AFORCLIMATE

LIFE15 CCA/IT/000089

EGU General Assembly 2018
European Geosciences Union
General Assembly 2018
Vienna, Austria, 08 – 13 April 2018
Programme BG2: Terrestrial Biogeosciences
Session BG2.23
Forests under pressure: current knowledge and future science directions

Climate variability in forest management: The AForClimate project

(Adaptation of **FOR**est management to **CLIMATE** variability)

Fabrizio D'Aprile and Ugo Chiavetta

Council for Agricultural Research and Economics (CREA)

Research Centre for Forestry and Wood

COORDINATOR

crea Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria

PARTNER

Università degli Studi del Molise

Università degli Studi di Palermo

Unione Montana dei Comuni del Mugello

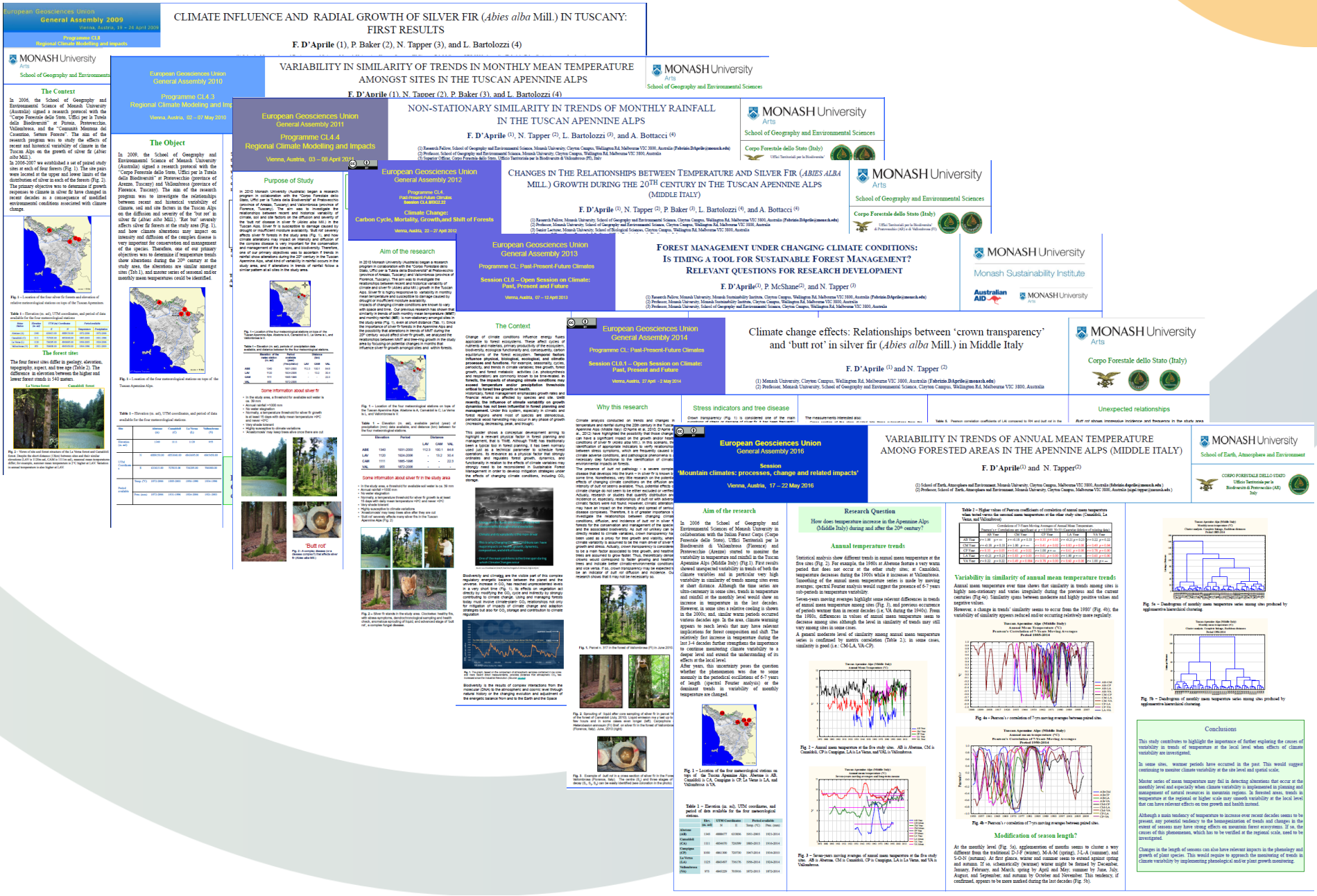
Regione Molise

Regione Sicilia

D.R.E.Am

Compagnia delle Foreste

Forest management and climate variability in the EGU history



Rationale of the project

- Research shows that climate variability plays a relevant role in forest planning and management under climate change (D'Aprile *et al*., 2013, 2012, 2009; Keenan, 2015; Albert *et* Schmidt, 2010; Lindner *et al*., 2010).

- In forest planning and management, yield tables, site quality indices, age class, rate of growth, and spatial distribution are some of the most used tools and parameters. However, **these methods do not take into account the influence of trends in climate variability on forest and tree growth although climate is the main driver of growth response**.

