



# XIV<sup>th</sup> STICS seminar for developers and users of the STICS soil-plant model

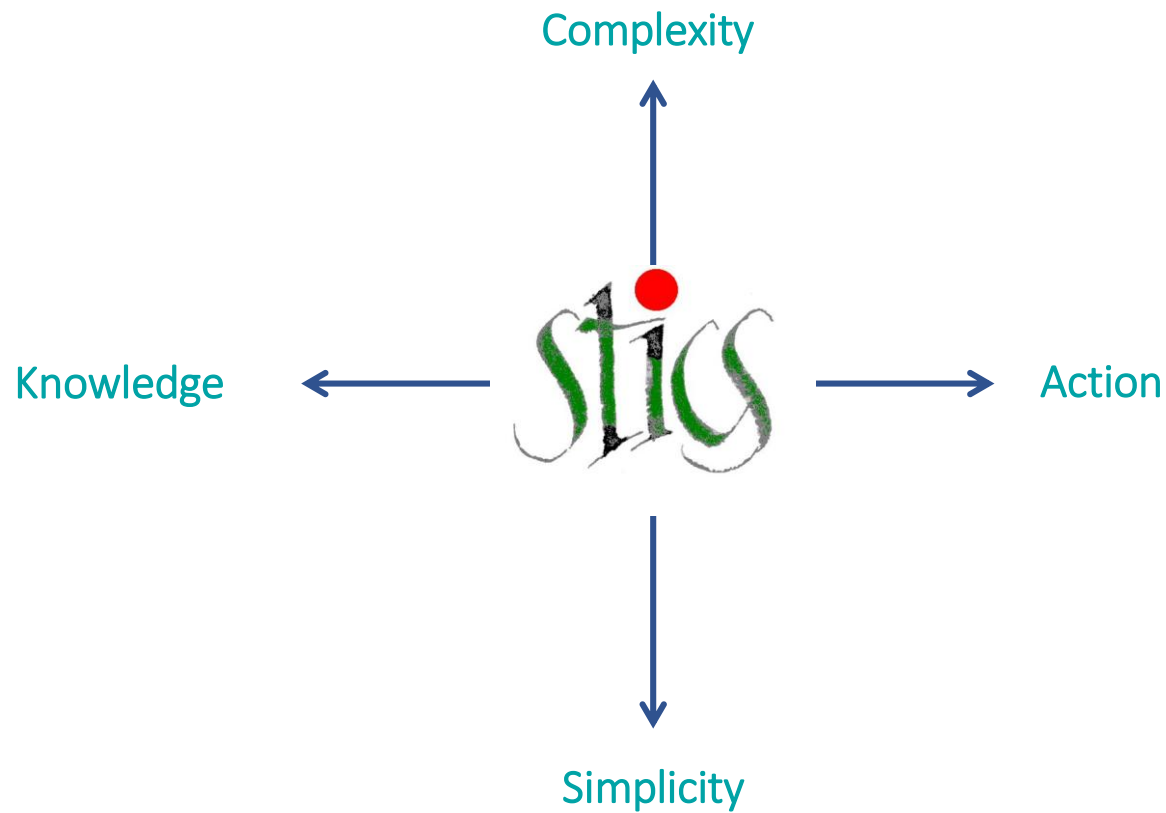
The  model: Organization and progress

**XIV<sup>th</sup> STICS seminar, 17-19 march 2026, organized by ULiege-GxABT & INRAE**

Presented by the STICS team coordination cell  
Realised with the involvement of the STICS Project Team

## ➤ Objectives

Process based model of crops at field level,  
balanced in terms of complexity level,  
appropriate for both scientific research on agro-ecosystems  
and for agro-ecological engineering



### STICS objectives

- **A tool box: Integrate the newest knowledge on atmosphere / plant / soil processes** (e.g. C & N reserves pools in perennials, P cycle, ...)
- **A tool: Research at field level** = mass and energy flux between atmosphere, plants and soil (e.g. benchmarking of cropping systems in terms of N flux in environment, impacts of climate change on yields and resources use)
- **A tool piece: Contribute to operational tools for applied usage, at field or larger scales** (e.g. regional production index, Biosphere models, automation, serious games...)

## ➤ Outline

The STICS scientific community: structure, growth and impact

The STICS ecosystem: tools, data and documentation

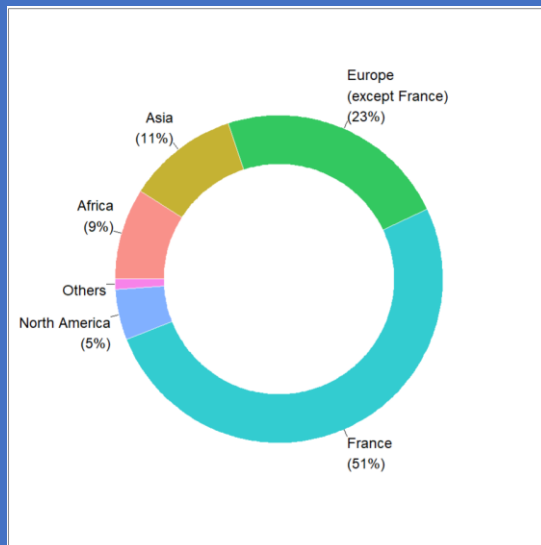
On Going Developments and Future Directions

➤ The STICS scientific community: structure, growth and impact

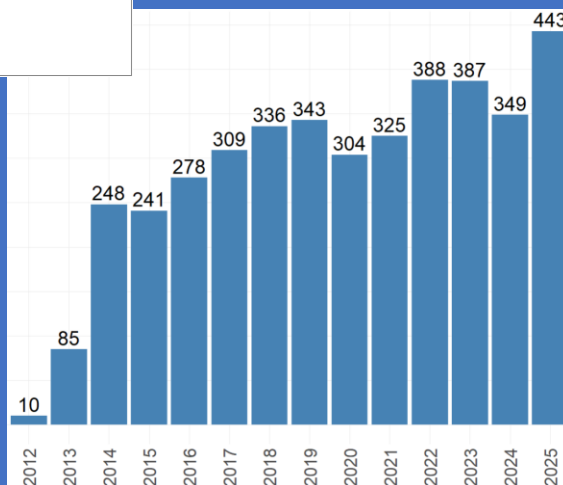
# 1. The STICS scientific community: **structure**, growth and impact

## ➤ STICS users network and project team

### Users network

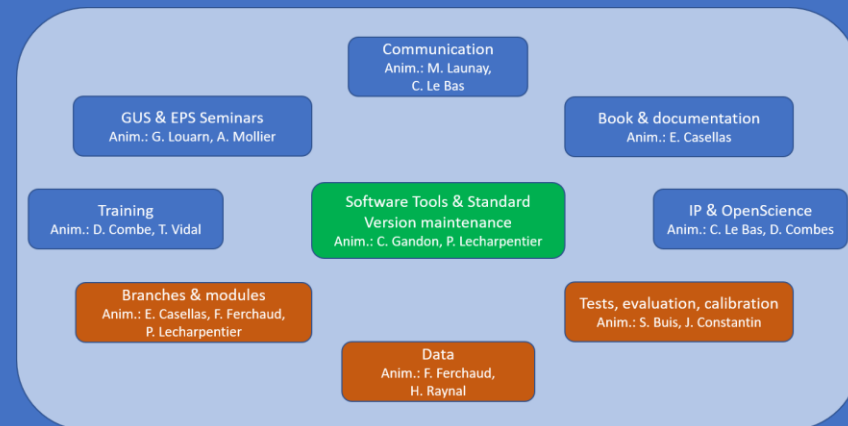


4087 new accounts since 2012



### STICS Project team

27 members, 9 working Groups



# 1. The STICS scientific community: *structure*, growth and impact

## ➤ The STICS Project Team: 27 members

Recruitment of Loïc Strullu

Retirement : Jean-Louis Durand and Marie-Odile Bancal

Departure from the head-team: Iñaki Garcia de Cortazar

Co-animation: Samuel Buis & Marie Launay



Ecophysiology, cropping systems & climate/microclimate

Soil, nutrients, C, N, H<sub>2</sub>O transfers and evolution



Tiphaine Vidal  
Fungal diseases & microclimate



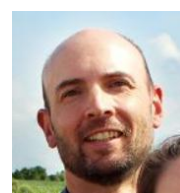
Eric Justes  
Intercropping



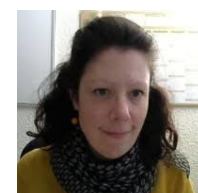
Benjamin Dumont  
Wheat & Decision tools



