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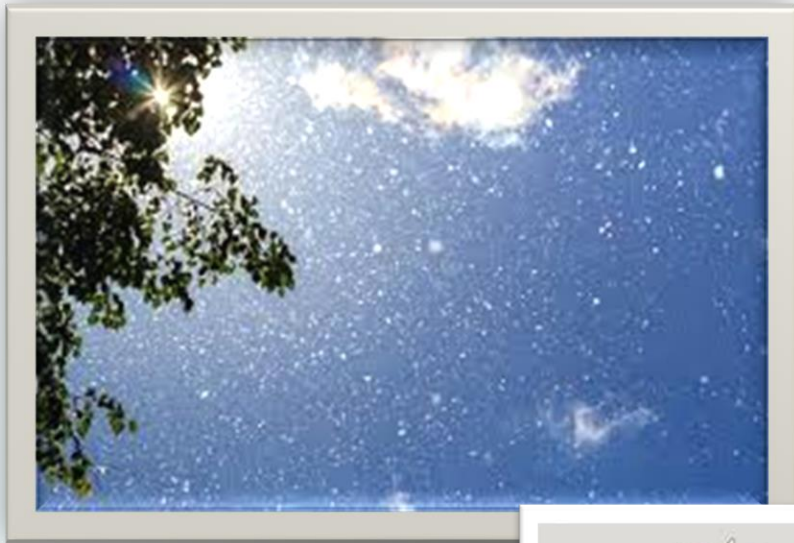
The importance of pollen monitoring for olive yield forecasting

Prof. Marco Fornaciari da Passano

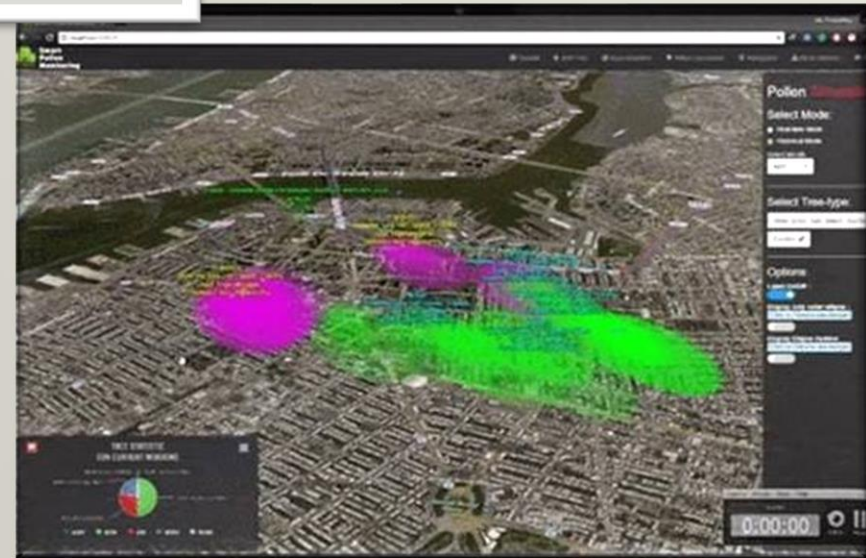
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Pollen monitoring in
urban and country areas