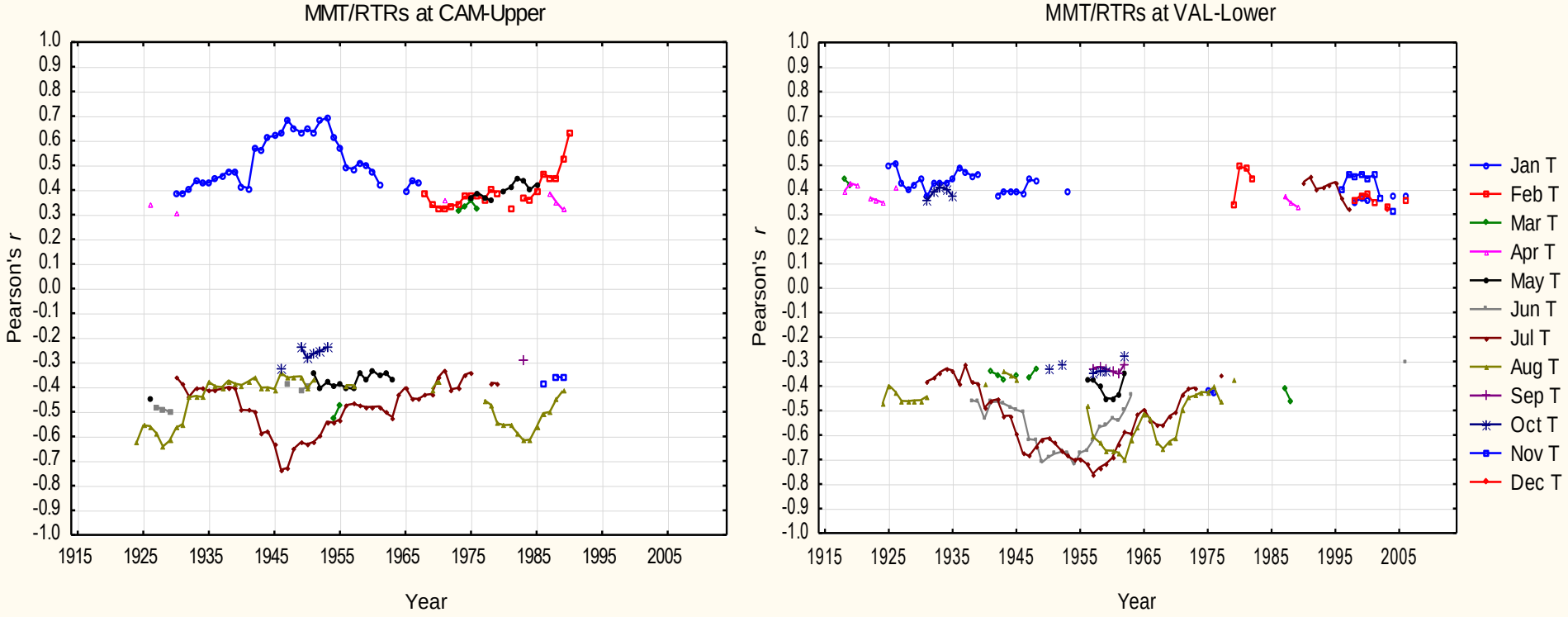
- Changing climate conditions can impact on temperature and/or precipitation thresholds critical to forest tree growth; forest biomass, resilience, and CO_2 storage may be damaged.

- Thus, **forest planning and management** need to **implement the relationships between climate variability and trends of tree growth to mitigate the impacts of climate change on forest resilience, biomass, productivity, and CO_2 storage**

