



modextreme
agriculture facing extreme climatic events

Workshop

Approaching BioMA-Site

The Team of Work Package 2

crea

softeco SISMAT

BioMA

Agricultural Production Systems Simulation

Biophysical Model Applications
Site Simulation Graphical Interface

Version 0.4.2.0

modextreme

agriculture facing extreme climatic events

European Union flag



September 7-8,
2016, JRC



What does it do?

BioMA-Site is a multi-modelling solution runner

Configuration:

- i) modelling solution (*MS*),
- ii) inputs,
- iii) parameters,
- iv) output settings,

which allow running a simulation.





BioMA-Site - Resources

The screenshot shows a Windows desktop environment with several open windows and pinned icons.

- Left Sidebar:** A sidebar titled "Resources" contains links to BioMA documentation, Tutorials, Models, Tools, Utilities, and AgroManagement Configuration Generator.
- Middle Window:** A window titled "SEAMLESS APES - Agricultural Production and External Events System" is open, showing simulation configuration options like "Simulation info" and "Simulation input".
- Top Taskbar:** Icons include "Risorse di rete", "Ad-Aware SE Personal", "Vodafone Mobile Connect", "Vodafone Internet Box", "ONDA CONNECTI...", "KEDITW32", "Sandcastle", "HelpStudio", "XML Notepad 2007", "Captivate", and "Adobe Acrobat 7.0".
- Right Side:** A large window titled "modextreme" is open, showing "Domain Classes Editor" for "Auxiliary" and "Rates" domain classes. The "Auxiliary" class has attributes like "PhenophaseEffectID", "MinDegree", "MaxDegree", "Rate", and "Time". The "Rates" class has attributes like "growingDegreeDaysRate", "MinRate", "MaxRate", "Rate", and "Time".
- Bottom Taskbar:** Icons include "start", "Motorola Phone Tools", "bookmark.htm", "Outlook Express", "KerioHelp", "NostriPaper", "Reflector", and "ENSEN".

Textual Instructions (from slide 12):

- Once done, let's click on save XML button to save the xml file with the definitions of the variables. Then, click on the Generate code button to generate the C# code of the two classes Auxiliary.cs and AuxiliaryVarInfo.cs and select the folder to save them.
- Come back to DCC and write the variables belonging to the Rates domain class (variable GrowingDegreeDaysRate)
- Once done, let's click on save XML button to save the xml file with the definitions of the variables. Then, click on the Generate code button to generate the C# code of the two classes Rates.cs and RatesVarInfo.cs and select the folder to save them.





BioMA-Site – *Simulation environment*

Screenshot of the BioMA-Site Agricultural Production Systems Simulation software interface. The window title is "BioMA-Site Agricultural Production Systems Simulation". The menu bar includes File, Tools, Plugged Tools, Help, Parameters, AgroManagement, Output display, Explore components. The tabs at the top are Resources, Simulation environment (highlighted with a red box), Inputs, Model configuration, Output configuration, Model variables, Summary output.

The "Modelling solution" dropdown shows two entries: "Wofost model" and "WOFOST.WOFOSTExtremeModelCaller". The "Description" field below it also lists "CropSyst model" and "CropSystCropSystExtremeModelCaller", with "CropSystCropSystExtremeModelCaller" highlighted in blue. The "Log screen level" and "Log file level" are both set to "Verbose".

Below the interface, a light blue sidebar contains the heading "Available Modeling solutions:" followed by a list of modeling solutions:

- WOFOST (van Keulen and Wolf, 1986)
- WOFOSTPlusExtreme
- CropSyst (Stöckle *et al.*, 2003)
- CropSystPlusExtreme
- WARM (Confalonieri *et al.*, 2009)
- WARMPlusExtreme
- AquaCrop (Steduto *et al.*, 2009)

At the bottom of the slide, there is a horizontal row of five images: a world map showing agricultural productivity, a field of young corn plants, a dry, cracked landscape with a vehicle, a close-up of a person's hands in a field, and a city street scene with people walking.





BioMA-Site – *Inputs*

BioMA-Site Agricultural Production Systems Simulation

File Tools Plugged Tools Help

Parameters AgroManagement Output display Explore components

Resources Simulation environment **Inputs** Model configuration Output configuration Model variables Summary output

Weather data SharedData\Weather&Locations2000_2009.csv View...