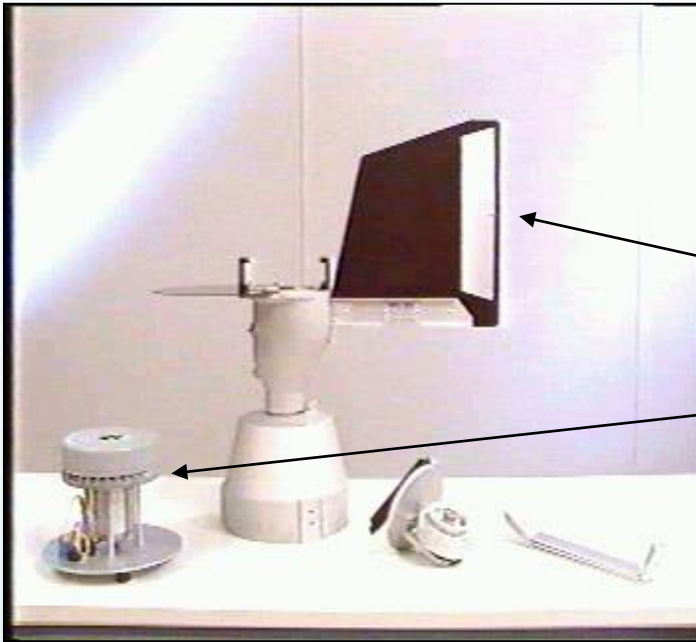


The pollen released can be monitored through different aerobiological monitoring techniques and in particular the volumetric method permits to estimate daily pollen concentrations per volume of air sampled (n° pollen grains/cubic metre).



VOLUMETRIC SAMPLER

The sampler consists essentially of three components: an impact unit, a wind vane and a vacuum pump.



AEROBIOLOGICAL SAMPLING

Methods of Capture,

Collection and Sample Preparation

Information on airborne biological-particle counts should be of use in a wide range of disciplines and fields of application, including...

Biodiversity, Agricultural Engineering, Forestry, Phytopathology, Meteorology, Climatology, Forensic Science, Bioterrorism, and Pollinosis.

In wind-pollinated plant species sufficient reproductive performance can be achived only producing abundant pollen grains dispersed in atmosphere during flowering period



Olive pollen network, and the importance of continuity in biological research

Experience of the Applied Aerobiology Laboratory
University of Perugia, Italy, POST-MARS

- 1999-2001 P.O.M. A31 “An inter-regional network for the olive pollen monitoring in relationship to the potential fruit production ”
- 2002 International Olive Oil Council Project UnivPg-UnivCo
“Olive flowering analysis in mediterranean areas (Spain, Italy)”
- 2003-2012 Official Contract with the UNAPOL to “Monitor olive flowering and to forecast the future harvest in South Italy”
(REG. CE 1331/04).
- 2007-2008 CFC/IOOC/07 "Pilot project for comparing olive flowering and crop yield in a Mediterranean area"