AFORCLIMATE

Climate-growth relationship and its changes

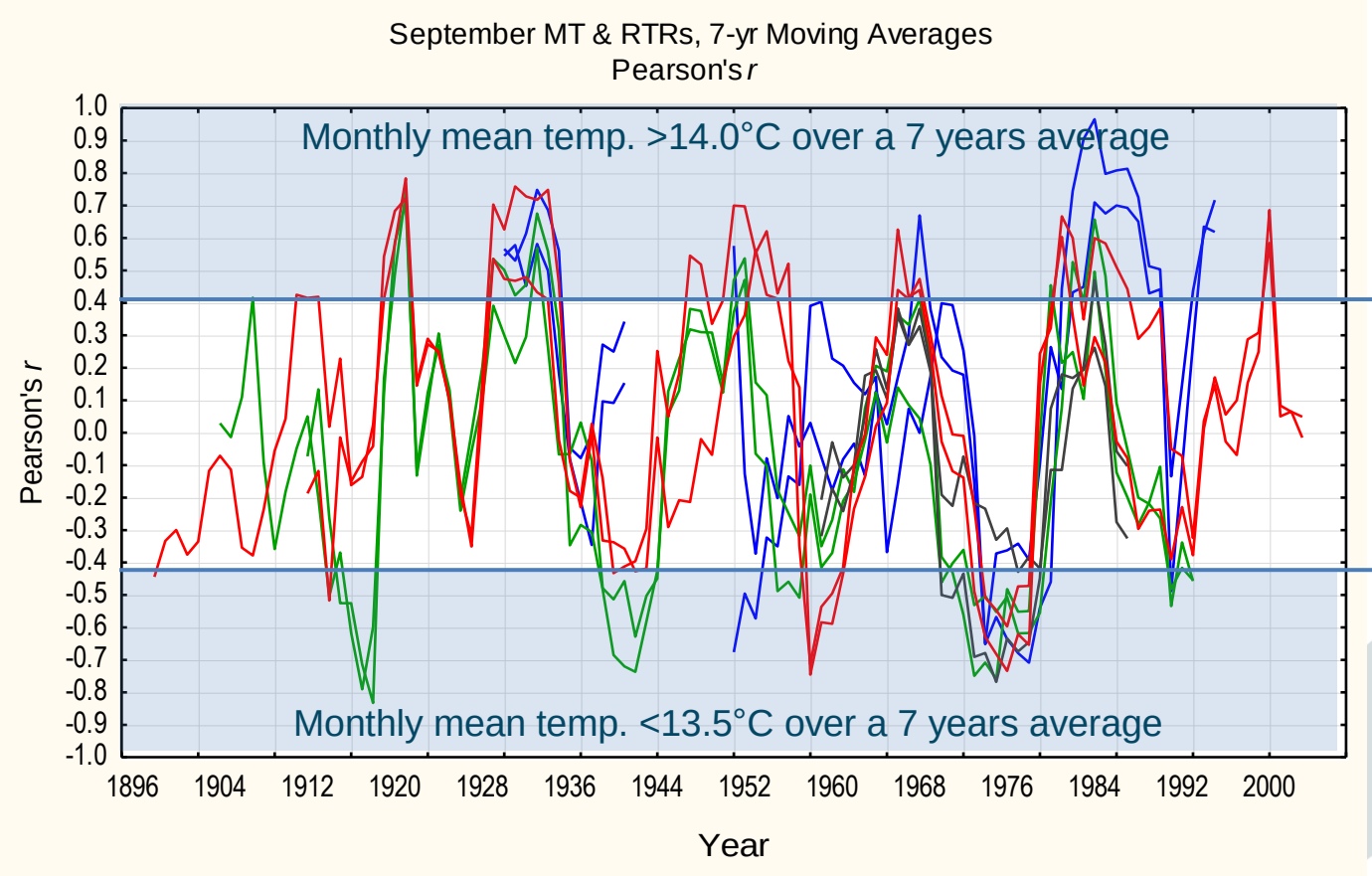
Climate-growth relationships show that months related to tree ring growth have changed during the last century. For example, January MT is related to RTRs until the end of the mid 1960s at the upper site in Camaldoli (Italy) (m. 1111 asl) and February MT afterward (left). At a lower site (VAL) (850 m asl), cold months show irregular influence on tree ring growth and drier and warmer months (June, July, and August) show negative correlation with tree ring growth. However, July MT appears to be variably but usually related to ring growth while August MT tends to substitute June MT during time (right)



Statistically significant levels of correlation between MMT and RTRs at forest sites in the Tuscan Apennine Alps. Months where MMT is associated with RTRs change during the 20th century and their level of correlation can be highly non-stationary.

AFORCLIMATE

The Mean Temperature Thresholds



The related values of September MT **above** which tree growth **increases** can be seen in the correponding chronological series of Sep MT.

The related values of September MT **below** which tree growth **decreases** can be seen in the correponding chronological series of Sep MT.

AFORCLIMATE

Setting the lag time for moving averages

ABE Upper	ABE Lower	CAM Upper	CAM Lower	LAV Upper	LAV Lower	VAL Upper	VAL Lower
(99.0)	(99.0)	(99.0)	(99.0)	(99.0)	(99.0)	(99.0)	(99.0)
49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5
33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0
24.8	24.8	24.8	24.8	24.8	24.8	24.8	24.8
19.80	19.8	19.8	19.8	19.8	19.8	19.8	19.8
16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5
14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1
12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4
11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9
9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3
7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6
7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1
6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6
6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2
5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2
5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7
4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50
4.30	4.30	4.30	4.30	4.30	4.30	4.30	4.30
4.13	4.13	4.13	4.13	4.13	4.13	4.13	4.13
3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96
3.81	3.81	3.81	3.81	3.81	3.81	3.81	3.81
3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
3.54	3.54	3.54	3.54	3.54	3.54	3.54	3.54
3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41
3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30
3.19	3.19	3.19	3.19	3.19	3.19	3.19	3.19
3.09	3.09	3.09	3.09	3.09	3.09	3.09	3.09
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91
2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83
2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75
2.68	2.68	2.68	2.68	2.68	2.68	2.68	2.68
2.61	2.61	2.61	2.61	2.61	2.61	2.61	2.61
2.54	2.54	2.54	2.54	2.54	2.54	2.54	2.54
2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48
2.41	2.41	2.41	2.41	2.41	2.41	2.41	2.41
2.36	2.36	2.36	2.36	2.36	2.36	2.36	2.36
2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25
2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20
2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15
2.11	2.11	2.11	2.11	2.11	2.11	2.11	2.11
2.06	2.06	2.06	2.06	2.06	2.06	2.06	2.06
2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02

Mean: 99.0; **6.64** x 15 = 99.6 (99.0)

Mean: 49.5; **6.64** x 7 = 46.5 (46.2)

Mean: 33.0; **6.64** x 5 = 33.2 (33.0)

Mean: 19.8; **6.64** x 3 = 19.9 (19.8)

Mean: 13.3 ; **6.64** x 2 = 13.3 (13.2)

Mean = 6.64 (6.6)

- Periods (years) that are shown most frequently in the RSE of **tree ring series** as found **by Fourier spectral analysis**. Peak periods are yellow, secondary peak periods are gray.
- **Temperature and tree rings show similar periods (and subperiods)**

Hypothesis: tree ring growth follows the same cycles/periods of mean temperature

AFORCLIMATE

AForClimate Objective

General Objective

To preserve and improve the efficiency of beech forest ecosystems
through an effective forestry planned
on the basis of climate variability and trends