Location definition SharedData\LocationData&Locations.csv View...

Soil profiles SharedData\Soil_SoilParameters.xml SiltyClayDeep Edit...

Soil initial condition SharedData\Soil_SoilInitialization.xml WetProfile Edit...

Agromangement packages\CropSystModelingSolution.CropSystModelCaller\Parameters\AgromangementFile_maize_irrigate Preview graph Edit...

Location Milan

Start simulation 01 January 2000

End simulation 31 December 2009

Pre/Post cond. check

Current modelling solution CropSystModelingSolution.CropSystModelCaller

Current simulation configuration CropSyst_irrigated_maize.acf

Save Validate Run View

- Weather data
- Soil data
- Agromanager
- Simulation length





BioMA-Site – Inputs

BioMA-Site Agricultural Production Systems Simulation

File Tools Plugged Tools Help

Parameters AgroManagement Output display Explore components

Resources Simulation environment Inputs Model configuration Output configuration Model variables Summary output

Weather data SharedData\Weather

Location definition SharedData\Location

Soil profiles SharedData\Soil

Soil initial condition SharedData\Soil

Agromangement packages\CropSyst

Location Milan

Start simulation 01 January 2000

End simulation 31 December 2000

Pre/Post cond. check

Current modelling solution CropSystModel

Current simulation configuration CropSyst_irrigation

CRA.AgroManagement configuration file diagram

length of rotation 1 name CropSyst_management

CropSyst Agromangement created from a template for location 58068

Planting Irrigation Harvest

rotationYear 1

Maize_Europe operation = planting

Maize_Europe operation = irrigation

volume (mm) = 50

volume (mm) = 50

volume (mm) = 50

Maize_Europe operation = irrigation

Run View

Graph Edit...

View...

View...

Edit...

Edit...

Graph Edit...

View...

View...

Edit...

Edit...

Graph Edit...

Run View





BioMA-Site – MS settings

MS components

Parameter key

Switches

BioMA-Site Agricultural Production Systems Simulation

File Tools Plugged Tools Help

Parameters AgroManagement Output display Explore components

Resources Simulation environment Inputs Model configuration Output configuration Model variables Summary output

Model Components Configuration (Switches and Parameters)

Weather CropSystPot SoilW CropSystLimited

Parameters for CropSystPot (Parameter values may be changed by agro-management)

CropSyst parameters

packages\CropSystModelingSolution.CropSystModelCaller\Parameters\JRC.IPSC.MARS.Crop.CropML_WL_Parameters_CropSyst_WL.xml

Select key: Maize_Europe Edit

Switches for CropSystPot

Component	Switch name	Switch value
CropSystPot	UseVernalization	false
CropSystPot	UseCO2	false
CropSystPot	UsePhotoPeriod	false
CropSystPot	UseTemperature	false

Current modelling solution: CropSystModelingSolution.CropSystModelCaller
Current simulation configuration: CropSyst_irrigated_maize.acf

Save Validate Run View





BioMA-Site – Outputs

BioMA-Site Agricultural Production Systems Simulation

File Tools Plugged Tools Help

Parameters AgroManagement Output display Explore components

Resources Simulation environment Inputs Model configuration **Output configuration** Model variables Summary output