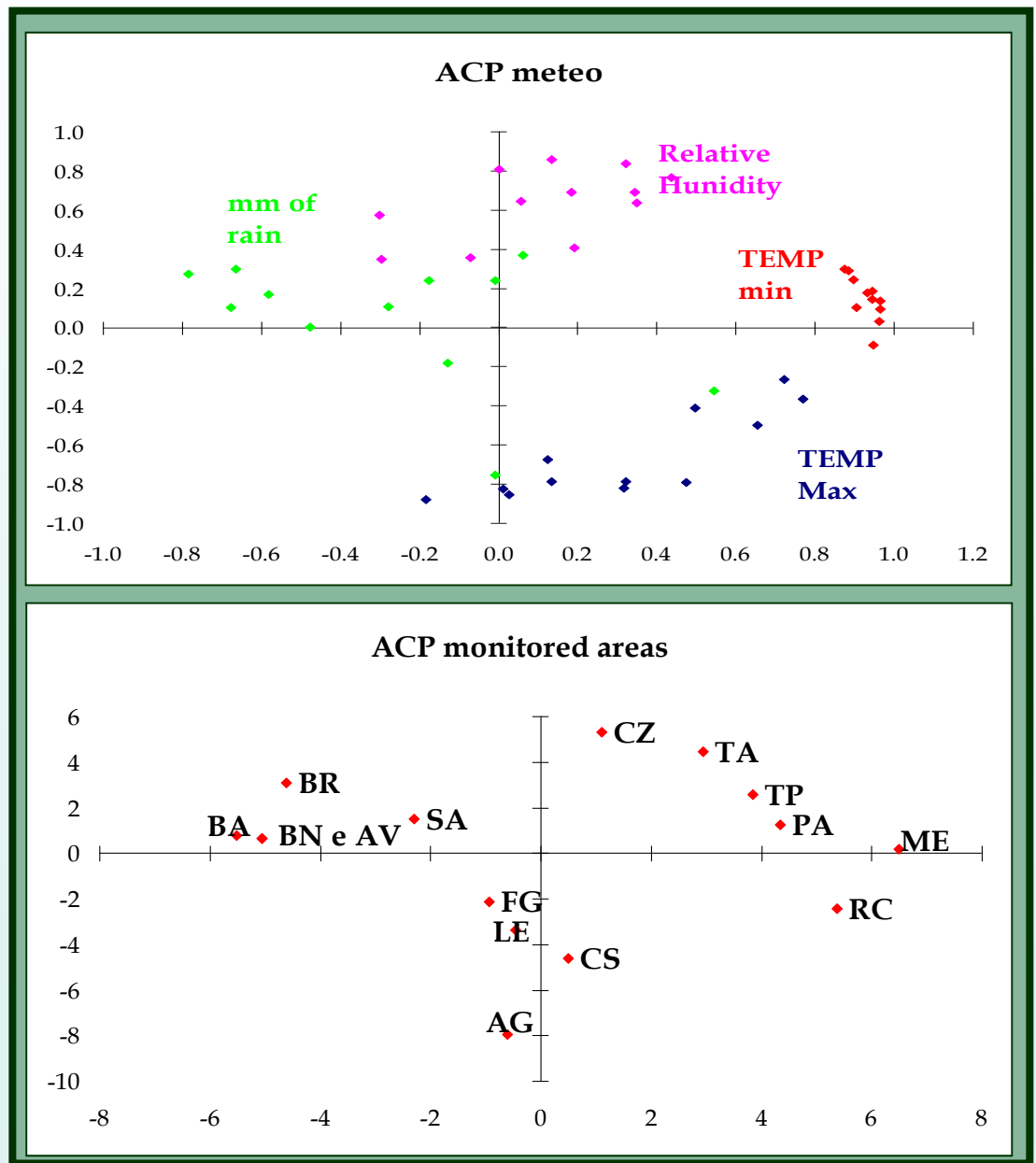
REGIONE	PROVINCIA	COMUNE	CULTIVAR
CALABRIA	Cosenza	Spezzano Albanese	Carolea, Coratina, Leccino Grossa di Cassano (Cassanese)
	Catanzaro	Staletti	Carolea, Ottobratica, Sinopolese
	Reggio Calabria	Palmi	Grossa di Cassano (Cassanese) Biancolilla (Nocellara)
SICILIA	Messina	Ficarra	Minuta (Olivio minuto), Verdello
	Palermo	Termini Imerese	Ogliarola messinese (Ogliarola terminisa)
	Trapani	Castelvetrano	Nocellara del Belice, Giarraffa Biancolilla, Cerasuola
	Agrigento	Ribera	Biancolilla, Cerasuola
CAMPANIA	Avellino	Ariano Irpino	Ravece, Oglierola, Olivella Cellina di Nardò (Leccina)
	Benevento	Solopaca	Ortolana, Coratina Curatore
	Salerno	Campagna	Frantoio, Leccino
PUGLIA	Foggia	San Severo	Provenzale (Peranzana) Cerasuola, Oglierola barese
	Lecce	Squinzano	Cellina di Nardò Ogliarola di Lecce (Ogliarola salentina)
	Brindisi	Pezze di Greco	Ogliarola di Lecce (Ogliarola salentina) Leccino, Coratina Frantoio, Picholine
	Bari	Bitonto	Coratina, Oglierola barese
	Taranto	Avetrana	Cellina di Nardò (Leccina) Carolea, Nociara, Frantoio

The multiregional network for an olive flowering survey was established in Sicily, Puglia, Calabria and Campania

