temperature (soil cables) and 3 paired untreated control catchments.	Stavanger	Skien Fredrikstad	Karistad
Data Status:	Spreadsheets Vol.1, No.2, pp.216-225.	Sandnes		
Web Link:	http://www.macaulay.ac.uk/dynamo/climex.htm		Üddevalla	Skövde
Person name	Contact detail	Institu Kristia	nsand • • Ti	ollhättan
Richard Wright	richard.wright@niva.no	Norwe		Sec. M
Additional Persons:		Contract of the	Göteboro	Boras@2011 Good

Frontpage

Information

CzechGlobe <u>3. Examples of various types of experiments from Europe</u>

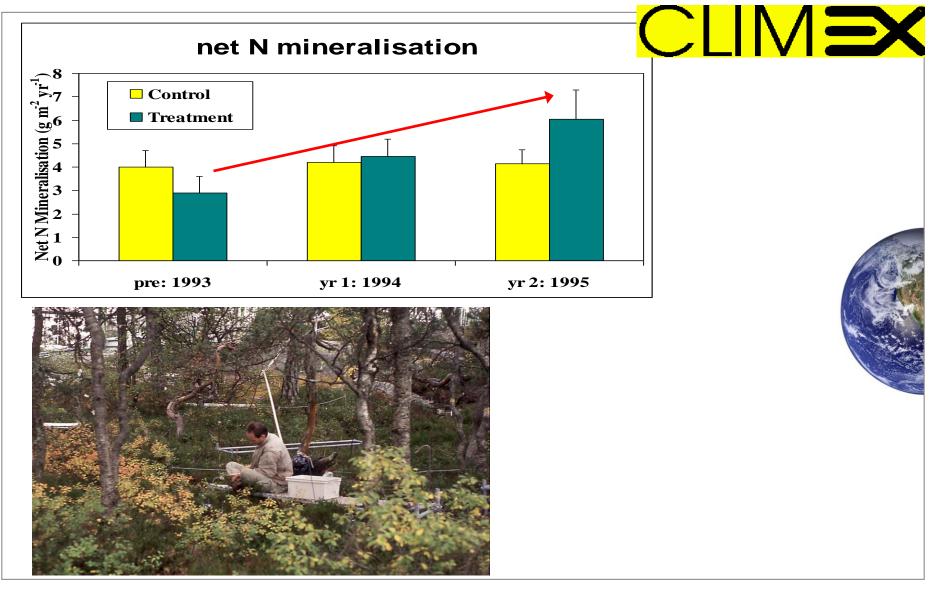
Experiment on the effect of increased CO2 (560 ppm) in combination with increased temperature (+3,5 °C) - at the ecosystem level (1000 m²)







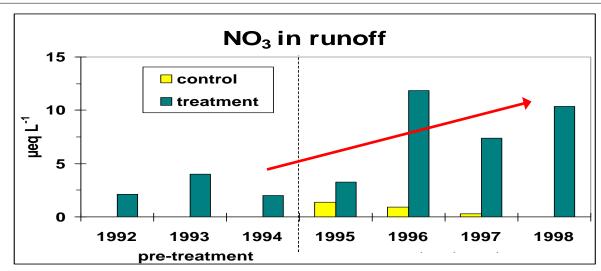
Examples of various types of experiments from Europe