Component | Save

Weather

SoilW

Save	Output Class	Output Name	Units	Max Value	Min Value	Default Value	Description
<input checked="" type="checkbox"/>	SoilW1_SoilWater	Step					
<input checked="" type="checkbox"/>	SoilW1_SoilWater	LocationID					
<input checked="" type="checkbox"/>	SoilW1_SoilWater	Date					
<input checked="" type="checkbox"/>	SoilW1_SoilWater	DOY					
<input checked="" type="checkbox"/>	SoilW1_SoilWater	Year					
<input checked="" type="checkbox"/>	SoilW1_SoilWater	CapillaryDrive	mm	800	50	300	Tension at th...
<input checked="" type="checkbox"/>	SoilW1_SoilWater	Evaporation...	m	0.3	0	0.1	Soil depth wh...
<input checked="" type="checkbox"/>	SoilW1_SoilWater	FlatBiomass	t/ha-1	20	0	0	Flat crop resi...
<input checked="" type="checkbox"/>	SoilW1_SoilWater	SoilProfileDe...	m	50	0	3	Soil profile d...
<input checked="" type="checkbox"/>	SoilW1_SoilWater	StandingBio...	t/ha-1	20	0	0	Standing cro...
<input checked="" type="checkbox"/>	SoilW1_SoilWater	SurfaceStora...	mm	30	0	0	Amount of wa...
<input checked="" type="checkbox"/>	SoilW1_SoilWater	SurfaceStora...	mm	30	0	30	Maximum hei...
<input checked="" type="checkbox"/>	SoilW1_SoilWater	VolumetricW...	m ³ m ⁻³	0.8	0	0.25	Volumetric so...
<input checked="" type="checkbox"/>	SoilW1_SoilWater	VolumetricFi...	m ³ m ⁻³	0.7	0.03	0.3	Volumetric so...
<input checked="" type="checkbox"/>	SoilW1_SoilWater	VolumetricW...	m ³ m ⁻³	1	0.03	0.5	Volumetric so...
<input checked="" type="checkbox"/>	SoilW1_SoilWater	VolumetricWi...	m ³ m ⁻³	0.4	0.01	0.15	Volumetric so...
<input checked="" type="checkbox"/>	SoilW1_SoilWater	VolumetricW...	m ³ m ⁻³	0.8	0	0.25	Volumetric so...

Component | Save

Soil data

Simulation C...

CropSystPot

CropSystLimi...

Agromanage...

Open directory

Current modelling solution CropSystModelingSolution.CropSystModelCaller

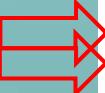
Current simulation configuration CropSyst_irrigated_maize.acf

Save Validate Run View





BioMA-Site - Toolbars



BioMA-Site Agricultural Production Systems Simulation

File Tools Plugged Tools Help

Parameters AgroManagement Output display Explore components

Resources Simulation environment Inputs Model configuration Output configuration Model variables Summary output

BioMA

- Wikipedia page
- BioMA framework home
- BioMA-Site Help
- Tutorials
- Video - Editing agro-management files
- Video - Graphical Data Display tutorial
- Models
- AgroManagement documentation
- Diseases documentation
- Tools
- AgroManagement Configuration Generator
- Utilities
- SoilReader

RSS - BioMA News

BioMA News Software downloads BioMA Posters BioMA References VideoTutorials

Implementing / re-implementing a modelling solution in a component-based software system is described in four documents, the first being on the conceptual model, which does not require any coding.

The BioMA components web portal was launched. The portal makes available, directly or via partner's portals, updated releases of the BioMA components, both for models and applications.

BioMa-Site / Release Notes v03.

Current modelling solution CropSystModelingSolution.CropSystModelCaller
Current simulation configuration CropSyst_irrigated_maize.acf

Save Validate Run View





BioMA-Site – Application Folder Structure

📁 StatisticalAnalysisLibraries	24/08/2016 16:28	Cartella di file	
📁 SharedData	24/08/2016 16:28	Cartella di file	
📁 Samples	24/08/2016 16:28	Cartella di file	
📁 ReferenceReader	24/08/2016 16:28	Cartella di file	
📁 Plugins	24/08/2016 16:28	Cartella di file	
📁 Packages	24/08/2016 16:33	Cartella di file	
📁 Mappings	24/08/2016 16:28	Cartella di file	
📁 DeployableMS	24/08/2016 16:33	Cartella di file	
📁 Data	24/08/2016 16:28	Cartella di file	
📁 CustomUserControls	24/08/2016 16:28	Cartella di file	
📄 ValuesXMLSchema.xsd	18/11/2015 12:25	XML Schema File	4 KB
📄 MatchersUserControlsConfiguration.xsd	18/11/2015 12:25	XML Schema File	1 KB
📄 BIOMASitePluginConfig.xsd	18/11/2015 12:25	XML Schema File	1 KB
📄 AgroManagementImpactData.xsd	18/11/2015 12:25	XML Schema File	2 KB
📄 AgroManagementConfig.xsd	18/11/2015 12:25	XML Schema File	2 KB
📄 AgroManagement.xsd	18/11/2015 12:25	XML Schema File	3 KB





BioMA-Site - Model parameter editor



Models Parameter Editor

JRC.IPSC.MARS.Crop.CropML_WL.Parameters

File Options ?

