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agriculture facing extreme climatic events

Modelling the impact of extreme climatic events in agriculture

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Project features

- **Title:** MODelling vegetation response to EXTREMe Events
- **Funding scheme:** FP7 European Collaborative Project
- **EC Grant:** 2000 K€
- **Start date:** 01/11/2013
- **Duration:** 36 months
- **Consortium:** 18 partners
- **Represented countries:** nine European countries, five non-European coutries (from Africa, Asia, South America, North America)

MODEXTREME in Europe

MODEXTREME overseas

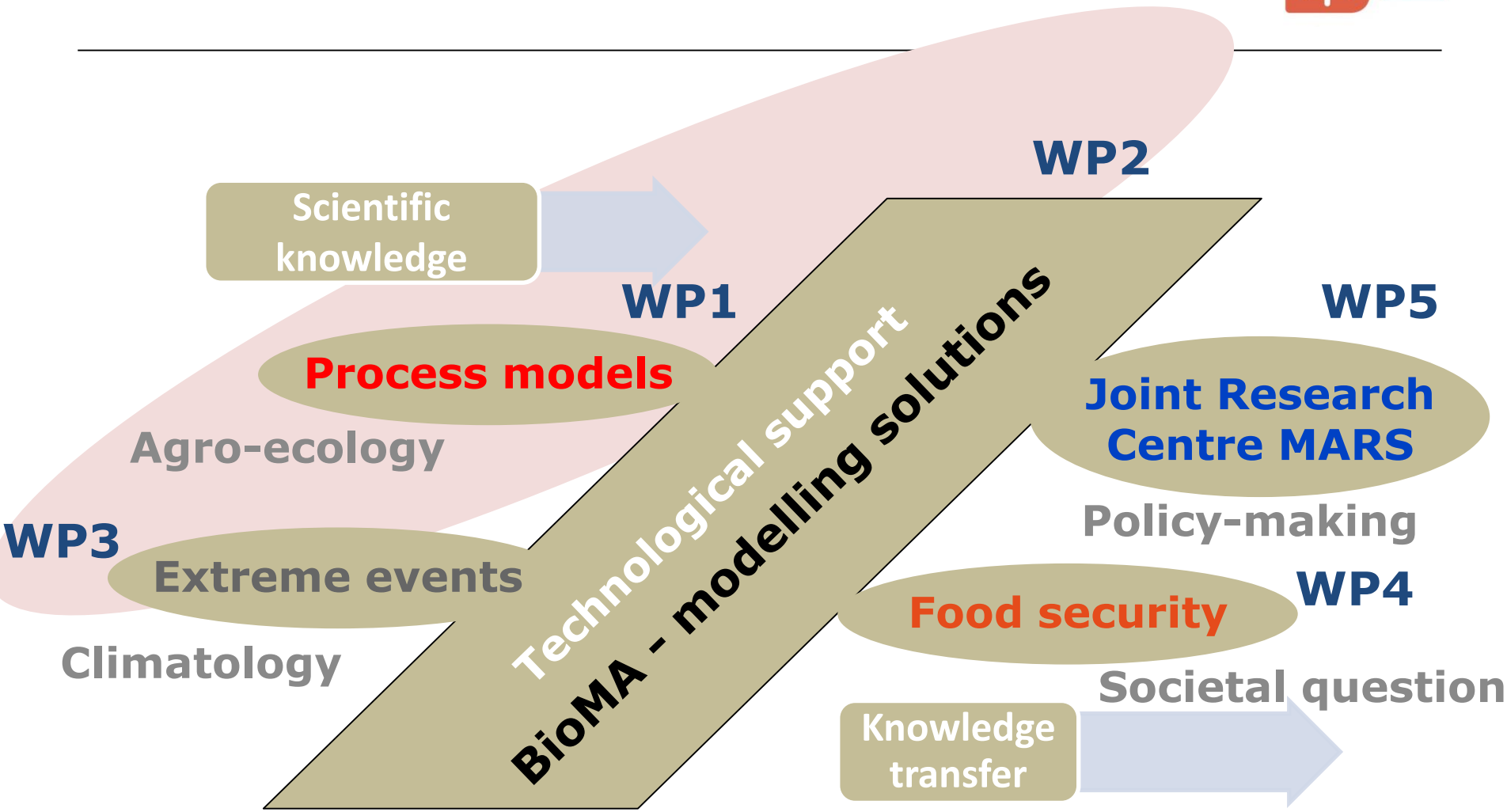
Project vision

"To help the European and non-European agriculture to face extreme climatic events by **improving the capability of biophysical models simulating vegetation responses to integrate climatic variability and extremes**"