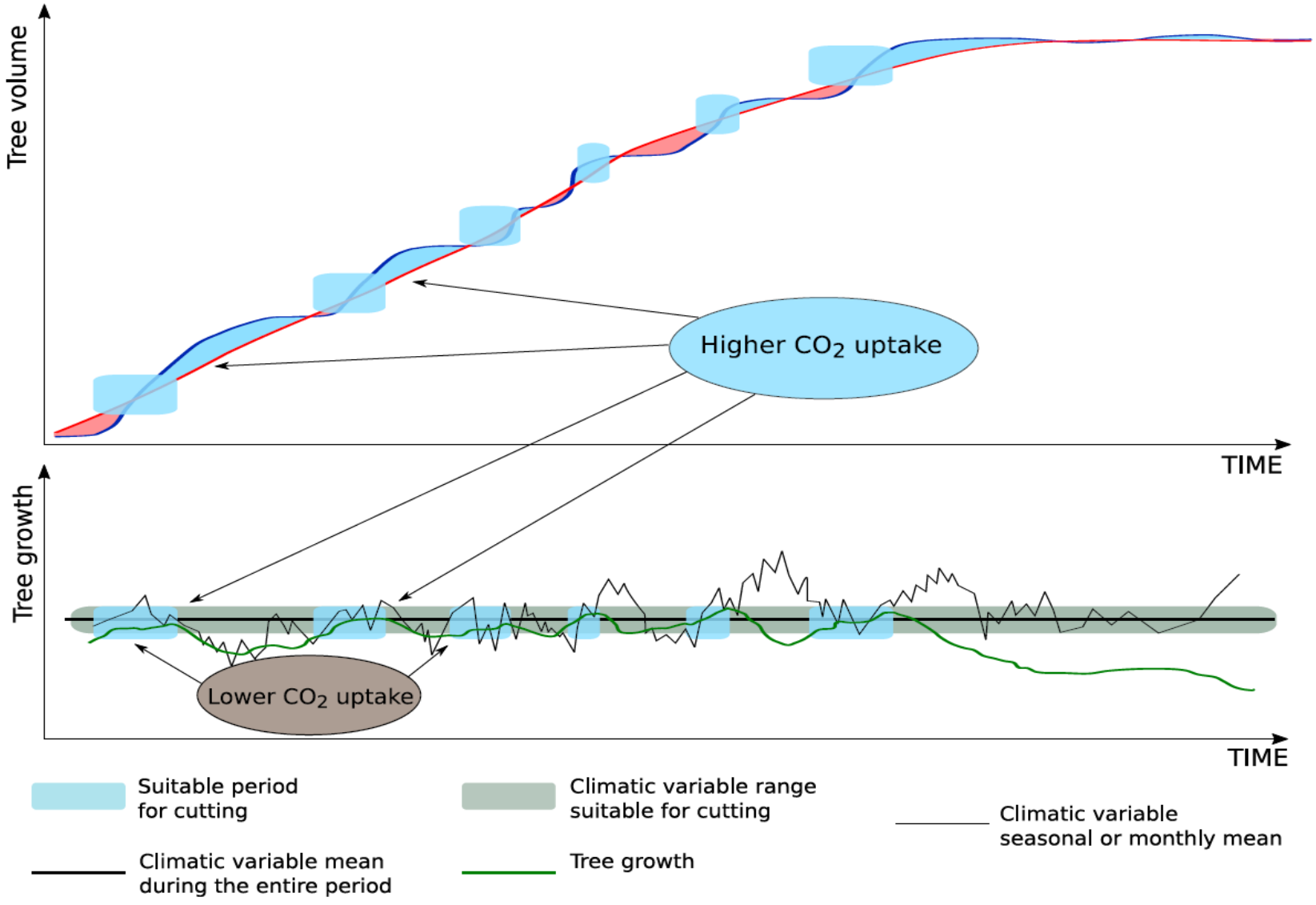
- Estimate the likely impacts of climatic factors on forest growth in order to manage forests by ways that preserve resilience;

- Distribute the wood mass harvested over periods with climate conditions favorable to growth