Model CropSyst_WL Parameters key ParameterKey Key Value Maize_Europe

Parameter set key

Name	Value	Min	Max	Description	Type	Unit	Use default value
IsC3	1	0	1	Boolean value for C3 crops (1=C3, 0=C4)	int	unitless	Set 0
Development Susceptibility To Water Stress	0.3	0	1	Development susceptibility to water stress (0: not susceptible)	double	unitless	Set 0.3
Thermal Time To Emergence	108	85	400	Thermal Time To Emergence	double	°C-d	Set 100
Thermal Time To Flowering	684	300	2000	Thermal Time To Flowering	double	°C-d	Set 500
Thermal Time To Begin Yield Formation	810	200	1700	Thermal Time To Begin Yield Formation	double	°C-d	Set 700
Thermal Time To Maturity	1368	800	3000	Thermal Time To Maturity	double	°C-d	Set 1200
Base Temperature Development	8	-10	40	Base temperature for development	double	°C	Set 10
Cutoff Temperature Development	34	10	50	Cutoff temperature for development	double	°C	Set 40
Photo Inhibition	10	0	24	Daylength to inhibit flowering	double	hour	Set 14
Photo Insensitivity	18	0	24	Daylength for insensitivity to photoperiod	double	hour	Set 6
High Temperature	20	0	20	High temperature for optimal vernalization	double	°C	Set 5
Low Temperature	8	-10	10	Low temperature for optimal vernalization	double	°C	Set 0
A	7	0	10	Vernalization A parameter	double	°C	Set 7
Days To Start Vernalization	0	0	30	Days requirement to start vernalization	double	unitless	Set 0
Days To Complete Vernalization	50	0	200	Days requirement to complete vernalization	double	unitless	Set 50
Minimum Factor	0	0	1	Minimum vernalization factor	double	unitless	Set 0
Initial Leaf Area Index	0.03	0.001	0.5	Initial leaf area index	double	m ² m ⁻²	Set 0.03
Minimum Initial Green Leaf Area Index	0.05	0.05	0.2	Maximum initial green leaf area index	double	m ² m ⁻²	Set 0.1

Fill all empty values (using default)

Info Exit





BioMA-Site - ACG

ACG - AgroManagement Configuration Generator

Information

Name: CropSyst_management
Description: CropSyst Agromanagement created from a template for location 58068

rules impacts

Rule – Impact concept

Change rule or impact

rule

Varie	CropName [Maize_Europe] Maize_Eu CropOperation planting
Description	Trigger an event based on
Domain	Agromanagement
DomainClassOfRefere	StatesAgroMan
ImpactDependency	
IsContext	False
Metadata	Operazione o metodo non
ModellingOptionsMan	CRA.ModellLayer.Strategy
ModelType	Agromanagement.Rule
PublisherData	Operazione o metodo non
RelativeDate	110
RotationYear	1
TimeStep	
URL	http://www.apesimulator.c

impact

Varie	CRA.AgroManagement.Impacts.CropPlanting
Description	Parameters for crop planting
DomainClassOfRefere	CRA.AgroManagement.Impact
ManagementType	CROP_OPERATION
PlantingDepth	0.05
PropertiesDescription	
StrategyUsed	
URL	http://ontology.seamless-ip.org

show parameter attributes enter pair

Rot. Year Rule

Rot. Year	Rule
1	CRA.AgroManagement.Rules.RuleDate

open configuration save configuration preview graph preview configuration help exit



BioMA-Site - Model Component Explorer



MCE - Model Component Explorer

Interfaces and Domain Classes Models (Strategies) Explore Model Responses

discover strategies assembly C:\Program Files (x86)\CREA\BioMaSite\Packages\CropSystModelingSolution.CropSystModelCaller\EC.JRC.MARS.Crop.CropML.dll

save XML

strategy's switches (select values to see inputs, outputs and parameters)

Switch	Value
UseVernaliz...	true
UseCO2	true
UsePhotoPer...	true
UseTempera...	true

Switches

CropSyst model for crops growth and development - Stockle, C.O., Donatelli, M., Nelson, R., 2003. CropSyst, a cropping system simulation model. European Journal of Agronomy, 18, 289-307. Composite strategy. See also references of the associated strategies.