This is done via:

- Development of generically usable software units implementing libraries of models
- Extension of the multi-model platform for plant growth and development simulations (BioMA) of the European Commission Joint Research Centre (MARS: Monitoring Agricultural ResourceS)"

Project rationale



WP6 Dissemination

WP7 Management & Coordination

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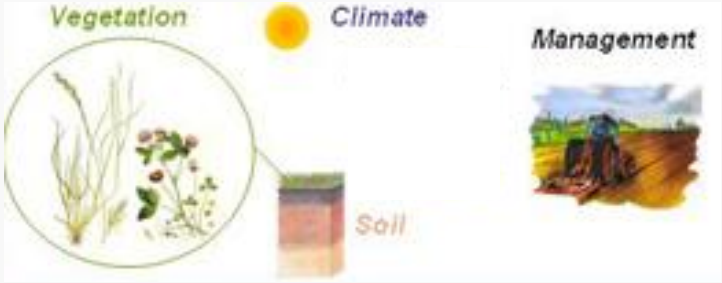
Biophysical modelling (arable crops)



Agro-ecosystem

Plot scale

Modelling

Inputs
(climate, soil, management)

Initial values

Parameters

heat stress on pollination

STICS
flooding

CropSyst
cold shock on flowering

WARM

AQUACROP

WOFOST

generic specific (rice)

Crop models

Outputs
(yield, aboveground biomass, flowering date, …)

implicit account of extreme events

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SyriusQuality, PaSim, Olivecan, Grapes, Poplar, etc.

Biophysical processes: example of Harvest Index (HI) / 1

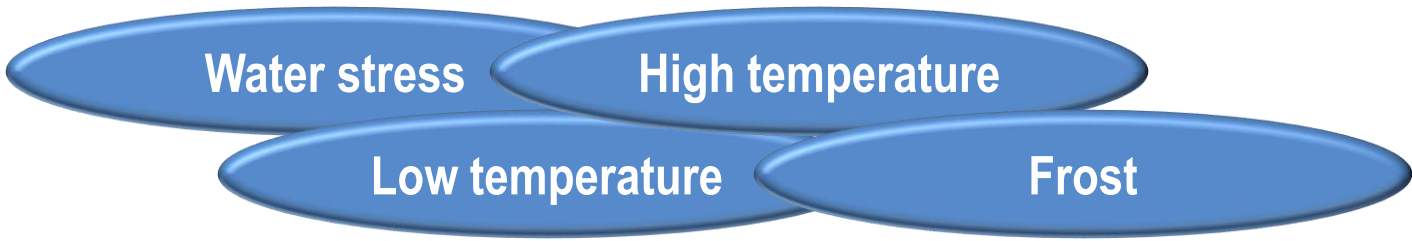
Harvest Index (HI) = yield (Y) / total above ground biomass (B)

$Y = HI \cdot B$

Valid for all crop models
(when linked to biomass at maturity)

Valid for all weather events
(drought – low temperature – high temperature)