CzechGlobe 3. Examples of various types of experiments from Europe



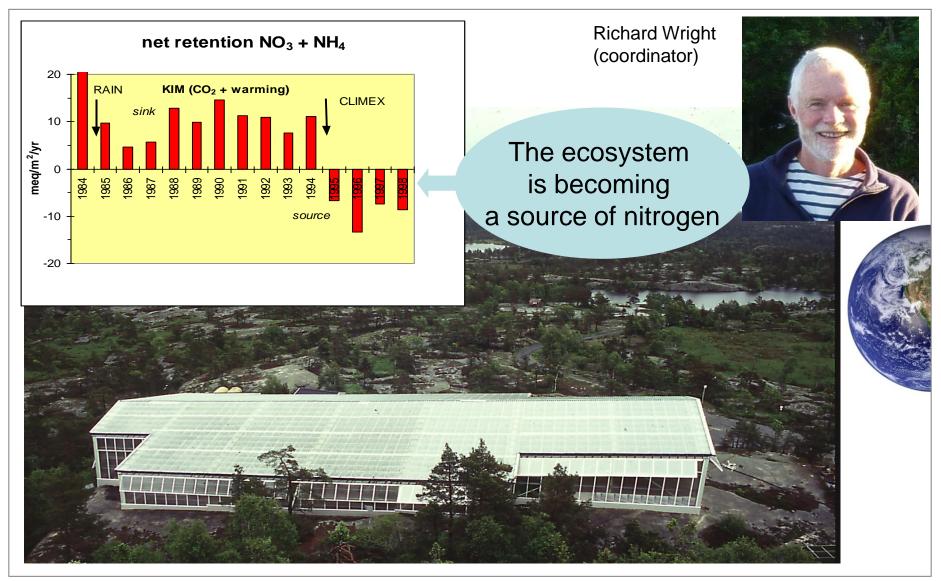






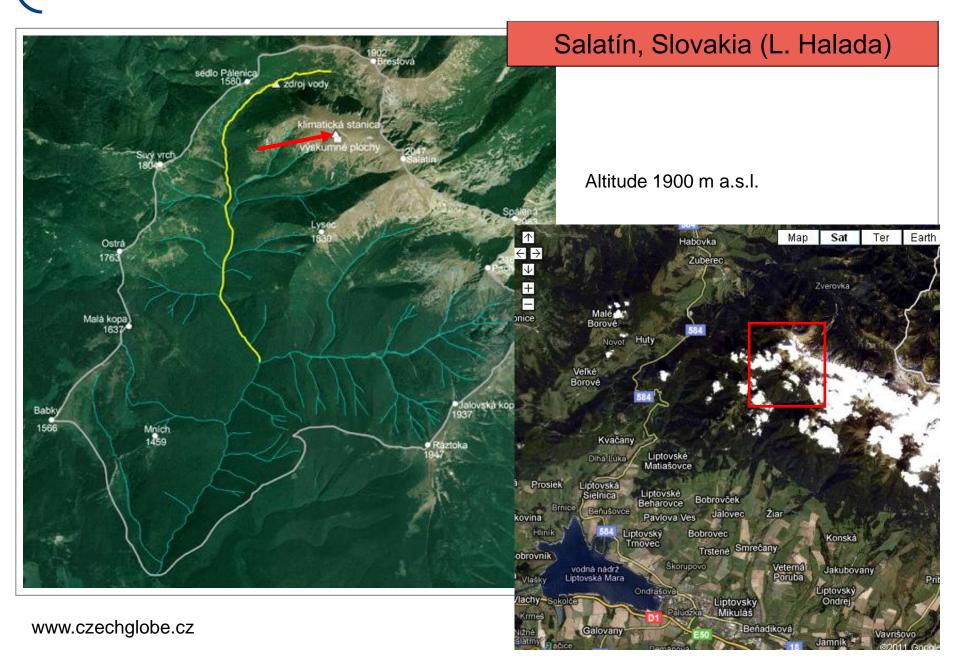


3. Examples of various types of experiments from Europe



(Van Breemen et al. 2001 Ecosystems)