Description

interfaces

- EC.JRC.MARS.Crop.CropML.Interfaces.IStrategyCropML
- CRA.ModelLayer.Strategy.IStrategy
- CRA.ModelLayer.MetadataTypes.IAnnotable

domain classes

- EC.JRC.MARS.Crop.CropML.Interfaces.Rates
- EC.JRC.MARS.Crop.CropML.Interfaces.States
- EC.JRC.MARS.Crop.CropML.Interfaces.Auxiliary
- EC.JRC.MARS.Crop.CropML.Interfaces.Exogenous
- EC.JRC.MARS.Crop.CropML.Interfaces.RatesExternal

strategies (click to view)

- EC.JRC.MARS.Crop.CropML.Assimilation.Initialization
- EC.JRC.MARS.Crop.CropML.Assimilation.InstantaneousAssimilation
- EC.JRC.MARS.Crop.CropML.Biomass.NightTemperature
- EC.JRC.MARS.Crop.CropML.Biomass.RUEbasedBiomassAccumulation
- EC.JRC.MARS.Crop.CropML.Biomass.TUEbasedBiomassAccumulation
- EC.JRC.MARS.Crop.CropML.Biomass.Yield
- EC.JRC.MARS.Crop.CropML.CropModels.CropSyst**

strategies associated

- EC.JRC.MARS.Crop.CropML.Biomass.Yield
- EC.JRC.MARS.Crop.CropML.CropSyst.BiomassAccumulationC
- EC.JRC.MARS.Crop.CropML.CropSyst.PotentialPhenologyC
- EC.JRC.MARS.Crop.CropML.CropSyst.RUEactualC

inputs (domain class)

- AbovegroundBiomass
- AbsorbedSolarRadiation
- AirTemperatureMaximum
- AirTemperatureMinimum
- BiomassRadiationDependent

Input

outputs (domain class)

- AbovegroundBiomass
- AbovegroundBiomassRate
- AbsorbedSolarRadiation
- AbsorbedSolarRadiationRate
- BiomassRadiationDependent

Output

parameters (click to view)

- A
- BaseTemperatureDevelopment
- BaseTemperatureForGrowth
- CutoffTemperatureDevelopment
- DaysToCompleteVernalization

Parameters

all outputs estimated (click to discover strategies)

- DaysAfterYieldFormation
- DeadLeafAreaIndex
- DeadLeafAreaIndexRate
- DevelopmentStageCode
- DiffuseIrradiationPerpendicularToDirectionOfLight
- DryWeightDeadRoots_DWRT
- DryWeightDeadStems_DWST
- DryWeightDeadStorageOrgans_DWSO
- DryWeightLivingLeaves_WLT
- DryWeightLivingRoots_WRT
- DryWeightLivingStems_WST
- DryWeightLivingStorageOrgans_WSO
- GreenLeafAreaIndex**
- GreenLeafAreaIndexExponential
- GreenLeafAreaIndexExponentialRate
- GreenLeafAreaIndexFromSLA
- GreenLeafAreaIndexFromSLARate
- GreenLeafAreaIndexRate
- GrossCH2OAssimilation
- GrossCO2Assimilation
- GrowingDegreeDays
- GrowingDegreeDaysRate
- GrowingDegreeDaysTemperature

strategies (click to view)

- CropSyst**
- DailyAssimilationC
- FinalAssimilation
- FinalLeafIndexC
- FinalLeafIndexRate
- PotentialLeafAreaExpansion
- SpecificLeafAreaWARM
- StartLAI
- MinLAI
- MaxLAI
- MinHourly
- MaxHourly
- MinJST
- MaxJST

info if installation was made from URL

about MCE exit





BioMA-Site – Graphic Data Viewer

Graphic Data Viewer

Tabular view Graph Var vs Time Graph Generic Time Graph Var vs Var Histograms Graph sc

Component: Crop summary Write all to Excel... Write table to Excel...