Julie Constantin  
Long-term simulations, Cover crops



Guillaume Jego  
Energy balance & continental conditions



Anne-Isabelle Graux  
Grassland



Iñaki Garcia de Cortazar  
Vineyards & perenial crops



Christine Le Bas  
Soil properties



Florent Levavasseur  
Organic waste products



Hugues Clivot  
Soil micro-organisms



Marie Launay  
Intercropping & Fungal diseases



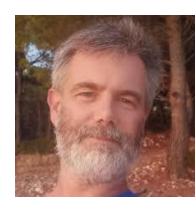
Rémi Vézy  
Intercropping



Gatien Falconnier  
Low input systems & tropical crops



Antoine Couëdel  
Tropical intercropping



Gaétan Louarn  
Ecophysiology & Coupling with FSPM



Didier Combes  
Agrivoltaics & microclimate



Loïc Strullu  
Bioenergy & Biogeochemical cycles



Alain Mollier  
Phosphorus



Fabien Ferchaud  
Soil N transfers & C storage



Joël Léonard  
N<sub>2</sub>O emissions

### IT & scientific computing

### Administration



Cyril Gandon  
Development



Jérôme Duval  
Database



Samuel Buis  
Mathematical methods



Eric Casellas  
Modularization



Patrice Lecharpentier  
Development



Hélène Raynal  
Multisimulations & spatialisation

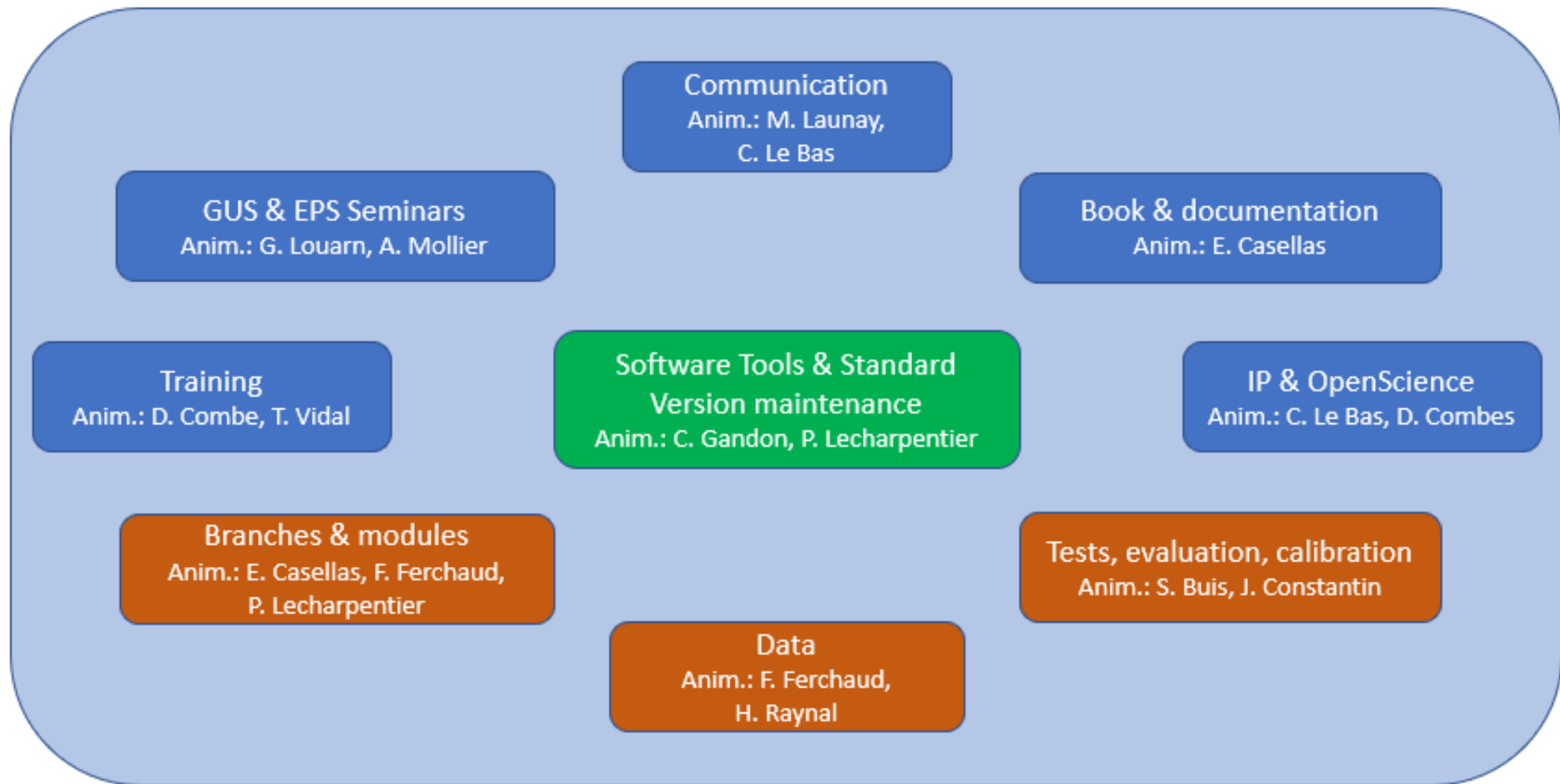


Isabelle Le Mouëllic  
Budget management & organisation of training courses and seminars.