3. Examples of various types of experiments from Europe



3. Examples of various types of experiments from Europe

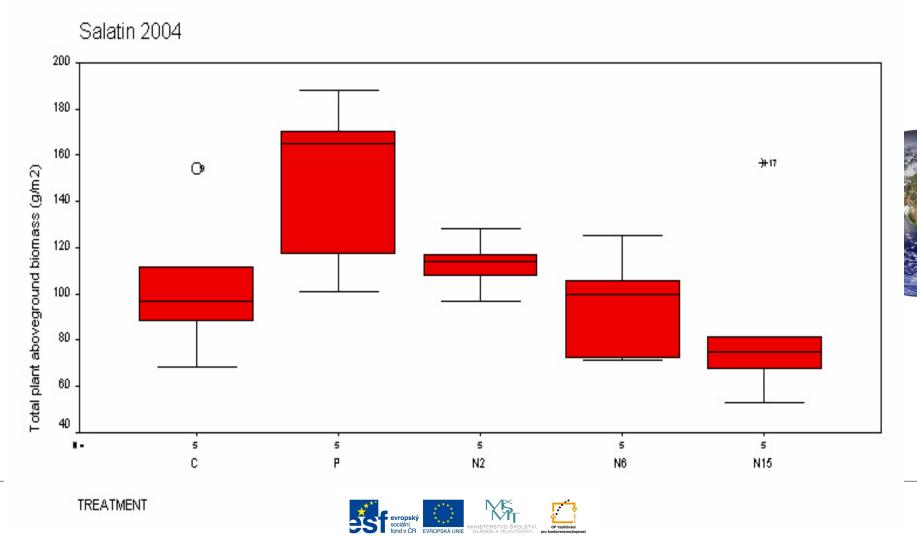


Monitoring of plant species diversity Microlyzimeters Soil analyses Biomass (nutrients) Atmospheric depozitions Climatic data Treatments:

N2 (2 g N m⁻² year⁻¹) N6, N15, P (5 g P m⁻² year⁻¹), K (control)

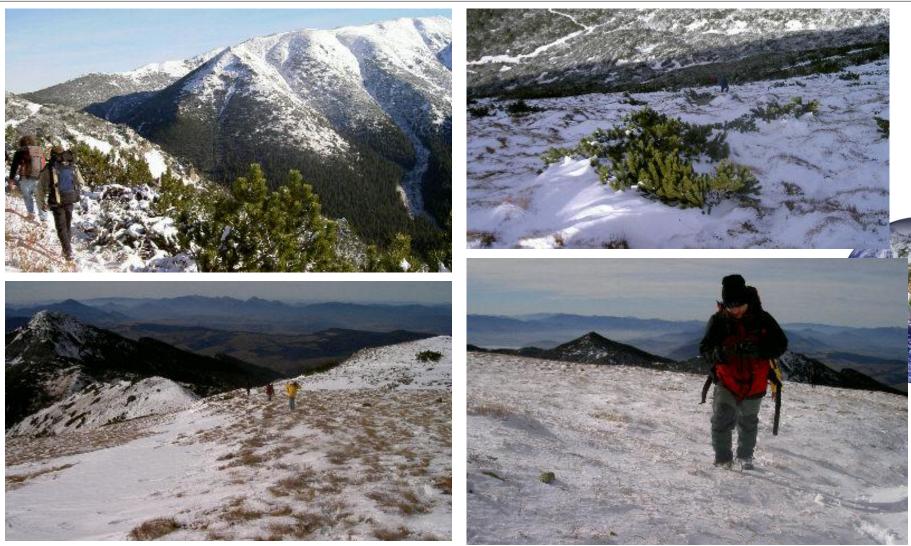
Examples of various types of experiments from Europe

Salatín, Slovakia Experiment on the effects of nitrogen deposition on alpine grass vegetation



INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

CzechGlobe <u>3. Examples of various types of experiments from Europe</u>



Luboš Halada - Coordinator of the project





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Site name	Project name	Country	Location	Altitude
ILE	ECOCRAFT	CZECH REPUBLIC	49.30N, 18.32E	908
Site Description	Project Description	Landuse		
Bílý Kríž (Moravia-Silesian Beskydy Mts.)	Climate change experiment (elevated CO2)- glassdomes. Measurements of responses at the species level.	Forest		
Treatments		Slavkov	Kravale Map Sat	Ter Earth
CO2 increase		Hradec na	d Hlućin Bohumin 7	States in
Control			Ostrava Oriová Karviná	
Response name	response type	sov+d	Petivald	
Biomass	plant	sor Vitkov	Sk	oczów s1 J
Ecophysiology	plant	Vitkov	Bilovec	
LAI	plant		Studénka Český Těšio Čiesz	yn Ustroń
NEE	plant	Fulne	Fairdak Mietak	Usului
Plant C pools	plant	Odny	Trinec	~ 20
Plant chemistry	plant	Potštát	Pribor	K (Wisła
Root biomass	plant		Frýdlant nad Ostravici	N Kess
Basic climate variables	site	Bélatín: Nov		ablunkov (Isteb
General soil characteristics	site	Hranice	Frenštát pod	1 5
Soil respiration	site	had	-1/ Radhostem	Čierne
Additional Information:		u Kelč	Zašová Rožnov/pod	Svrćinovec
Data Status:			Valašské Radhoštěm Meziřičí Horní Bečva Rakov	Y Y
Key References:	Marek MV, Kalina J, Matouskova M (1995) Responses of photosynthetic carbon assimilation of Norway spruce exposed to long-term elevation of CO2 concentration. Photosynthetica 31: 209-220.	vstrice pod Hostynem	Velké Karlovice E442	Čadca Os Krásni Kýsu
Web Link:		lešov.	Vsetin Karolinka	Kysucké
Person name	Contact detail	Inst Frystak	Veľké Rovné	Nové Mesto
Michael Marek	emarek@usbe.cas.cz	Slušovice	Štiavnik	Rádola
Additional Persons:		Zlin		Teplička ilina nad Váhor
www.czechglobe.cz		Vizoviće	Valašské Klobouky	Rosina Stree

- Main projects associated with this infrastructure:
- AnaEE Analysis and Experimentation on Ecosystems (2012-2018)
- CzechGlobe Center for Global Climate Change Impacts Studies (2010-2014)
- Czech Terra adaptation of lanscape carbon sinks in the context of global change (2007-2011)
- **CzechCarbo** Carbon cycle study focused on the terrestrical ecosystems in the Czech republic in connection on the CARBOEUROPE project (2003-2007)
- **EUROFACE** An integrated European scientific infrastructure for GC studieson forest and agroforest ecosystems utilising FACE technology (2003-2005)
- **MERCI** Methodological and Experimental Research Centre and Infrastructure for Studies of GCC Impacts on Forests (2003-2004)
- **CARBOMONT** Effects of land-use changes on sources, sinks and fluxes of carbon in European mountain areas (2002-2004)
- ECOCRAFT II (1996-1999)
- Another national projects

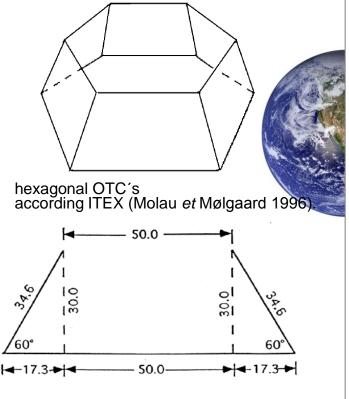




Project Ministry of Education 2007-2011

Changes in alpine ecosystems in the KRNAP, NPR Kralický Sněžník and CHKO Jeseníky in the context of global change (*M. Banaš, M. Zeidler*)

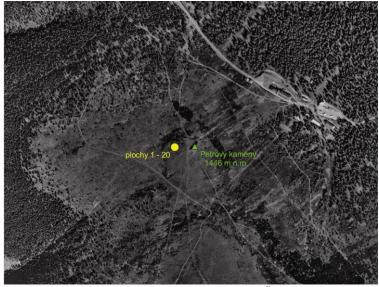




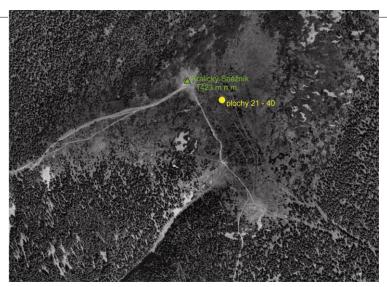
increase of the temperature by 1-3 °C (Henry and Molau 1997).