Simulation outputs

Doy	Year	GridNo	Date	Stu	IsCropPrese	Crop	Variety	CurrentCrop	CurrentVariet	Potential
1	2000	Milan	01/01/2000 0	(null)	<input type="checkbox"/>	22		22		0
2	2000	Milan	02/01/2000 0	(null)	<input type="checkbox"/>	22		22		0
3	2000	Milan	03/01/2000 0	(null)	<input type="checkbox"/>	22		22		0
4	2000	Milan	04/01/2000 0	(null)	<input type="checkbox"/>	22		22		0
5	2000	Milan	05/01/2000 0	(null)	<input type="checkbox"/>	22		22		0
6	2000	Milan	06/01/2000 0	(null)	<input type="checkbox"/>	22		22		0
7	2000	Milan	07/01/2000 0	(null)	<input type="checkbox"/>	22		22		0
8	2000	Milan	08/01/2000 0	(null)	<input type="checkbox"/>	22		22		0
9	2000	Milan	09/01/2000 0	(null)	<input type="checkbox"/>	22		22		0
10	2000	Milan	10/01/2000 0	(null)	<input type="checkbox"/>	22		22		0
11	2000	Milan	11/01/2000 0	(null)	<input type="checkbox"/>	22		22		0
12	2000	Milan	12/01/2000 0	(null)	<input type="checkbox"/>	22		22		0
13	2000	Milan	13/01/2000 0	(null)	<input type="checkbox"/>	22		22		0
14	2000	Milan	14/01/2000 0	(null)	<input type="checkbox"/>	22		22		0
15	2000	Milan	15/01/2000 0	(null)	<input type="checkbox"/>	22		22		0
16	2000	Milan	16/01/2000 0	(null)	<input type="checkbox"/>	22		22		0
17	2000	Milan	17/01/2000 0	(null)	<input type="checkbox"/>	22		22		0
18	2000	Milan	18/01/2000 0	(null)	<input type="checkbox"/>	22		22		0
19	2000	Milan	19/01/2000 0	(null)	<input type="checkbox"/>	22		22		0
20	2000	Milan	20/01/2000 0	(null)	<input type="checkbox"/>	22		22		0
21	2000	Milan	21/01/2000 0	(null)	<input type="checkbox"/>	22		22		0
22	2000	Milan	22/01/2000 0	(null)	<input type="checkbox"/>	22		22		0
23	2000	Milan	23/01/2000 0	(null)	<input type="checkbox"/>	22		22		0
24	2000	Milan	24/01/2000 0	(null)	<input type="checkbox"/>	22		22		0
25	2000	Milan	25/01/2000 0	(null)	<input type="checkbox"/>	22		22		0
26	2000	Milan	26/01/2000 0	(null)	<input type="checkbox"/>	22		22		0
27	2000	Milan	27/01/2000 0	(null)	<input type="checkbox"/>	22		22		0
28	2000	Milan	28/01/2000 0	(null)	<input type="checkbox"/>	22		22		0
29	2000	Milan	29/01/2000 0	(null)	<input type="checkbox"/>	22		22		0
30	2000	Milan	30/01/2000 0	(null)	<input type="checkbox"/>	22		22		0
31	2000	Milan	31/01/2000 0	(null)	<input type="checkbox"/>	22		22		0