SB+

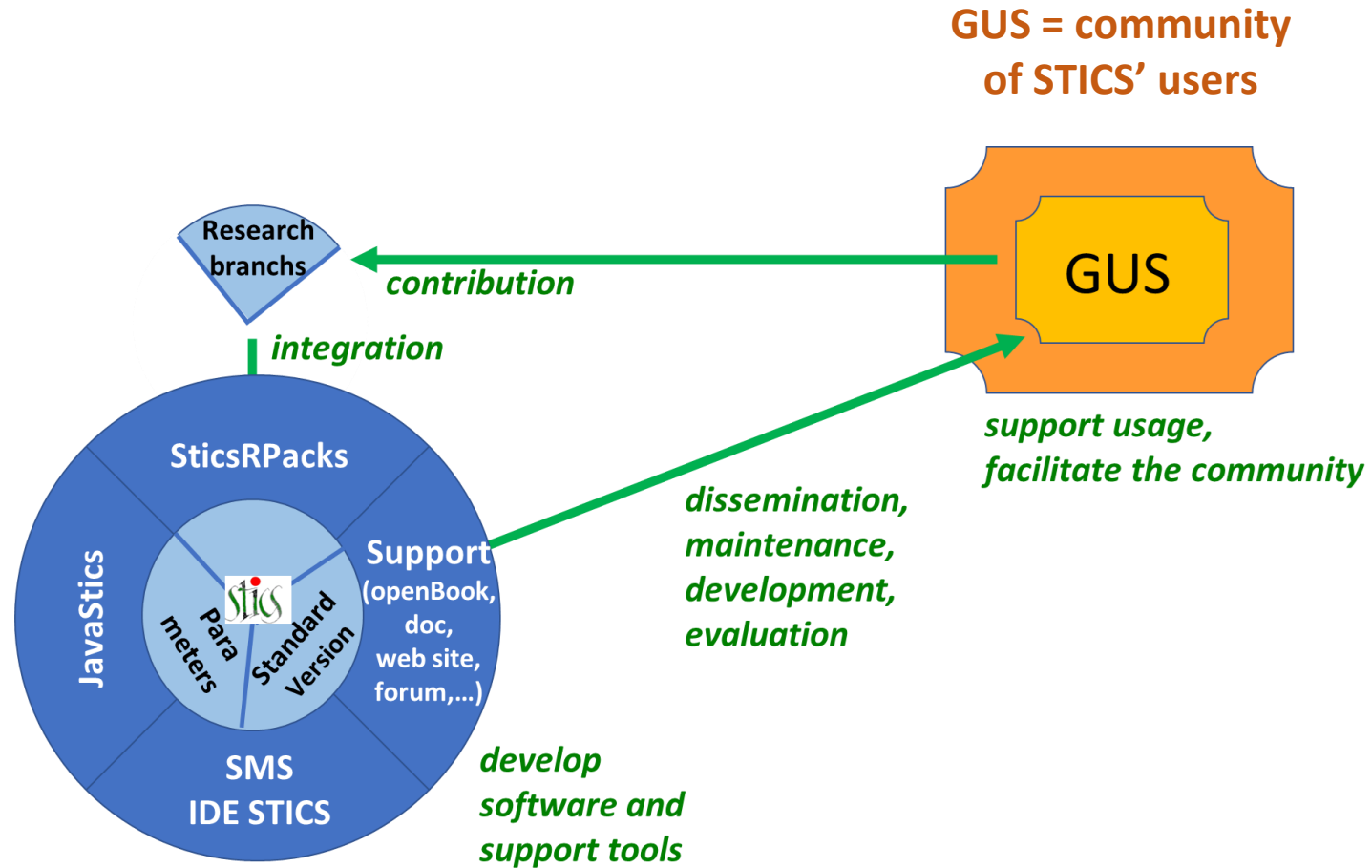


## ➤ Working Groups



1. The STICS scientific community: **structure**, growth and impact

> Links between user network and project team



*role of the STICS project team*

1. *The STICS scientific community: structure, **growth** and impact*

> Links between user network and project team

Communication: website, forum, email list

Training courses

Contribution to STICS development

STICS seminars

# 1. The STICS scientific community: structure, **growth** and impact

## > The STICS website

<https://eng-stics.paca.hub.inrae.fr/>

**REPUBLIC FRANÇAISE** **INRAE** **stics**

Your search

About us? General presentation of t... Download Support Resources Partners and projects All sections

**News** All news > Direct access

**Training**  
ARTICLE | 13 January 2026 | By: Stics Project Team  
Next training in 2026: registration open  
Next online Stics training in March-April 2026  
Know More

**A new version of JavaStics and Stics is available**  
The latest software distribution of JavaStics and STICS 10.5.0 is downloadable

**17/03** From 17 Mar. 2026 to 19 Mar. 2026 | Louvain-la-Neuve (Belgium)  
**XIVth STICS Seminar 2026**  
The XIVth STICS Seminar will take place from 17 to 19 March 2026, on the outskirts of Louvain-La-Neuve city.

**Rapport sur la vulnérabilité de la Wallonie au changement climatique**  
Diagnostic de vulnérabilités pour augmenter la résilience wallonne à travers l'adaptation aux changements climatiques - Volet Agriculture - Partie grandes cultures - Indicateurs agronomiques de vulnérabilité.

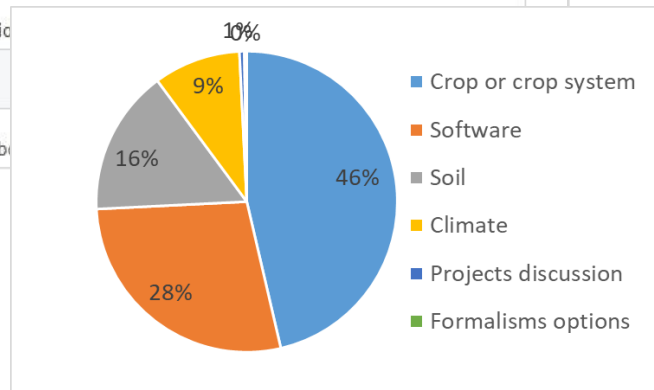
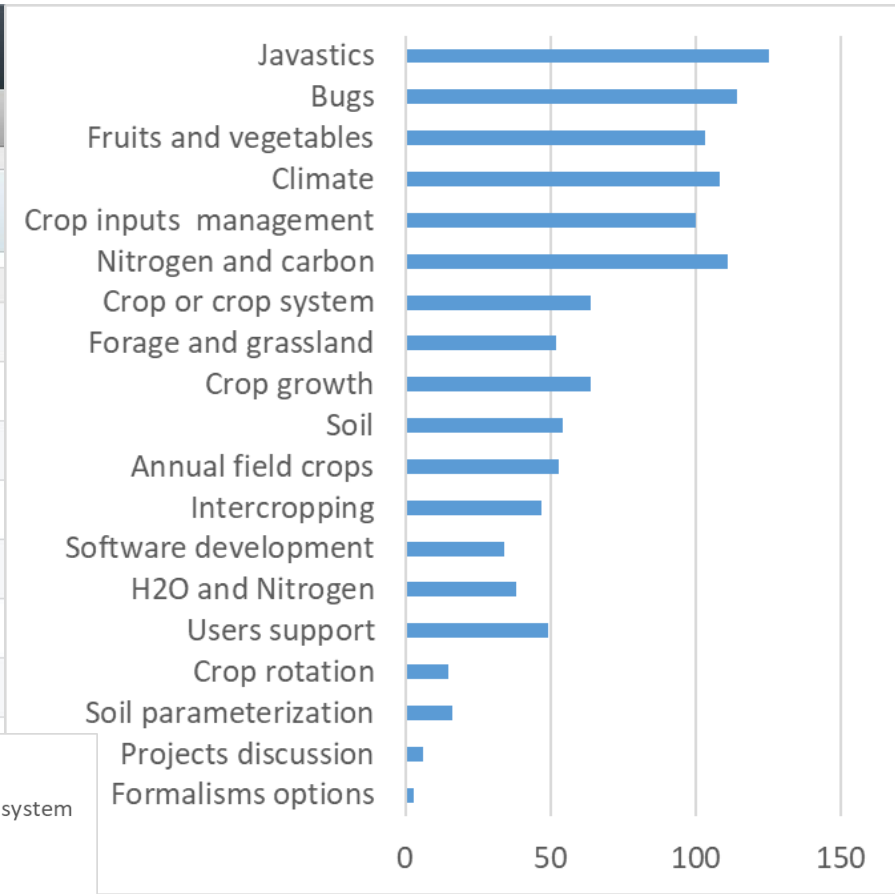
SB

# 1. The STICS scientific community: structure, **growth** and impact

## ➤ The STICS forum

The screenshot shows the STICS Forums website. At the top, there is a navigation bar with 'Aperçu', 'Activité', 'Forums', and 'Configuration'. Below this, the 'Forums' section is titled 'Forums' and lists several categories with their respective sub-topics:

- Users support: Please post your questions in the above items
- Crop or crop system: Please post your questions in the above sub-items
- Annual field crops: cereals, ...
- Fruits and vegetables: vineyard, sugarbeet, banana, ...
- Forage and grassland: ryegrass, fescue, miscanthus, ...
- Crop rotation: Crop rotation
- Intercropping: Intercropping
- Formalisms options: description of the plant formalism optio
- Crop growth: development, RUE, roots
- Nitrogen and Carbon: Fertilization, residues, Nitrogen and Carb