$HI = HI_{max} \cdot f(WS) \cdot f(LT) \cdot f(HT) \cdot f(F)$



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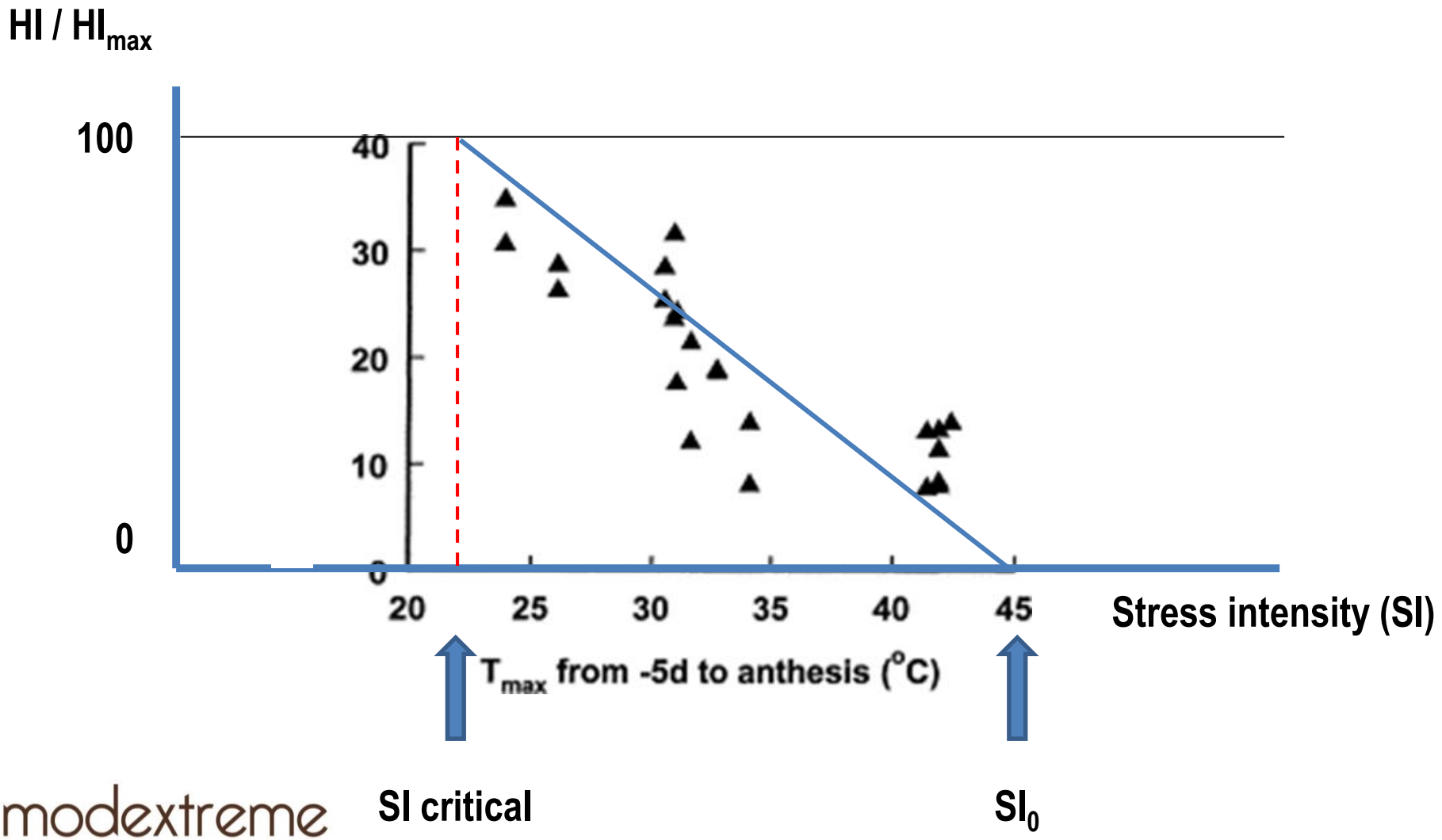
Biophysical processes: example of Harvest Index (HI) / 2

crop	pre-flowering	flowering	grain filling
winter cereals		F - WS - LT - HT	HT - WS
summer cereals		WS - LT - HT	HT - WS
sunflower	F	WS - HT	HT - WS
others	...	...	...

HI-based framework for calculating crop yield under extreme events / 1



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HI-based framework for calculating crop yield under extreme events / 2