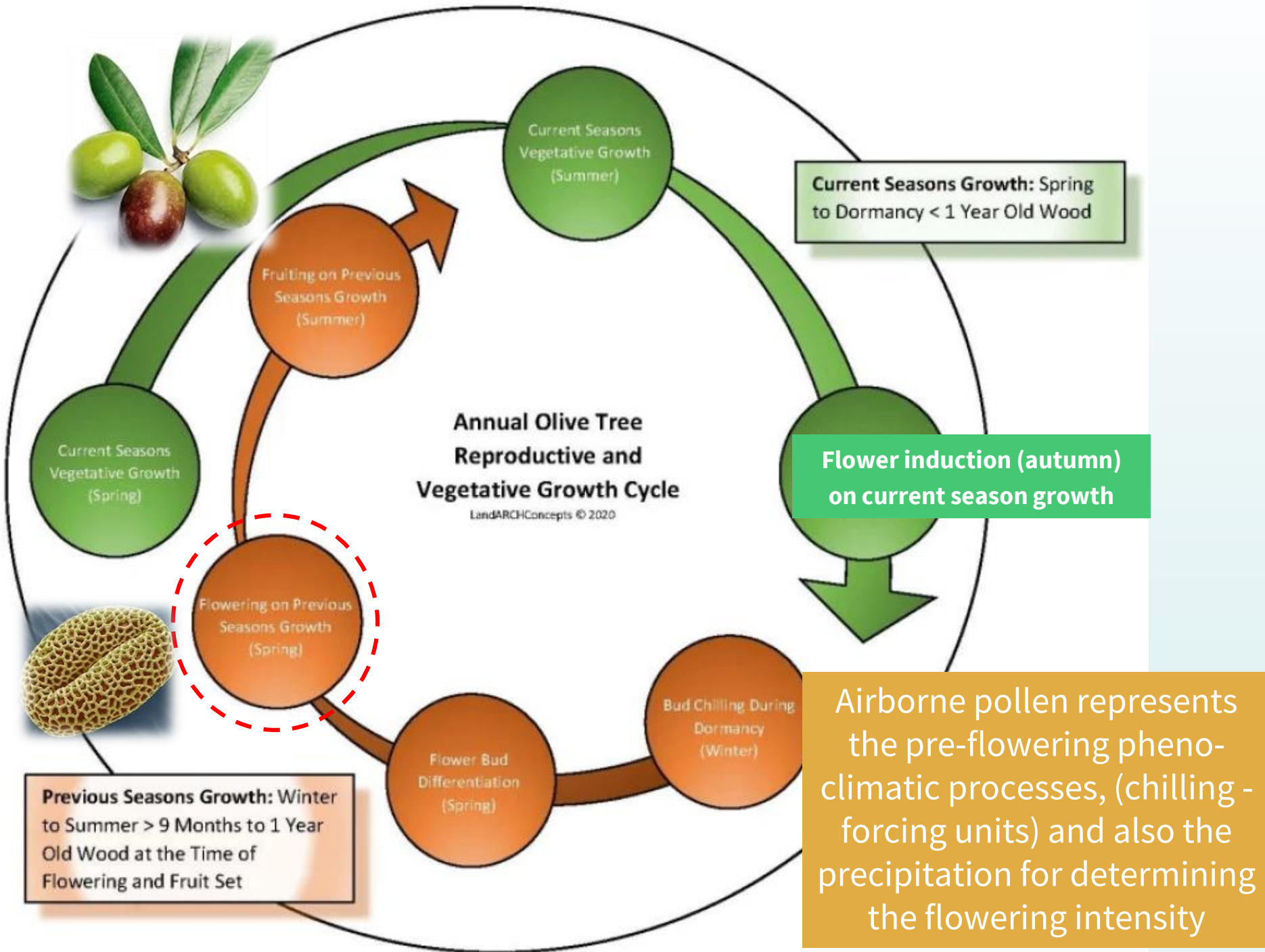
Besides the biological
variable....

Principal Component Analysis (PCA)

Relationships between
meteorological variables
and fruit productions in
the monitored
geographical areas