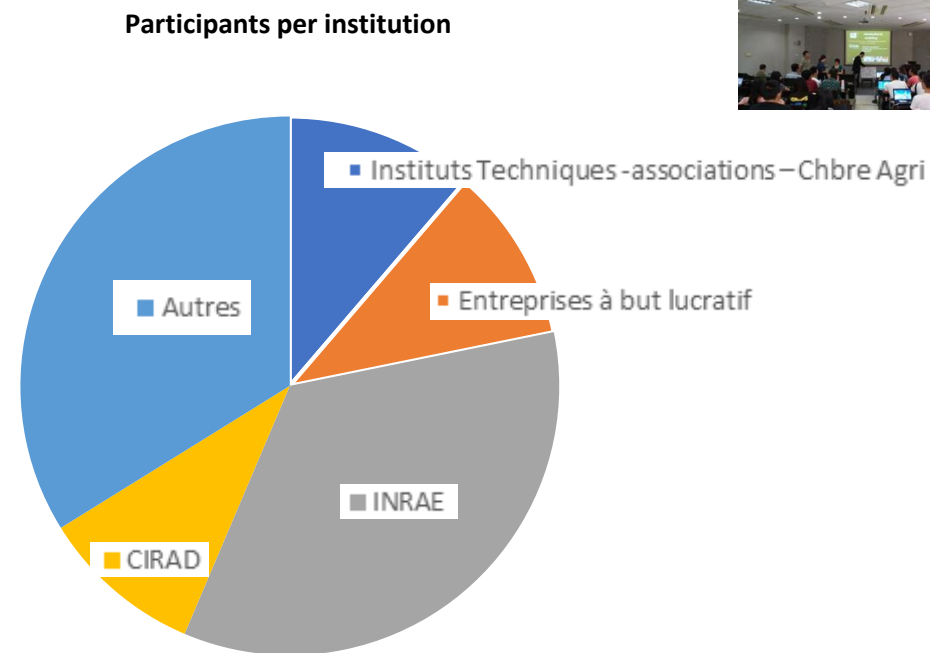
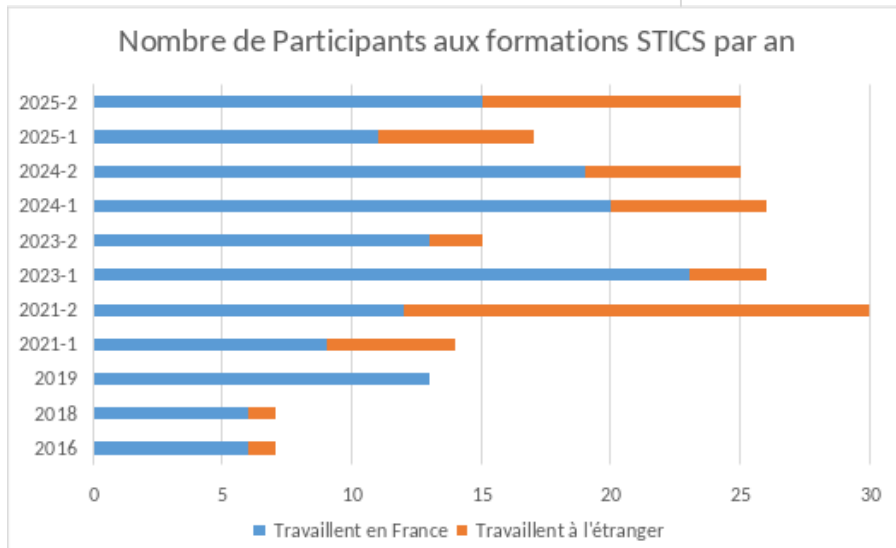
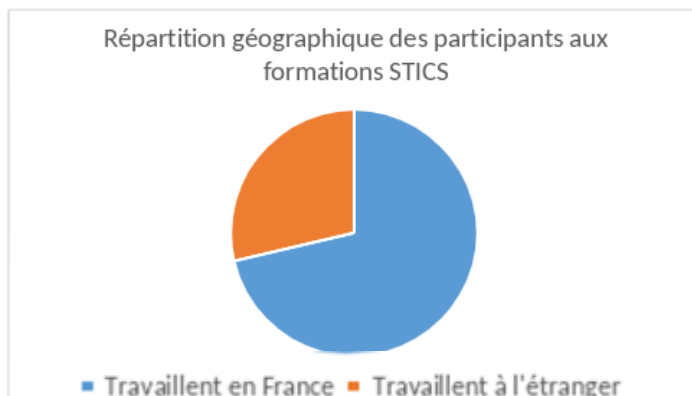


# 1. The STICS scientific community: structure, **growth** and impact

## ➤ Trainings

**206 people trained since 2016**  
**(2 five-day remote training courses per year since 2021)**

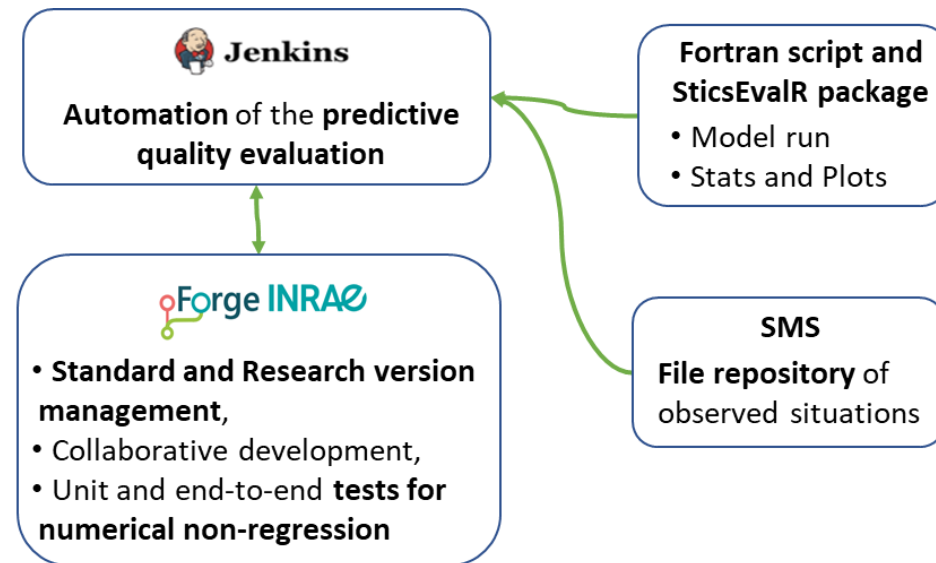
*for staff at INRAE, but also at CIRAD, technical institutes, private companies, ...*



## ➤ Contribution to STICS development

### Open to user experts

- Improvement / implementation of formalisms, (re)Parameterization of crops / cultivars, ...
- Research branches opened on demand
- Access to the team development environment (versioning system, automatic tests, data base, ...)
- Protocols for integration of the proposed modifications in the standard version



# 1. The STICS scientific community: structure, *growth* and impact

## > The STICS workshop

Every two-three years

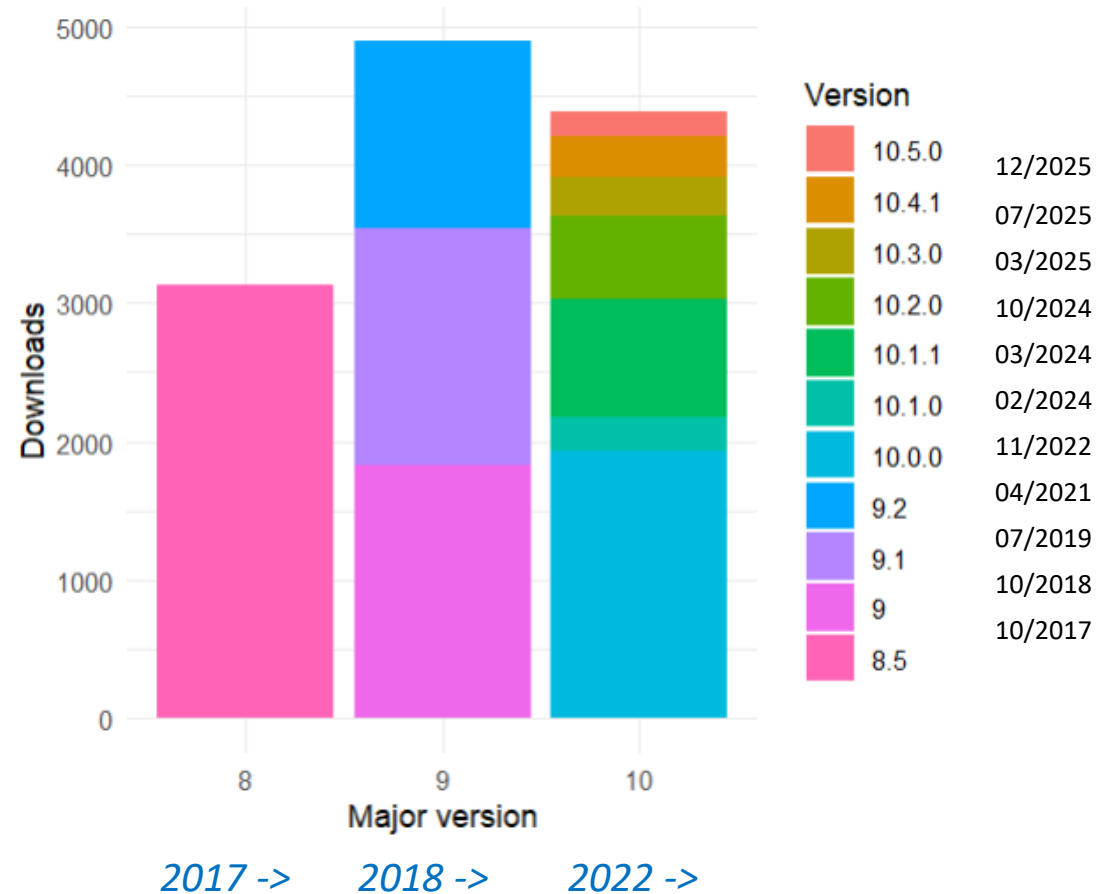
2003 Arles, 2005 Carry le Rouet, 2007 Reims, 2010 Sorèze, 2012 Sainte Montaine, 2015 Rennes, 2017 La Rochelle, 2020 Montpellier (ICROPM 2020), 2023 Bordeaux, 2026 Louvain