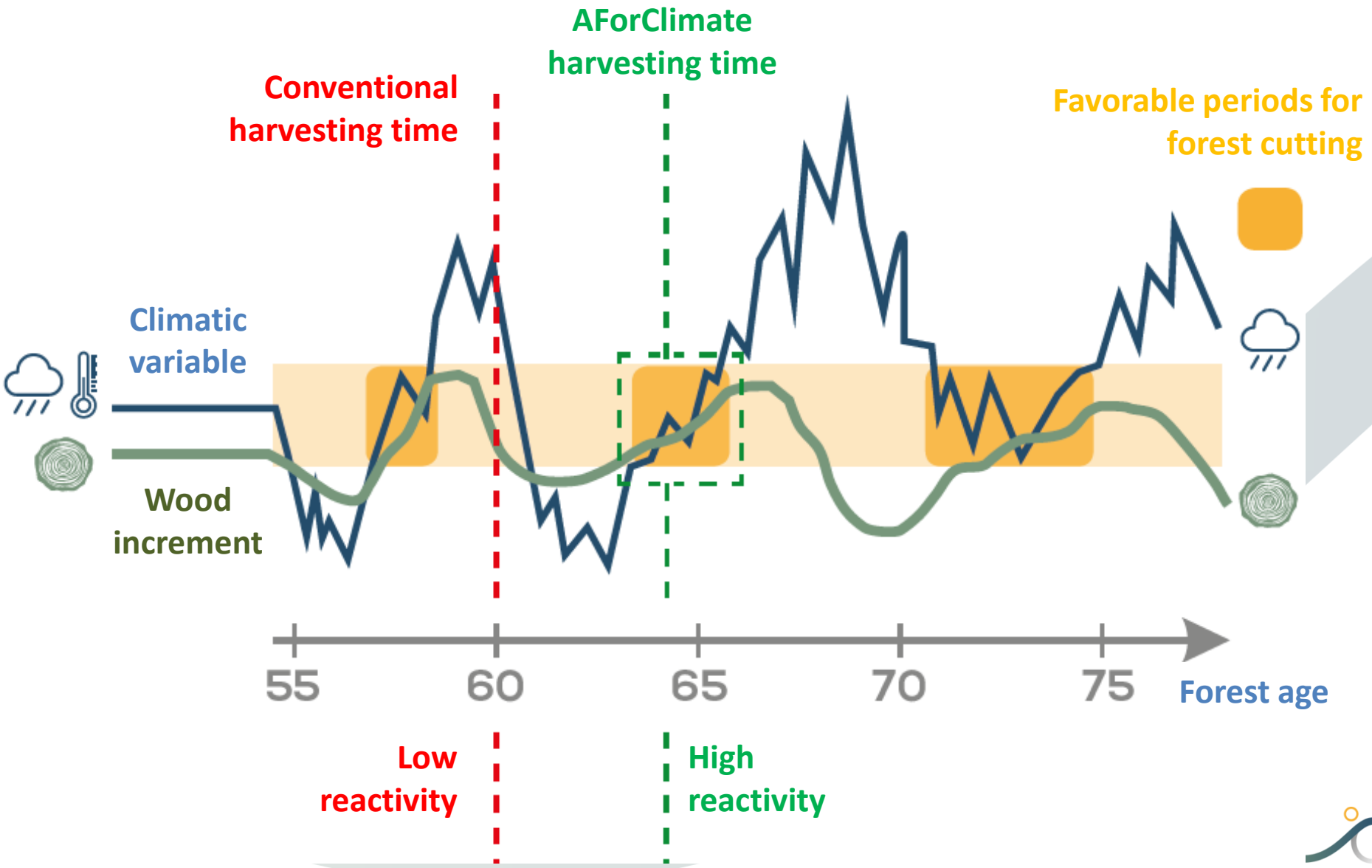
- Take into account forest regeneration

AFORCLIMATE

The AForClimate concept

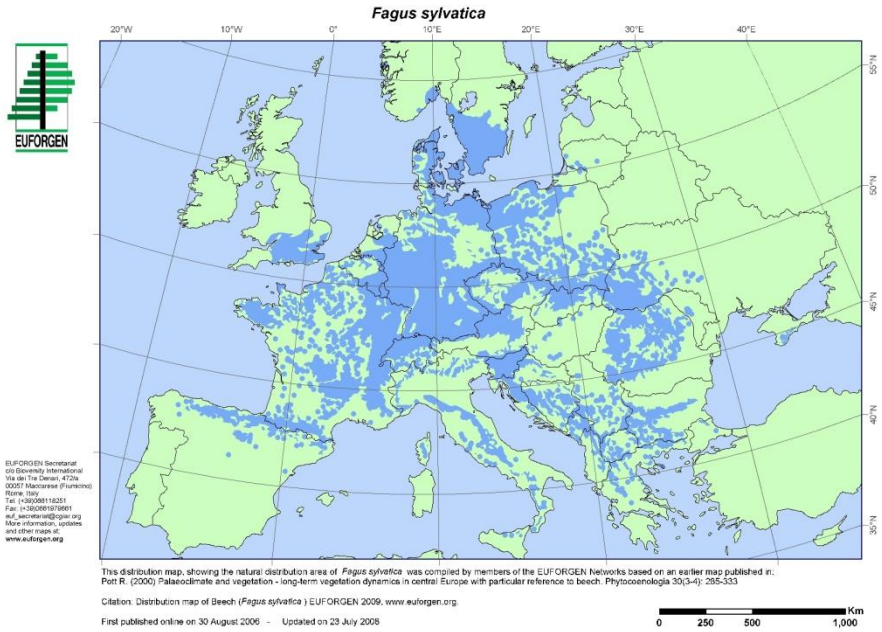


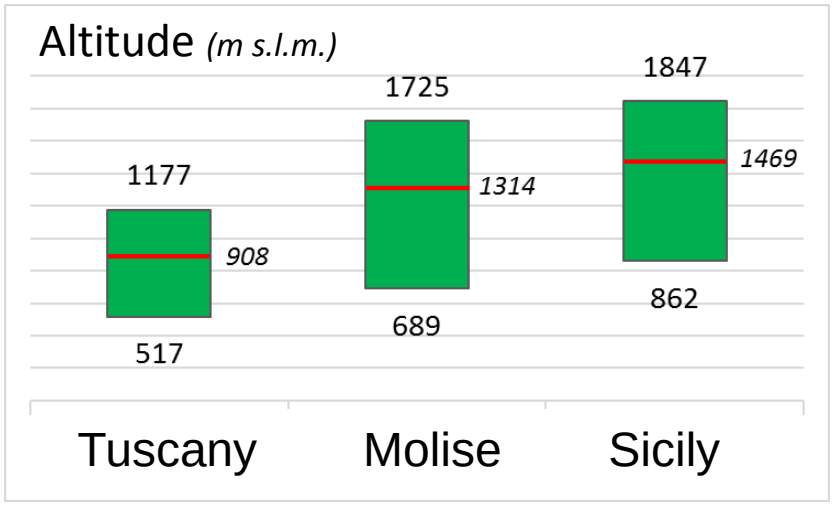
The AForClimate proposal



AFORCLIMATE

Demonstration areas



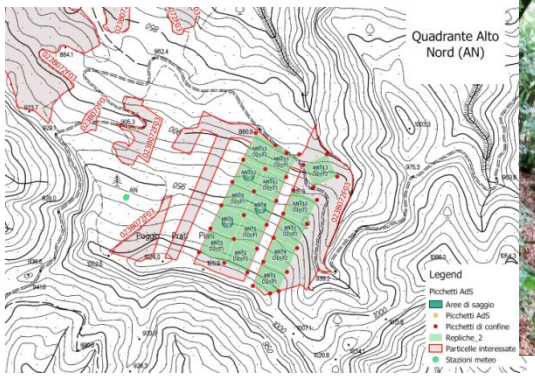


NORTH-SOUTH Transect in the southern extreme of beech range in three Italian Regions: Tuscany, Molise and Sicily

The team

	Acronym	Name	Type	Role in the project
	CREA	Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria Centro di ricerca per la selvicoltura	Public body **Research Centre**	**Coordinator beneficiary**
	CDF	Compagnia delle foreste	SME **Publisher**	**Responsible for communication and dissemination activities**
	DSRTRS	Regione Siciliana Assessorato Regionale dell'Agricoltura dello Sviluppo rurale e della Pesca Mediterranea	Public body **Regional Forest Service**	**Responsible for the implementation of the project in Sicily**
	DREAM	D.R.E.AM. Italia società cooperativa agricolo forestale	SME **Forestry Enterprise**	**Technical Manager** **Financial and Administrative responsible**
	DSAF	Università degli studi di Palermo Dipartimento Scienze Agrarie e Forestali	Public body **University**	**Implementation leader of monitoring in Sicily**
	REGMOL	Regione Molise	Public body **Regional Forest Service**	**Responsible for the implementation of the project in Molise**
	UMMUGE	Unione Montana dei Comuni del Mugello	Public body **Local Forest Service**	**Responsible for the implementation of the project in Tuscany**