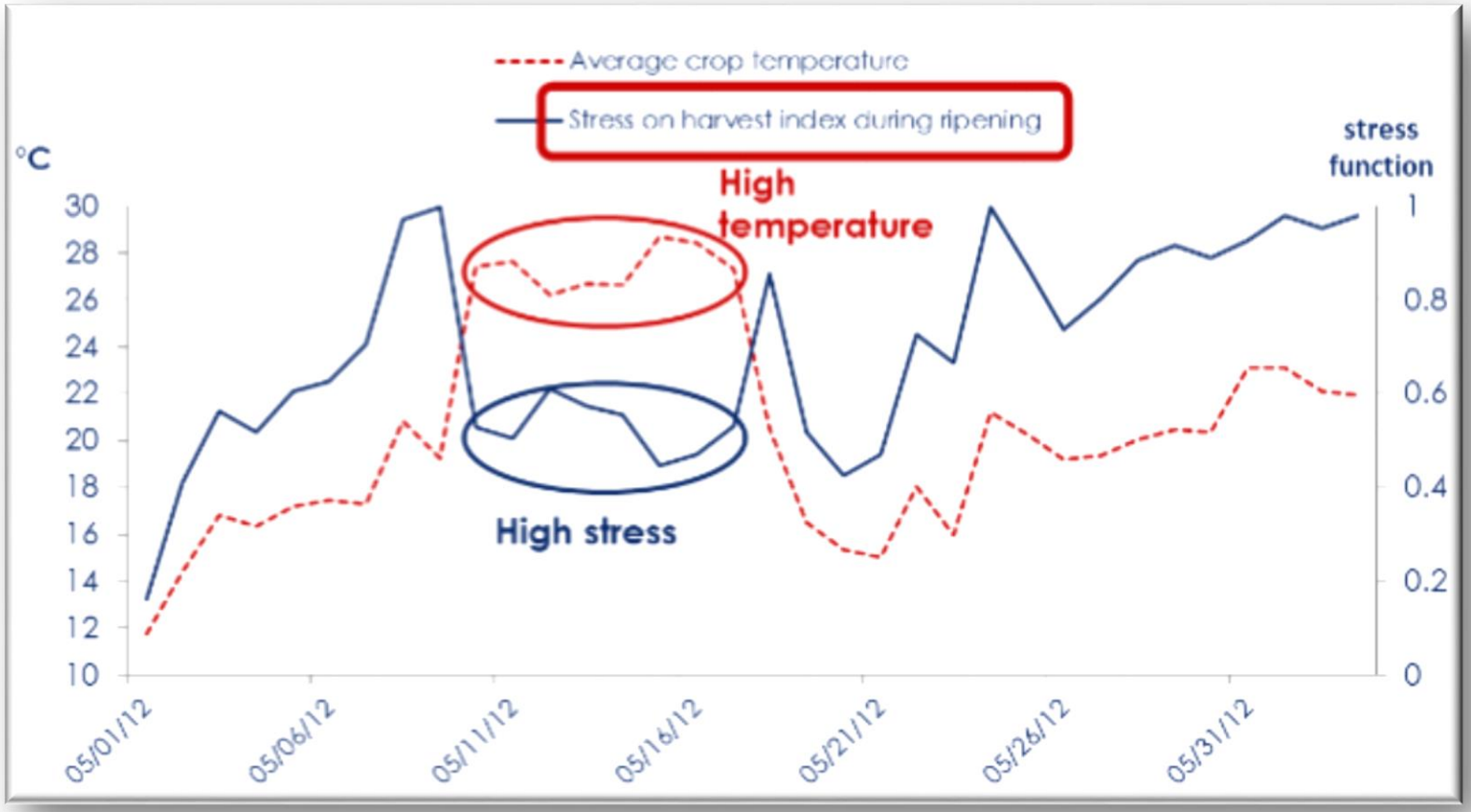
$$HI_{AA} = F_A \cdot HI_{max}$$

F_A: fraction of maximum HI that may be attained after anthesis is completed (HI_{AA})
(0, maximum stress; 1, no stress)

$$F_A = 1 / d_A \cdot \sum_1^{d_A} \min(F_T, F_W) \cdot \prod_1^{d_A} \min(F_F, F_H)$$

d_A: time window around anthesis
F_T: temperature factor (function of mean crop temperature)
F_W: water stress factor
F_F: frost factor (function of minimum crop temperature)
F_H: extreme heat factor (function of maximum crop temperature)