## ➤ STICS model downloads

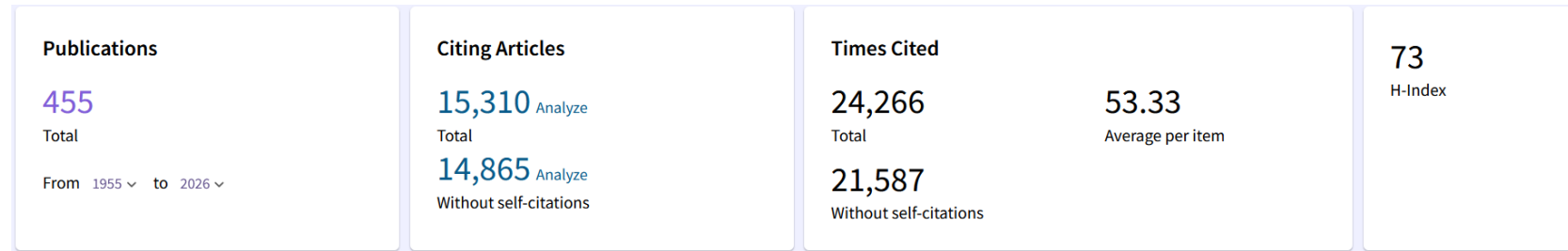
Total number of downloads since V8.5.0 (03/03/26) : **12406**