	UNIMOL	Università degli Studi del Molise Dipartimento di Bioscienze e Territorio	Public body **University**	**Implementation leader of monitoring in Molise** **Coordinator for defining guidelines**

Progress:



AZIONE	2016		2017				2018				2019				2020				2021				2022	
	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2
A1																								
A2																								
C1																								
C2																								
C3																								
C4																								
C5																								
C6																								
D1																								
E1																								
E2																								
E3																								
E4																								
F1																								
F2																								
F3																								
F4																								

Expected applicative results

R1 - Identification of **climatic parameters** (thresholds) that mainly affect the reactivity of ecosystems of beech forests

R2 - Development of **innovative methods of silviculture planning** based on climate variability

R3 - **Monitoring and validation** of the system through the replication of the experience

R4 - Ensure adequate visibility to **disseminate results**

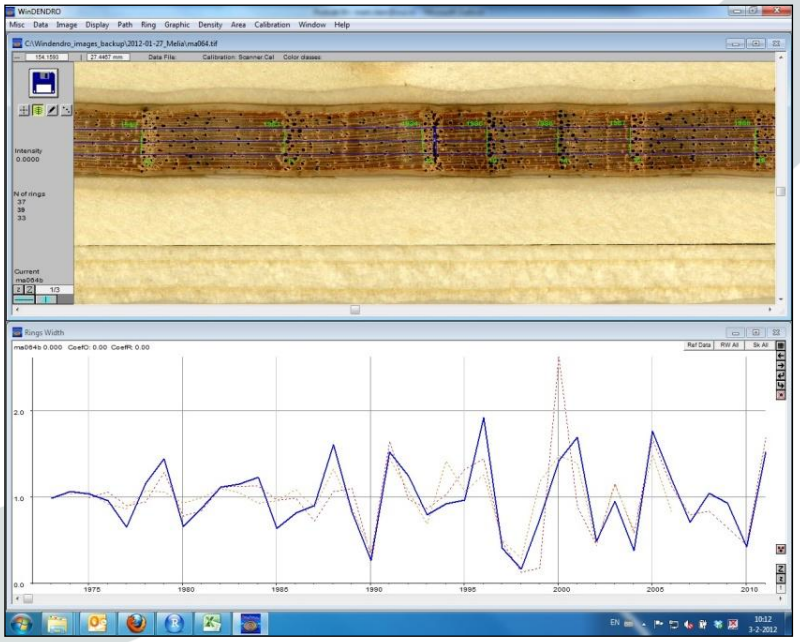
AFORCLIMATE

Dendroclimatological analysis:

Assesses the climate influence on tree growth

Climate monitoring through the positioning of 4 weather stations in each forest to measure all climate parameters (temperature, rainfall, snow and humidity)

Dendrochronological analysis



AFORCLIMATE

DSS (Decision Support System)