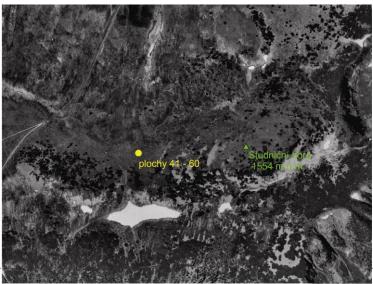
Localities:



(1) Petrovy Kameny (Jeseníky)



(2) Kralický Sněžník (SE from the top)







Design of the experiment:

Treatments:

warming (OTC), warming + irrigation (50% of ambient precipitation), warming + fertilization (2 g N m⁻² year⁻¹ - NH_4NO_3) control



Monitoring of plant species diversity Phenology Soil analyses Biomass (nutrients) Climatic data

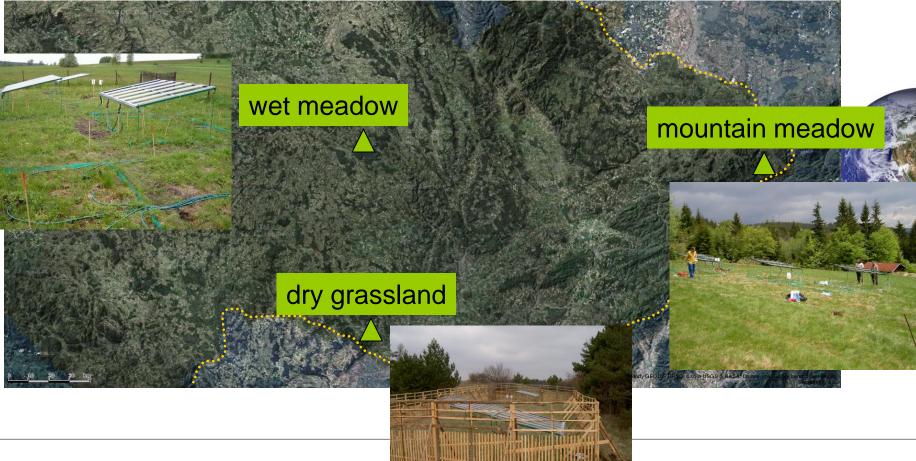
Long-term changes in vegetation



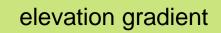


Project GA CR 2006-2008

Impact of precipitation changes on plant and soil processes in different grassland ecosystems (*K. Fiala*)





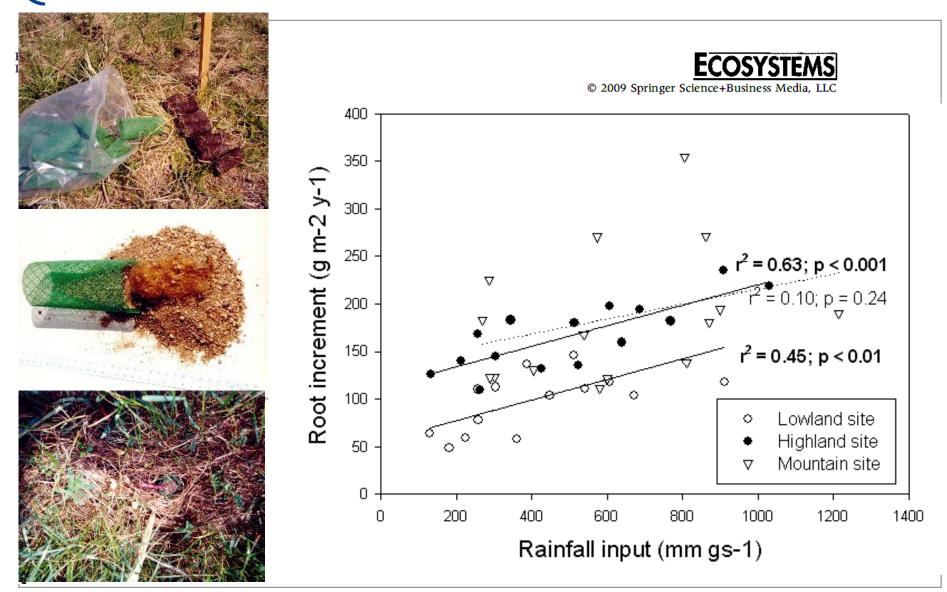




precipitation gradient











Experiment on the combined effect of drought and UV radiation in mountain grassland (2010-2015)

Hypotheses:

Effects of drought and UV has a similar effect on the induction of protective mechanisms of plants. The combined effect of drought and UV has a significant impact in comparison with the effects of individual factors.