Total number of downloads of the V10 family (03/03/26) : **4378**



# 1. The STICS scientific community: structure, growth and *impact*

## ➤ Bibliometric indicators

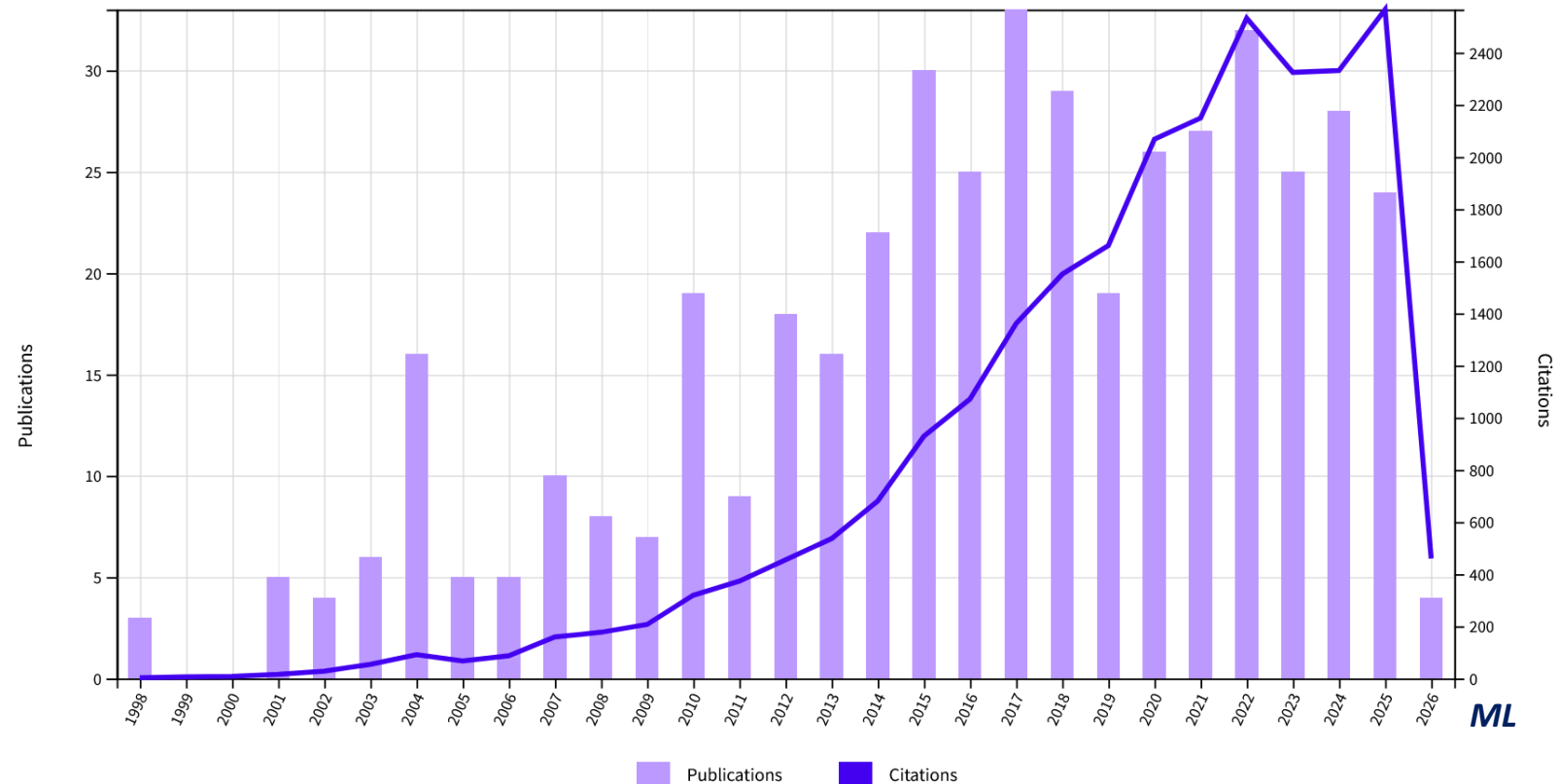


Times Cited and Publications Over Time

DOWNLOAD

A total of **524 articles** were compiled,

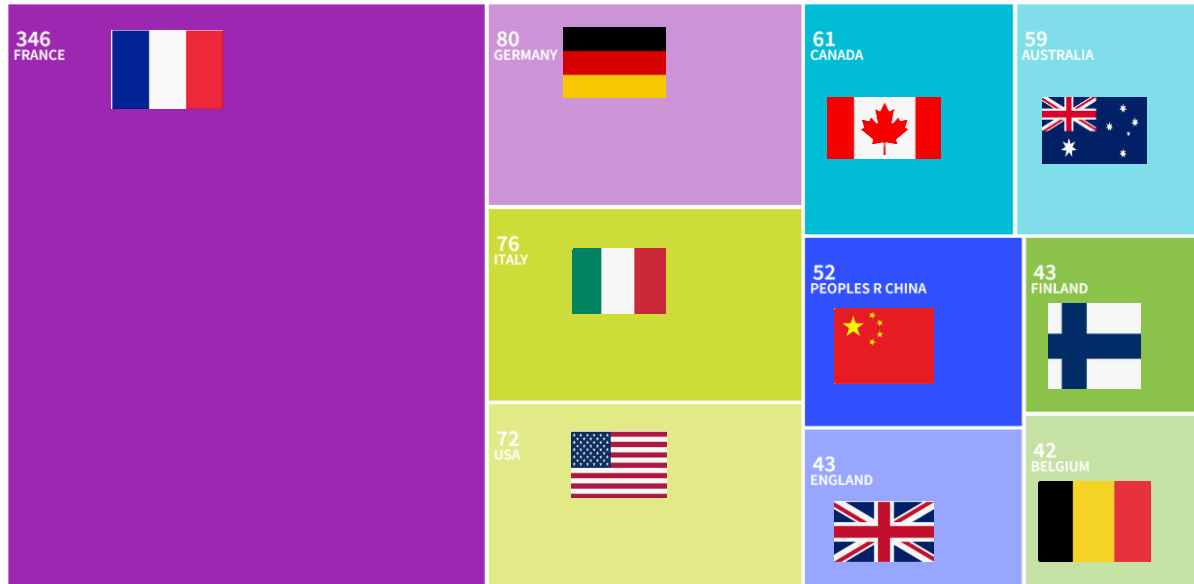
**455** of which have a recognised Web of Science DOI



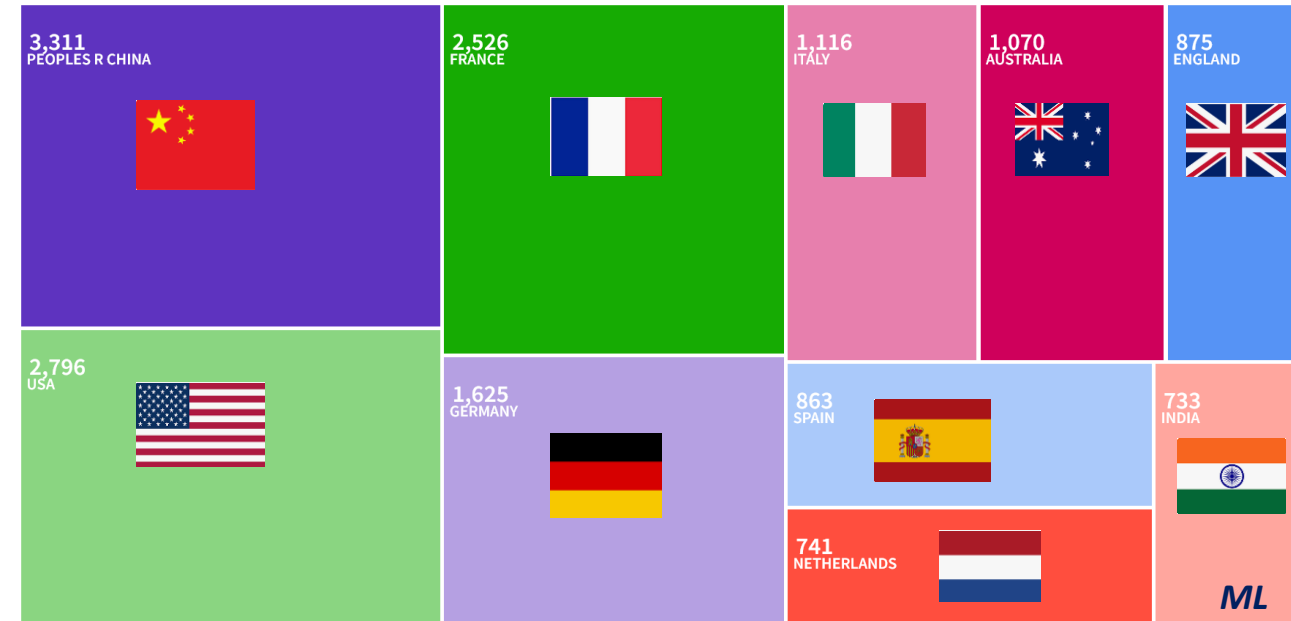
# 1. The STICS scientific community: structure, growth and *impact*

## ➤ Bibliometric indicators (*co-authors origin*)

455 articles published in scientific journals (WOS)

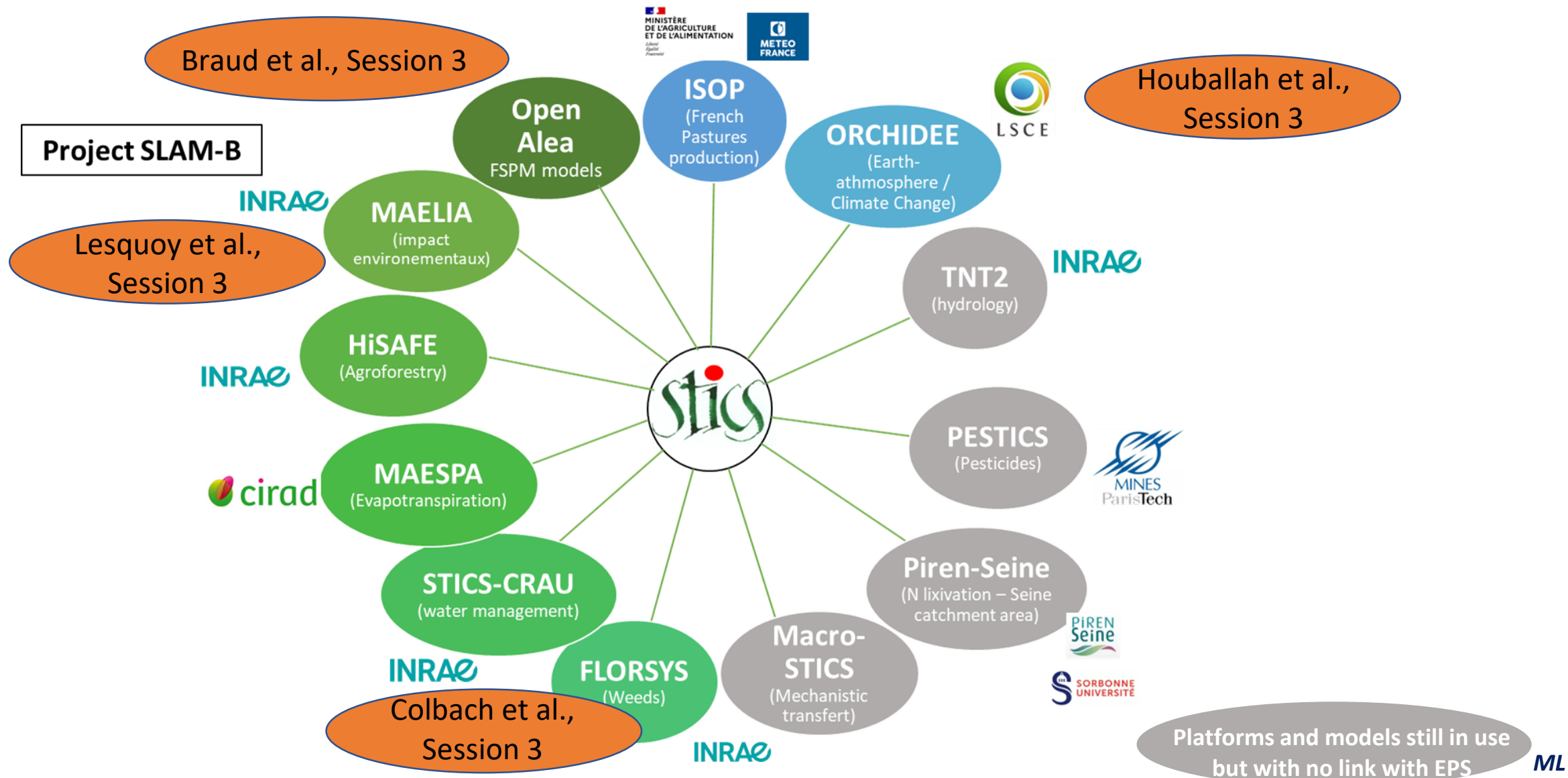


455 articles cited by 14 865 articles



# > Couplings and links with platforms and models

Contribute to operational tools for applied usage, at field or larger scales



# 1. The STICS scientific community: structure, growth and **impact**

## > Focus on some projects

### ALAMOD (PEPR FairCarboN, 2024-2030):

-> Compare and improve models of ecosystem-level carbon dynamics

### SLAM-B (PEPR FairCarboN, 2023-2029) :

-> Coupling STICS with an information system and decision rules for the deployment of a sustainable regional bioeconomy based on agroecology (CIVE, crop residues, permanent grasslands, methanization)