Example **year 1**

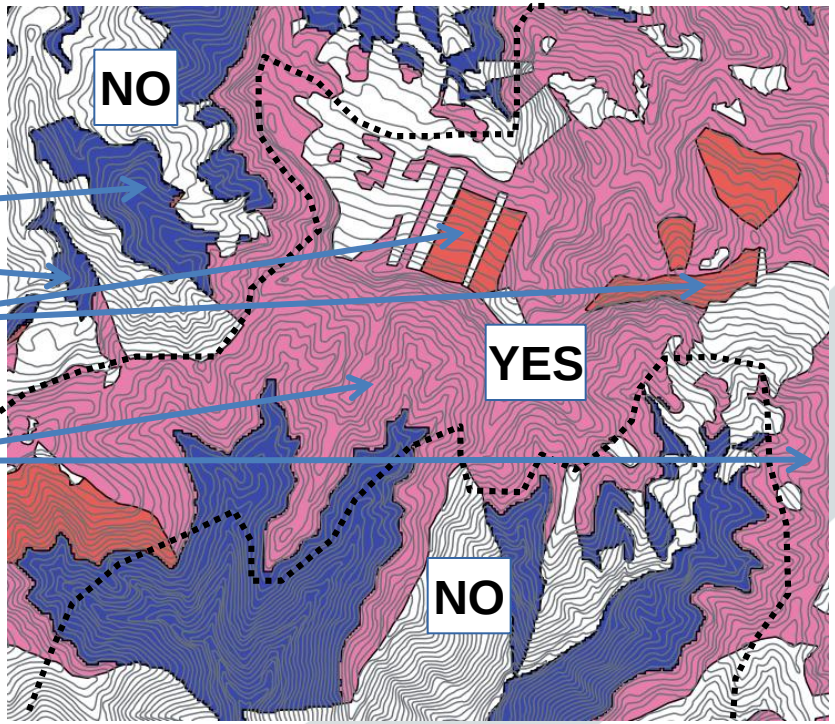
Already planned

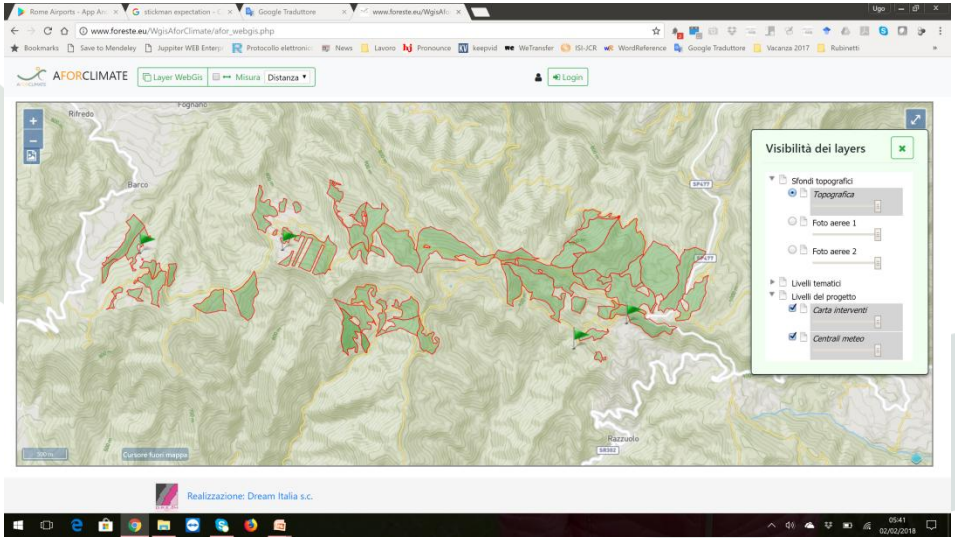
- Period 1
- Period 2
- Period 3

To be posponed

Can be anticipate to year 1

Can be anticipate to year 1
After check





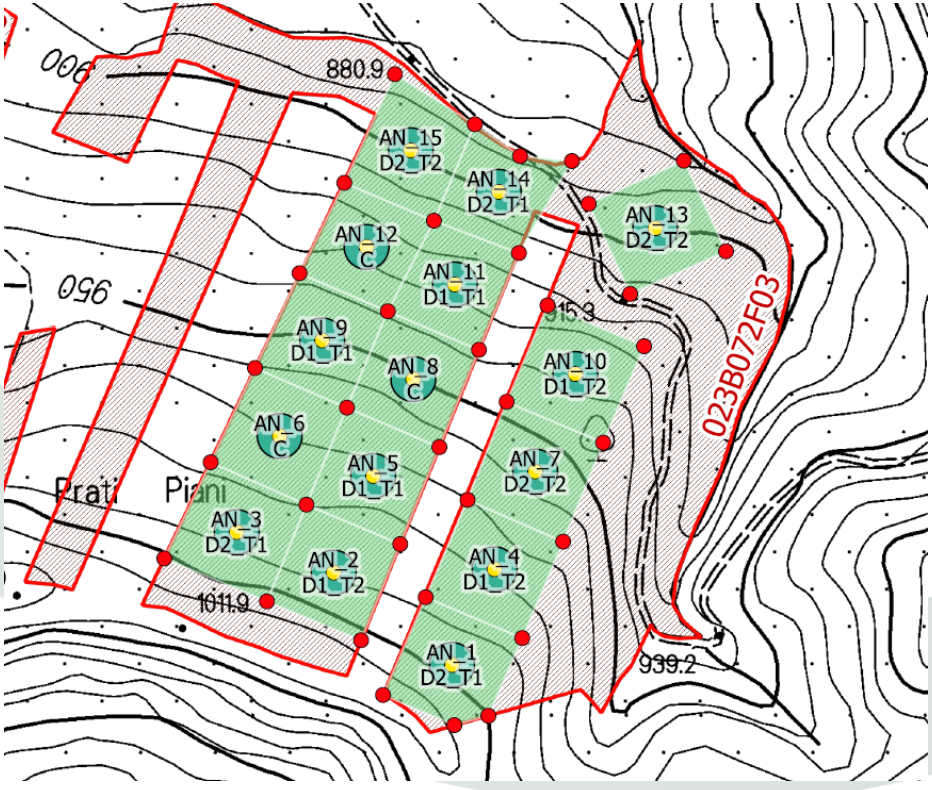
Draft and simplified version online at

http://www.foreste.eu/aforclimate.php

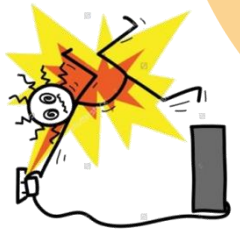
AFORCLIMATE

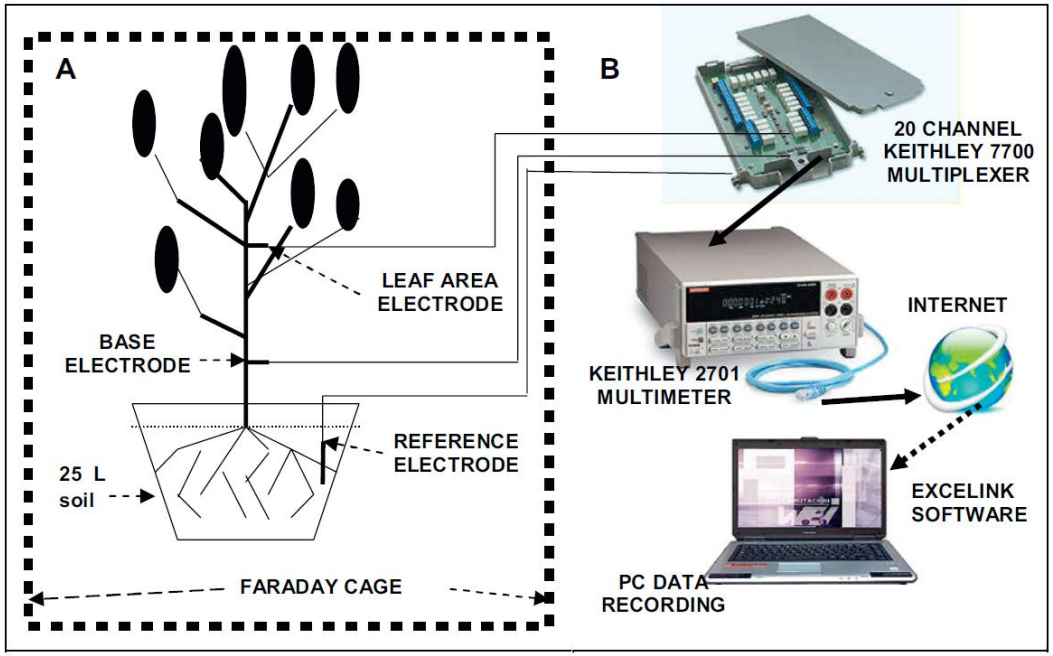
Monitoring and Validation