Configuration

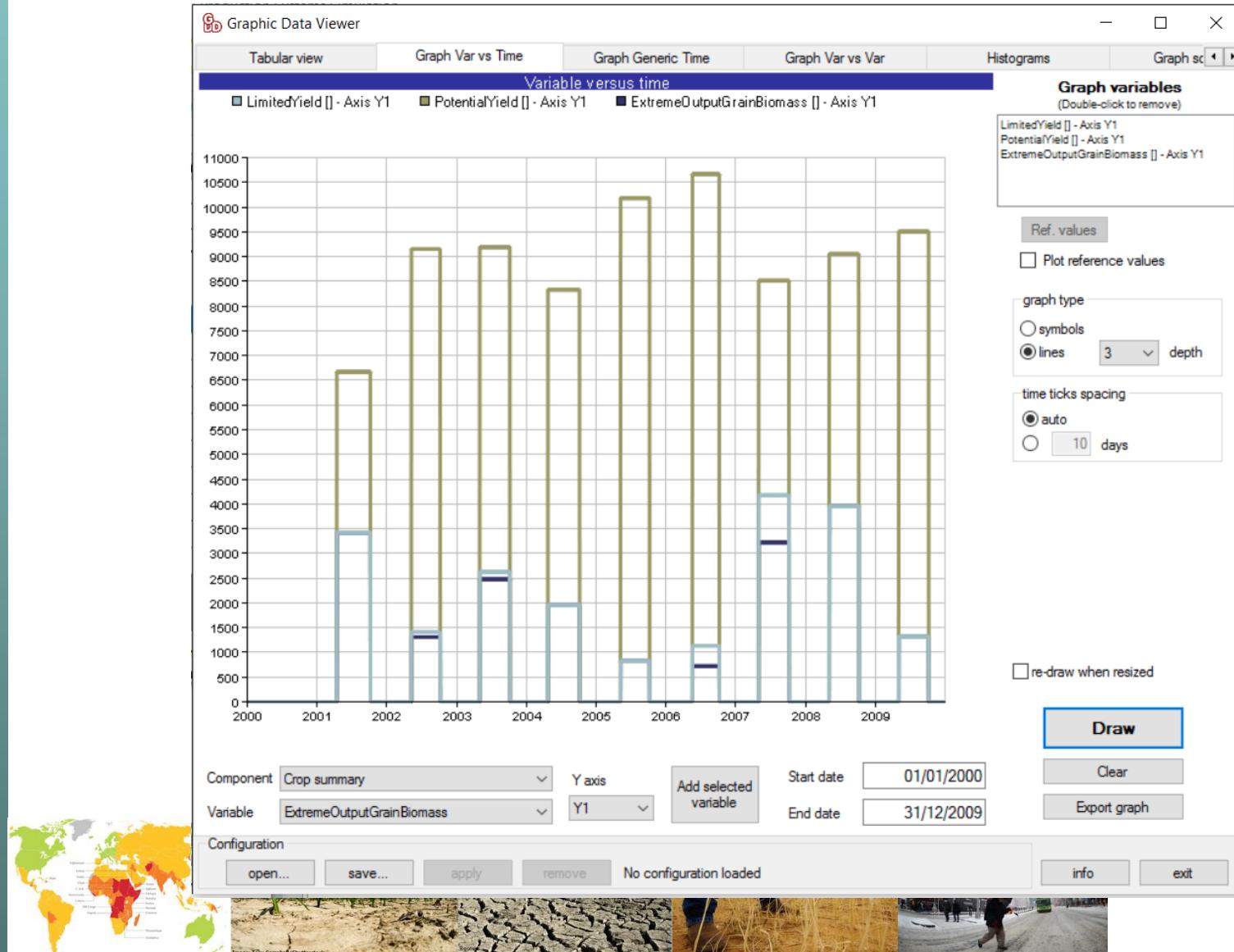
open... save... apply remove No configuration loaded info exit