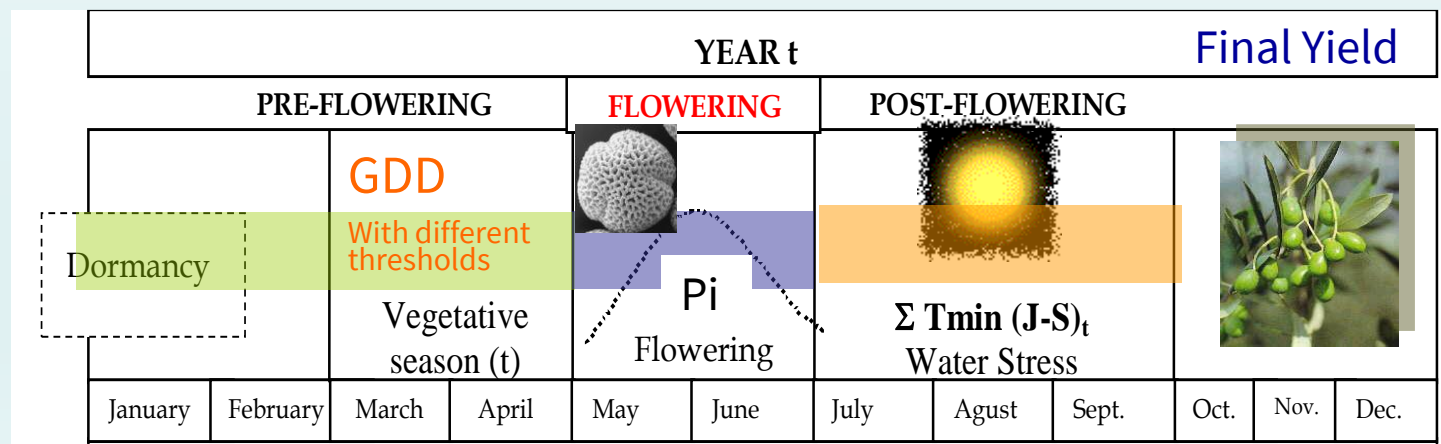
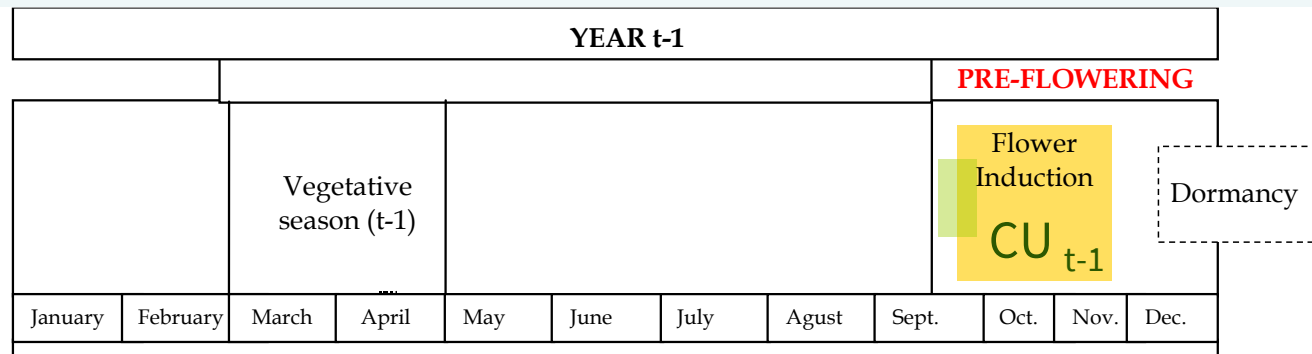


AG: Agrigento; AV: Avellino; BA: Bari; BN: Benevento; BR: Brindisi; CS: Cosenza; CZ: Catanzaro; FG: Foggia; LE: Lecce; ME: Messina; PA: Palermo; RC: Reggio Calabria; SA: Salerno; TA: Taranto; TP: Trapani



THE THEORETICAL APPROACH TO FORECAST POTENTIAL PRODUCTION:

- Pre-flowering phase (phenology, biological tests, climatic data, etc.);
- Flowering phase (pollen monitoring investigation) ;
- Post-flowering phase (phenology, agro-climatic information)



YIELD FORECASTING MODEL

CHILLING
PHENOMENON

FORCING
PHENOMENON

POLLEN
EMISSION

SUMMER T°
STRESS

$$\text{Prod} = a1 \text{ CU}_{t-1/t} + a2 \text{ GDD}_t + a3 \text{ Ip}_t + a4 \text{ S Tmin(June-S)}_t + e$$