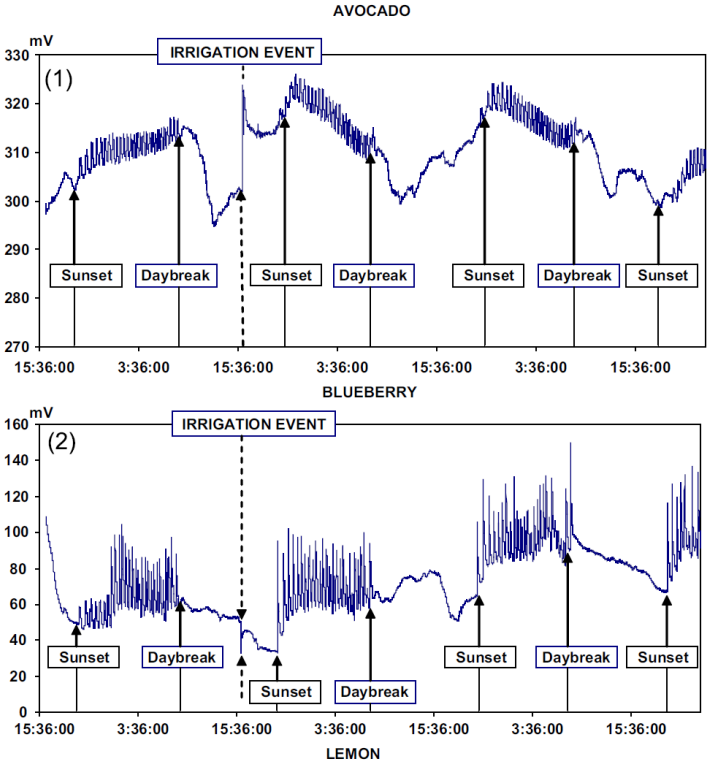
Design of a climate monitoring network in each demonstration area.
4 weather stations for each site located in 4 demonstration quadrant. The quadrants are combination of ASPECT (North and South) and ALTITUDE belt (high and low)
High-North and Low-South quadrants are upper and lower limit of local beech forests.



Electrophisiology







That’s all! Thanks for your attention!

www.aforclimate.eu

@aforclimate

fdaprile@aforclimate.eu

uchiavetta@gmail.com