Image: Tony Campbell/Shutterstock

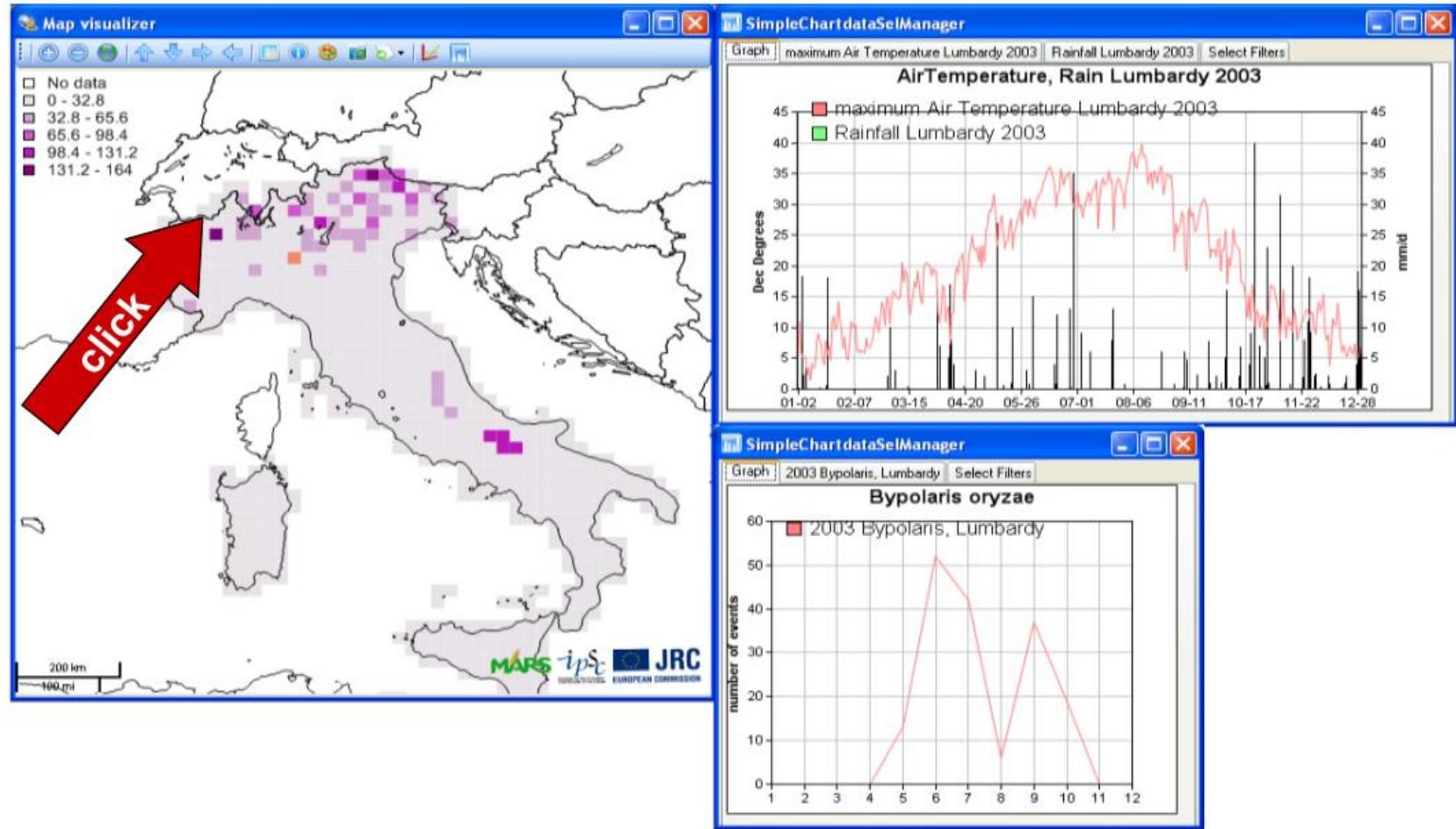


BioMA-Site – *Graphic Data Viewer*





BioMA-Spatial – scale up simulation





Provided material

- Software applications
(BioMA-Site, IMMA, Optimizer, LUISA)
- Software presentations
- Tutorials
- Material is downloadable
on web:

The screenshot shows a computer screen displaying a web browser window for the BioMA framework. The URL in the address bar is climpest.bioma-framework.org/Downloads.aspx?node=30. The page has a green header with the BioMA logo and navigation links for Home, Resources, Downloads, RSS, and ModellingSolutions. The main content area shows a tree-view menu under 'Applications' with items like UIComponents, DevModelLayer, DevCompositionLayer, BioMA-Site, Optimizer, Modelling Solutions, and Workshops. The 'BioMA-Site training at JRC' item is highlighted with a red border. To the right of the menu, there is a logo for 'Site' and the text 'BioMA-Site training at JRC'. Below this, it says 'This package is for the workshop of September 7-8, 2016 Ispra (VA)'. There are two buttons: 'Install From URL' and 'Help OnLine'. At the bottom, there is a note about the Creative Commons Attribution-ShareAlike 4.0 International License and a link to 'Disclaimer and credits'.

<http://climpest.bioma-framework.org/Downloads.aspx?node=30>





Let's start