### Intercropvalues (Horizon Europe, 2023-2026) :

-> Understanding processes underlying intercrop performances through modeling : tropical intercrops (STICS), as well as fungal disease (STICS MILA) regulation



### PNR AgriPV (National consortium of 57 public and private organizations )

-> Studying the conditions for synergies between agricultural production and electricity generation in agri-photovoltaic systems



### ISOP (INRAE - Météo-France – MASA)

-> Monitoring of grassland biomass production

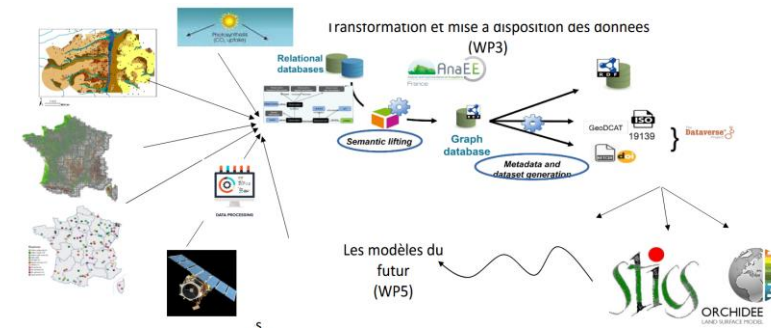


Figure 2 : Indicateur de rendement des prairies permanentes par région fourragère au 20 août 2025

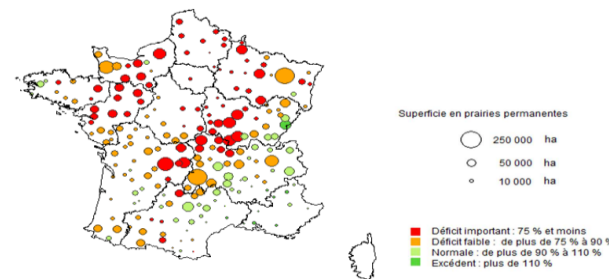
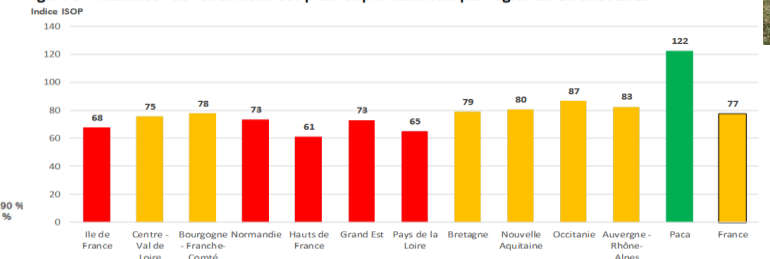


Figure 3 : Indicateur de rendement des prairies permanentes par région au 20 août 2025



## ➤ STICS in AgMIP: ongoing or recent exercises implying STICS


- Wheat :
  - Nitrogen (B. Dumont)
  - Waterlogging (B. Dumont)
  - CO<sub>2</sub> (M. Launay, M.-O. Bancal)
- AMEI / Crop2ML :
  - Soil T° (P. Lecharpentier, H. Raynal)
  - Disease (M. Launay)
- ET (G. Jego)
- Soybean (J. Constantin, E. Justes)
- Calibration (**S. Buis - co-lead.**, M. Launay, E. Justes, B. Dumont)
- Low input farming systems (**A. Couëdel et G. Falconnier - co-lead**, F. Ferchaud)

# 1. The STICS scientific community: structure, growth and *impact*

## ➤ STICS in AgMIP: publications

60+ publications using STICS since AgMIP began  
8 in 2025-2026

### Contribution to ensemble simulations



Agricultural and Forest Meteorology  
Volume 376, 15 January 2026, 110882

Inter-comparison of soybean models for simulation of evapotranspiration under rainfed and irrigated conditions

Kritika Kothari <sup>a, b</sup>, Andrew Suyker <sup>c</sup>, Rafael Battisti <sup>d</sup>, Kenneth J. Boote <sup>e</sup>



Journal of Hydrology  
Volume 661, Part B, November 2025, 133631

Evaluation of multimodel averaging approaches for ensembling evapotranspiration and yield simulations from maize models

Viveka Nand <sup>a</sup>, Zhiming Qi <sup>a, b, c, d, e</sup>, Liwang Ma <sup>b</sup>, Matthew J. Helmers <sup>c, d, e</sup>



Field Crops Research  
Volume 332, 1 October 2025, 110032

Wheat crop models underestimate drought stress in semi-arid and Mediterranean environments

H. Webber <sup>a, b, c, d, e</sup>, D. Cooke <sup>a</sup>, C. Wang <sup>a</sup>, S. Asseng <sup>c</sup>, P. Martre <sup>d</sup>, F. Ewert <sup>a, e, f</sup>, B.

**scientific reports**

OPEN **A multi model ensemble reveals net climate benefits from regenerative practices in US Midwest croplands**

Bruno Basso<sup>1,2,3,4</sup>, Tommaso Tadiello<sup>1,2</sup>, Neville Millar<sup>1</sup>, G. Philip Robertson<sup>2,3,4</sup>

### Contributions to reviews



Environmental and Experimental Botany  
Volume 232, April 2025, 106113

Review article  
Plant plasticity in the face of climate change – CO<sub>2</sub> offsetting effects to warming and water deficit in wheat. A review

Meije Gawinowski <sup>a, b, c, d, e</sup>, Karine Chenu <sup>c</sup>, Jean-Charles Deswarte <sup>b</sup>, Marie Launay <sup>d, 1</sup>, Marie-Odile Bancal <sup>a, 1</sup>

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Review Article | Published: 06 June 2025  
**Gaps and strategies for accurate simulation of waterlogging impacts on crop productivity**

Margarita Garcia-Vila <sup>1</sup>, Murilo dos Santos Vianna <sup>2</sup>, Matthew Tom Harrison <sup>3</sup>, Ke Liu <sup>4</sup>, Rogério de S. Nóia-


### Contributions to methods and software tools



European Journal of Agronomy  
Volume 168, July 2025, 127659

Evaluating the AgMIP calibration protocol for crop models; case study and new diagnostic tests

Daniel Wallach <sup>a, 1</sup>, Kwang Soo Kim <sup>b</sup>, Shinwoo Hyun <sup>b</sup>, Samuel Buis <sup>c</sup>, Peter



Agricultural and Forest Meteorology  
Volume 372, 15 September 2025, 110697

Why is there so much variability in crop multi-model studies?