Stress functions / 1



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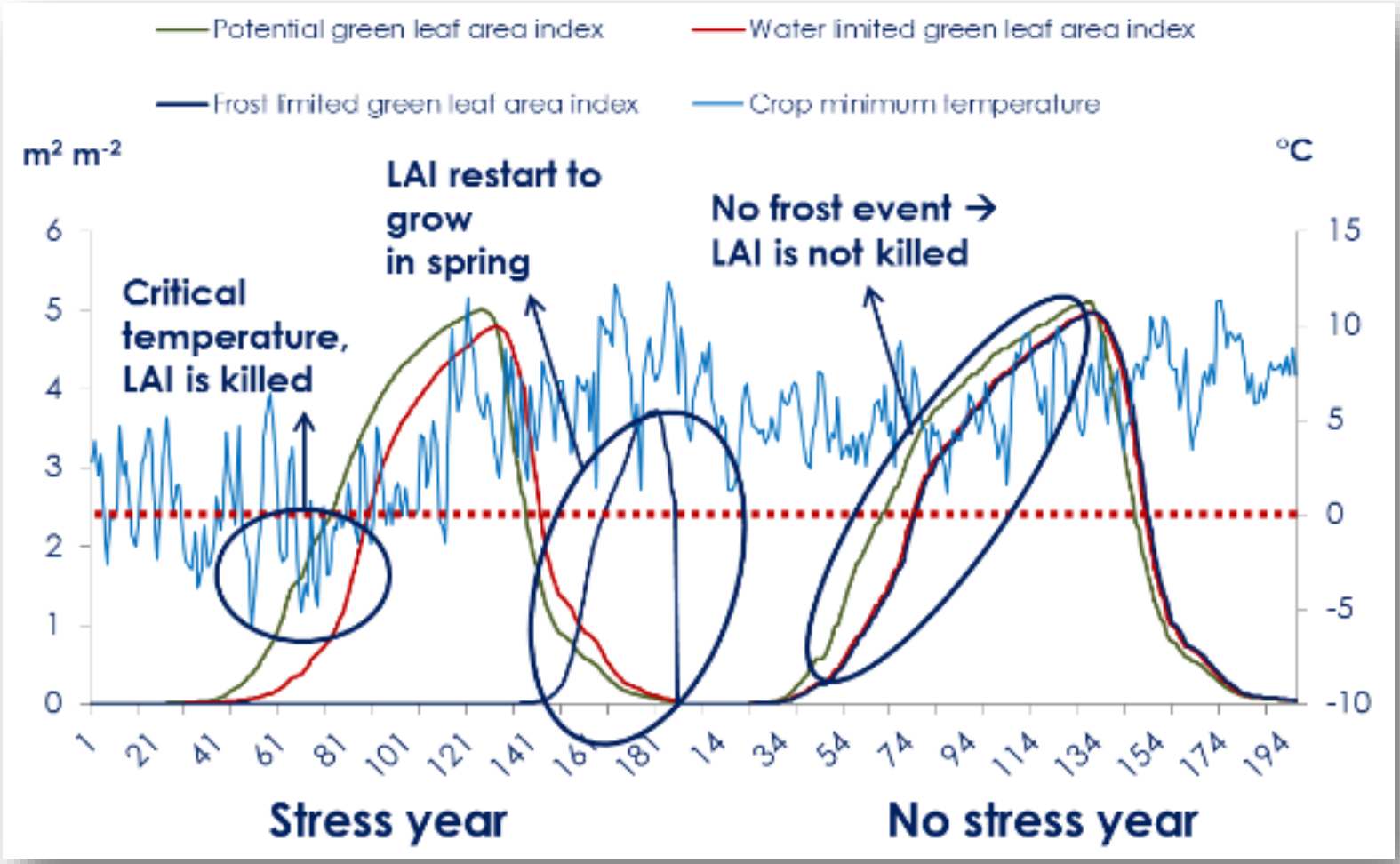
Stress functions / 2



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Agenda of the workshop / 1

09.00 Presentation of the workshop
Gianni Bellocchi - INRA Grassland Ecosystem Research Unit, Clermont-Ferrand (France)

09.30 Scenarios for future changes in extremes for agricultural modelling
Ole Christensen - Danish Meteorological Institute, Copenhagen (Denmark)

10.00 Assessing spatial and temporal patterns of agriculturally relevant extreme events by means of agroclimatic indices
Pierluigi Calanca - Agroscope, Zurich (Switzerland)

10.30 Is it possible to predict extreme yield loss using climate indicators?
David Makowski - INRA AgroParisTech, Thiverval-Grignon (France)

Agenda of the workshop / 2

11.00 Simulating frost impact on crop production
Jose Paulo de Melo e Abreu - Higher Institute of Agronomy-University of Lisbon (Portugal)

11.30 Models of growth as a function of temperature and water deficit with explicit genetic variability
François Tardieu, Boris Parent - INRA Supagro, Montpellier (France)

12.00 A comparison of modelling solutions for transpiration and yield of olive orchards
Luca Testi - Spanish National Research Council-Institute for Sustainable Agriculture, Cordoba (Spain)

12.30 Impacts of extreme events on grapevine: experimental and modelling activities
Marco Moriondo – University of Florence (Italy)

13.00 – 14.00 LUNCH BREAK

Agenda of the workshop / 3

14.00 A software component for simulation of the impacts of weather extremes on agricultural production
Livia Paleari, *Roberto Confalonieri* - University of Milan (Italy)

14.30 Impacts of extreme events in grassland models
David Borras, *Gianni Bellocchi* - INRA Grassland Ecosystem Research Unit, Clermont-Ferrand (France)

15.00 Discussion

15.30 Wrap-up and close-up of the workshop
Gianni Bellocchi - INRA Grassland Ecosystem Research Unit, Clermont-Ferrand (France)

16.00 END OF WORKSHOP

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SEVENTH FRAMEWORK PROGRAMME

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