CU Nov-Jan

CU Nov-Feb

CU Dec-Jan

CU Dec-Feb

CU Jan

CU Jan-Feb

GDD 3_7

GDD 6_7

GDD 3_10

GDD 4_10

GDD 5_10

GDD 6_10

GDD 7_10

GDD 3_12

GDD 4_12

GDD 5_12

GDD 6_12

GDD 7_12

lpc

EPP

EPPe

T min Jun I

T min Aug II

T min Aug III

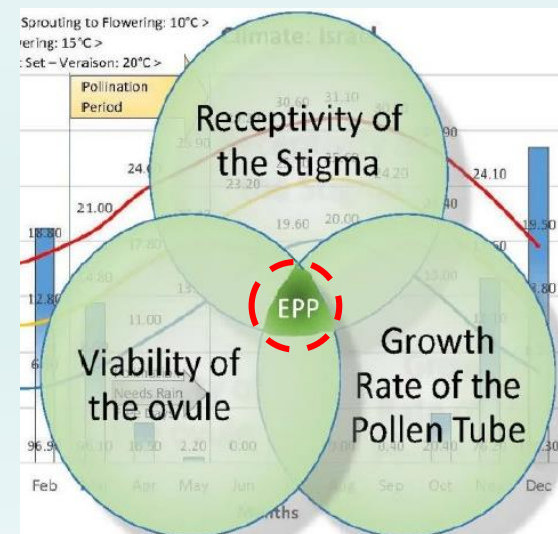
EPP is regulated by 3 integrated botanical factors:

- 1. Receptivity of the Stigma:** the ability of the stigma to support pollen germination;
- 2. Growth Rate of the Pollen Tube:** the time necessary for the pollen tube to grow through the style into the ovule;
- 3. Viability of the Ovule:** the duration the ovule viability

Different meteorological
variables weight in different
climates...



GDD Thresholds



The statistical models carried out for each olive growing area allowed to obtain excellent and long-range forecasting results

	RSME (1999-2012)	Regional average values		Total average
Ribera (AG)	5,9	SICILIA	8,6	8,3
Ficarra (ME)	18,7			
Termini I. (PA)	4,2			
Castelvetrano (TP)	5,5			
Bitonto (BA)	5,8	PUGLIA	5,9	
Fasano (BR)	0,7			
S. Severo (FG)	0,1			
Squinzano (LE)	21,4			
Avetrana (TA)	1,3	CALABRIA	10,6	
Staletti (CZ)	2,6			
Spezzano A. (CS)	15,7			
Palmi (RC)	13,6			
Ariano I. (AV)	6,1	CAMPANIA	9,5	
Solopaca (BN)	5,4			
Campagna (SA)	16,9			

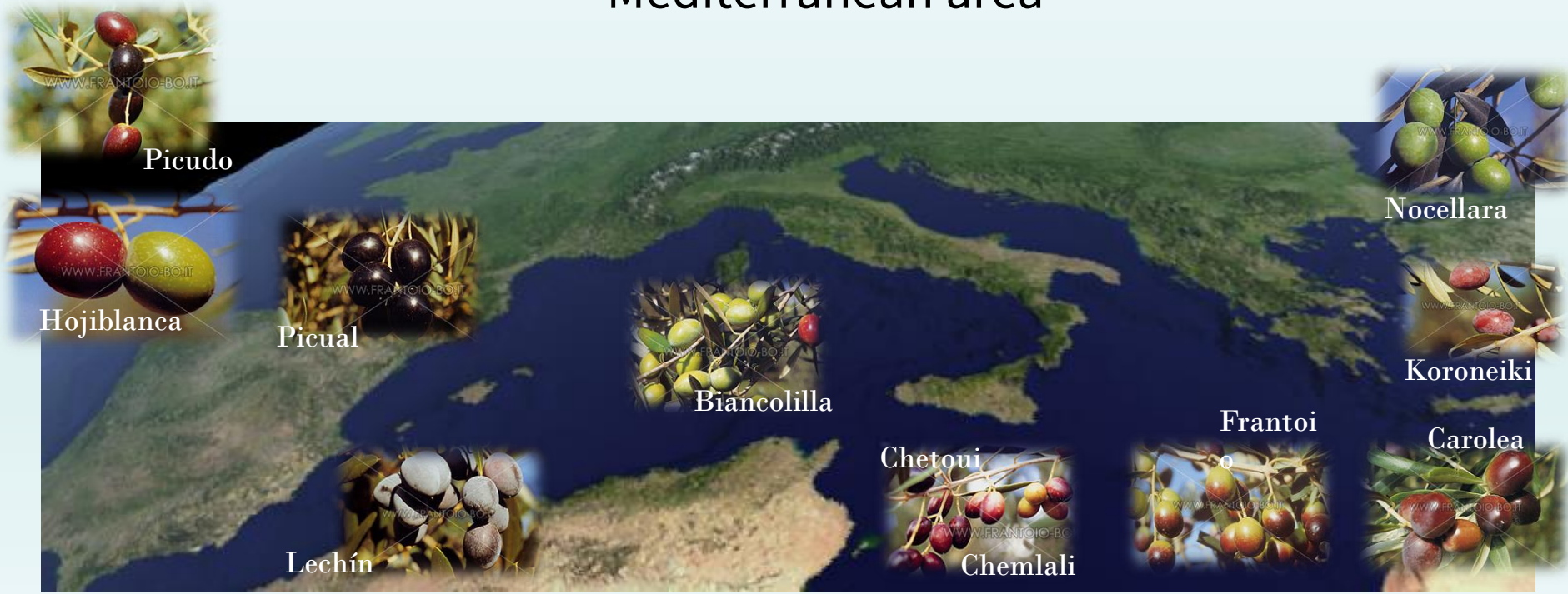
These researches will benefit the forecasting of the future yield, in order:

- ❖ to better manage the olive oil stocks until the new commercialization
- ❖ to programme the labour needed at the harvest



➤ Challenges identified with respect to the olive forecasting initiative

- ✓ To enlarge pollen monitoring network located in olive groves
- ✓ To fit regional models at different scales (from Countries to regions) for providing forecasting models adapted to the different Olive cultivars and meteorological characteristics
- ✓ To realize an integrated global model to predict olive crop in the Mediterranean area

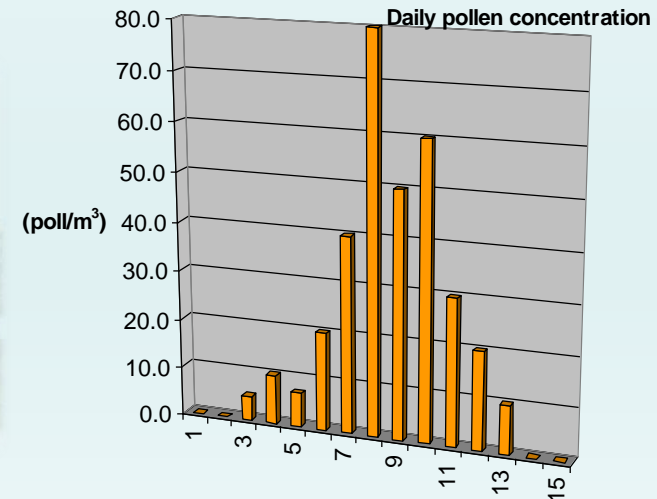
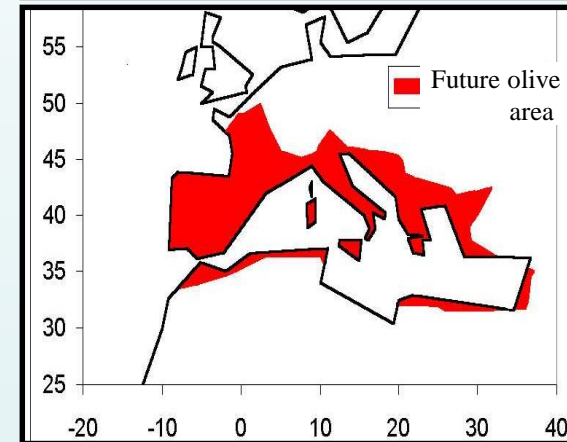
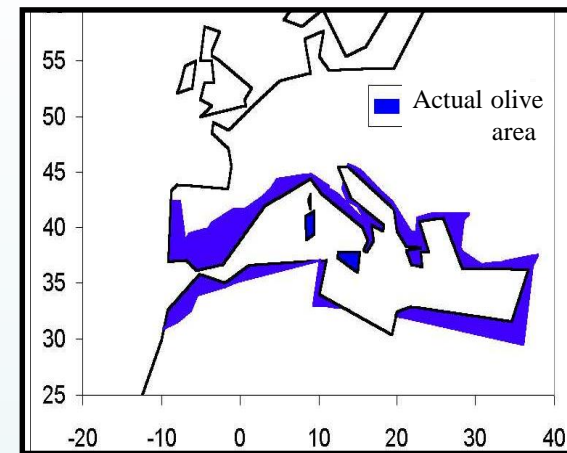