Design of the experiment:

Treatments changing precipitations: drought (4-6 weeks)

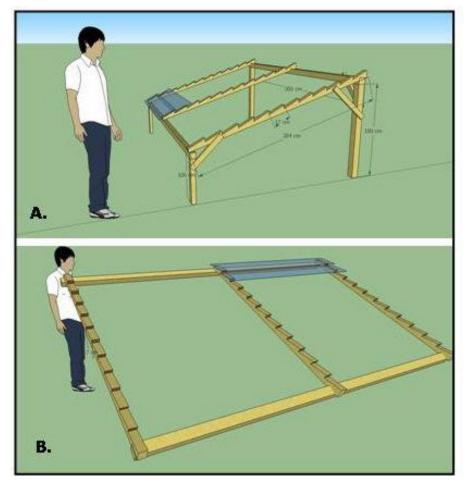
control with ambient precipitation

Treatments changing UV radiation: filtered UV (acrylic with filter of UV radiation) ambient UV (acrylic without filter)





Experiment on the combined effect of drought and UV radiation in mountain grassland (2010-2015)



control treatment with ambient precipitation



drought treatment for 4-6 weeks

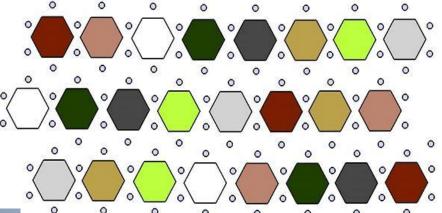




New infrastructure Domanínek - Experimental station of Plant Ecophysiology in the frame of project CzechGlobe (monitoring of multiple factors simultaneously)

24 Open top chambers (OTC)

Infrastructure allows to monitor the influence of three factors in two levels and their combinations in three replications



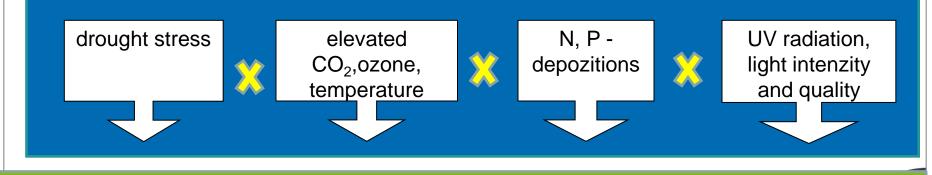


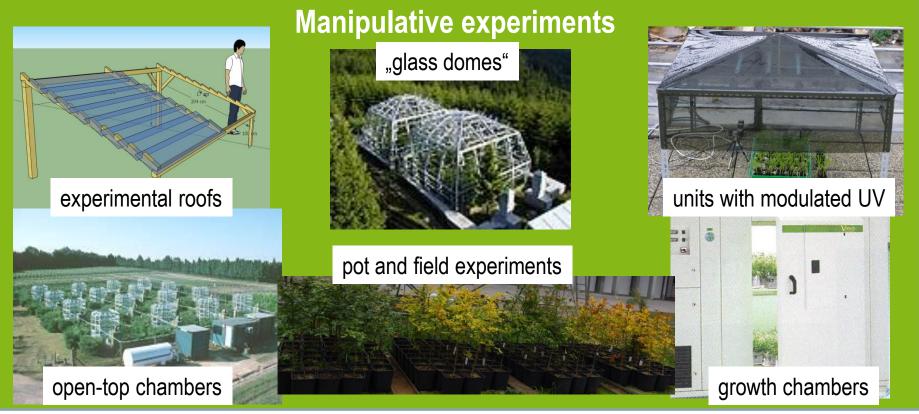
	elevated CO		nitrogen		drought	
treatment		+	5 5	+	-	+
1 ()	1		1		1	
2 (++++)		4		1		1
3 (+)	\checkmark		\checkmark			1
4 (-+-)	\checkmark			✓	✓	
5 (+)		1	1	207	1	5.00
6 (-++)	1			1		1
7 (++-)		1		1	1	
8(+-+)		1	1		a	1





Environmental factors in the global climatic changes and their interaction







Thank you for your attention...





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