Olive flowering Phenological value vs climate change

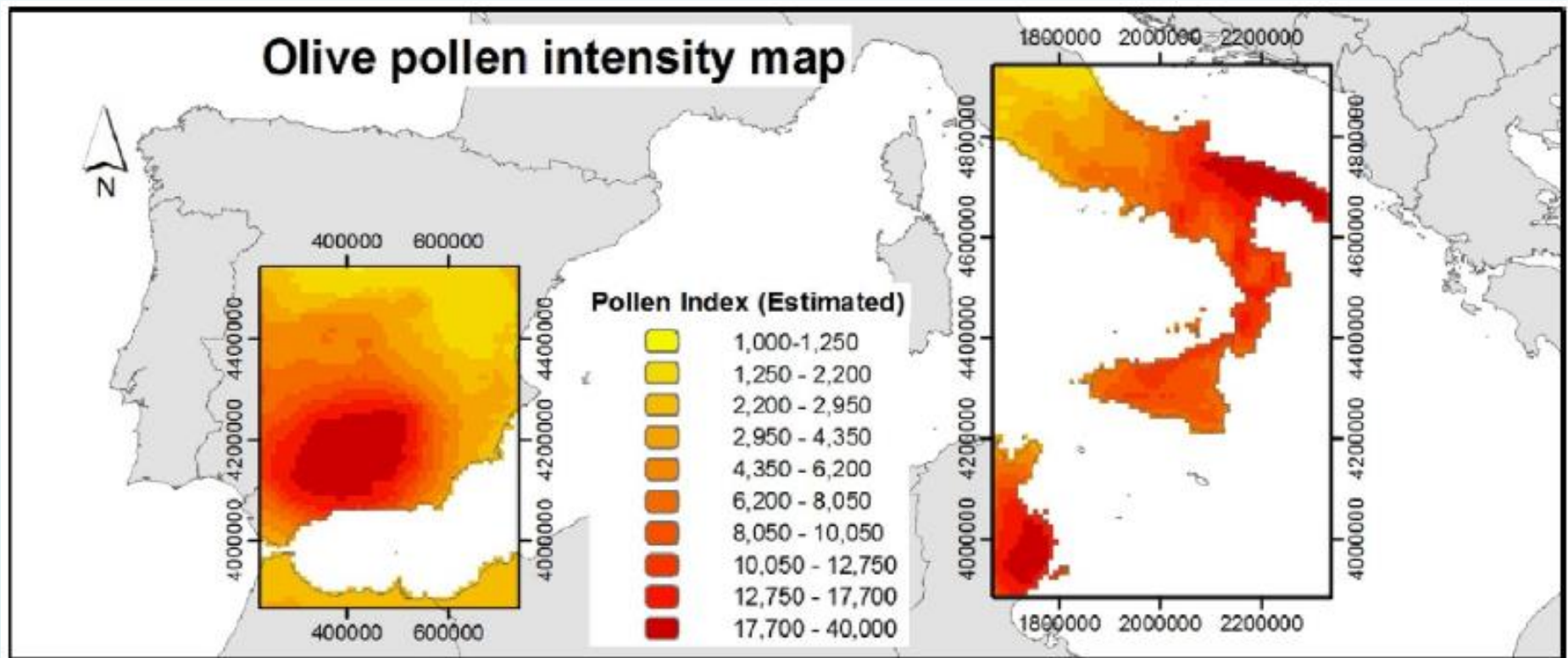
the suitable area for olive cultivation could be enlarged due to changes in temperature and precipitation (northward shift of olive cultivation area)

Potential increase of late frost risks due to an advance of flower development

Olive tree sanitary status monitoring by
“Pollen Indexes” records



Realization of airborne-pollen maps showing the mean of the annual Pollen Index for the whole Mediterranean area





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Thanks for your attention

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