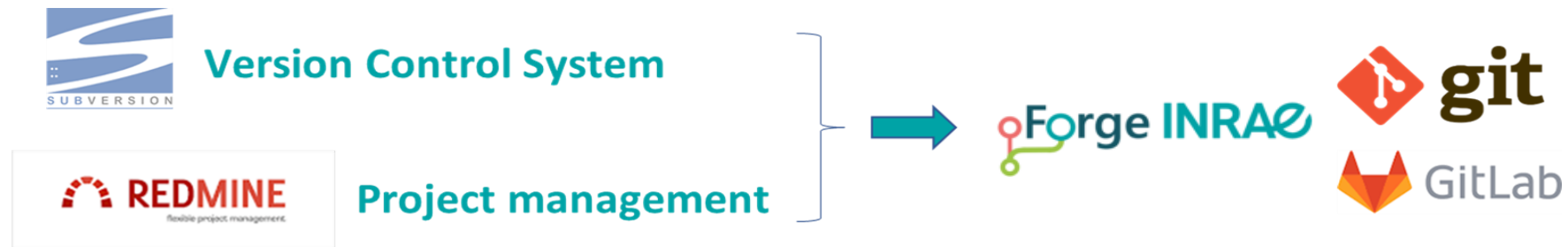
Daniel Wallach <sup>a</sup>, Taru Palosuo <sup>b, c, d, e</sup>, Henrike Mielenz <sup>c</sup>, Samuel Buis <sup>d</sup>, Peter

➤ The STICS ecosystem: tools, data and documentation


## > Software Engineering and Code Management

### Shared Development Infrastructure

- **Migration of STICS ecosystem projects** (STICS, JavaSTICS, documentation, book) to a **single GitLab repository**
- **Integrated version control and project management** (Git, issues, merge requests)



### Structured Development Workflow

- **Standardized practices:** branching strategy, code review, merge requests
- **Continuous Integration** (GitLab CI/CD): automatic build, unit tests and end-to-end tests
- **Agile-style project management:** issues, standup meeting, sprint planning
- **Automated release production and distribution**
- **Standardized development environment** (VSCode) 

## > Tools and software: STICS and JavaSTICS

### STICS Crop model

- ~120 000 Fortran lines code
- Free Software Licence (CECILL-C)
- A single model for all crops
- Executable and source code distribution
- Linux/Mac/Windows compatible

### JavaStics GUI

- Managing model inputs
- Running STICS simulations (independent, successive,...)
- Performing parameters optimisation
- Plotting simulated outputs

### Recent Releases (2024–2025) : 10.1 → 10.5

- **New output variables** (e.g. leaf N content, stem–leaf ratio, dominant crop status)
- **Improved JavaSTICS ergonomics** (soil profile cloning, smoother multi-simulation workflow, more efficient navigation ...)
- **Bug fixes** (Intercropping irrigation handling, radiative transfer related to canopy geometry, short-day maturity behaviour (RFPI), leap year handling, initialization issues)
- **Extensive code refactoring and cleanup**
- **Transition toward Modern Fortran (2018)** (modules, dynamic memory allocation, fpm, stdlib)
- **Improved warnings, error messages and logging**

## > STICS et JavaSTICS : Integration of the intercrop research branch

### Crop height

-> Adding an option for computing height using **phenological development**

-> Computing height **incrementally** each day:

$$\text{Current potential height of the } p \text{ species: } H_{p_i} = H_0 + \frac{a}{1 + e^{-c \cdot (\text{dev}_i - b)}}$$

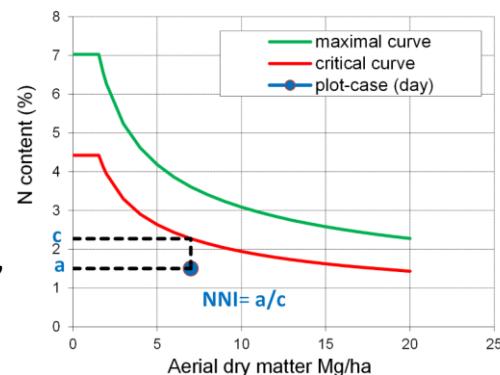
$$H_i = H_{i-1} + \Delta H_i \quad \Delta H_i = (H_{p_i} - H_{p_{i-1}}) \cdot S \cdot E$$

Down-regulating factor S: ↘ effect of abiotic stress factor (H2O, N, anoxia, frost)

Up-regulating factor E: ↗ shoot elongation when the species is shaded

### Nitrogen demand

-> N demand still driven by the dilution curve, but using the total biomass of the IC system instead of the aboveground biomass of (one species) (Louarn et al. (2021), but same equations and parameters.



→ of the total aerial biomass (sum of 2 crops)

### Same parameters than sole crops

-> no re-calibration except 1 intercrop parameter (up-regulating factor in crop height)



## > STICS et JavaSTICS : Integration of the intercrop research branch




### Interspecific competition

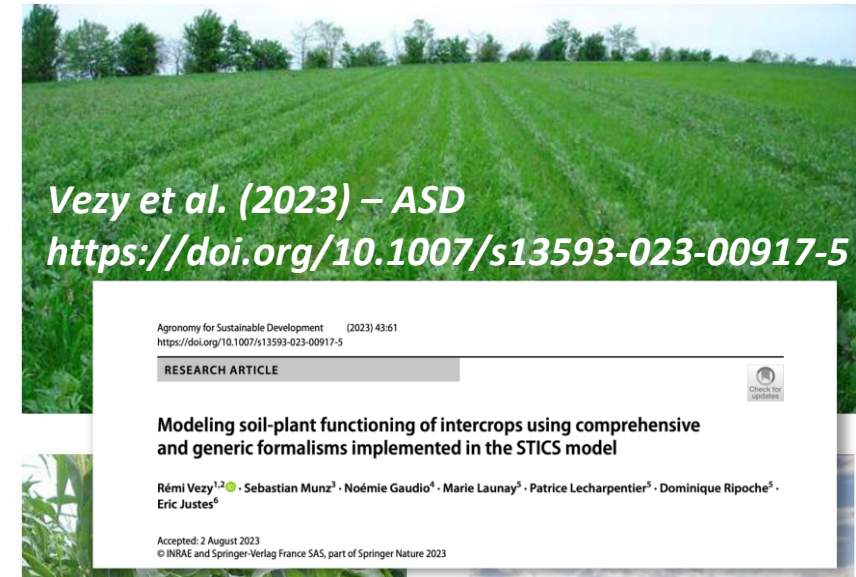
The plant density effect was already accounted for with the trophic-linked root length expansion option but not with the self-governing root expansion option.

### New in this version

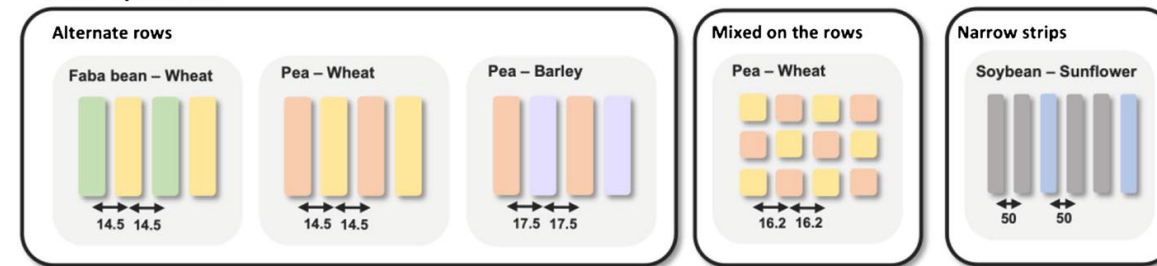
-> Introduction of an **equivalent plant density** effect in the root length growth rate

### Current state of integration into the standard version

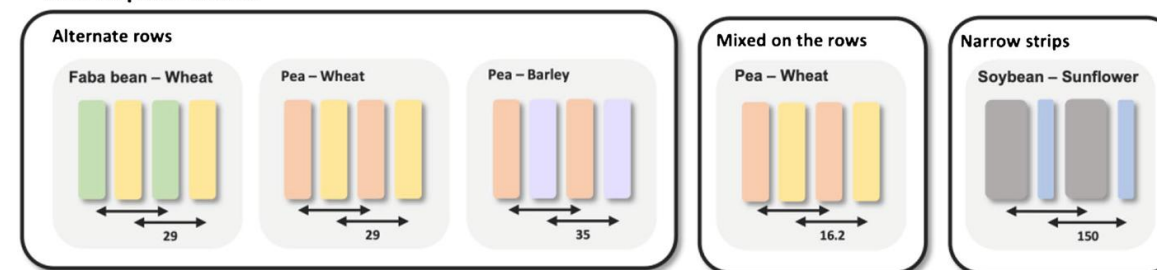
- >  Merge in the main branch
- >  Debugging on sole crops
- >  Evaluation on intercrop datasets (data set inventory ...)
- >  Update of the STICS book
- >  Release in the short/medium term



#### Field Experiment




#### STICS representation



## > Tools and software: SticsRpacks

-  packages collection, **open source** <https://github.com/SticsR Packs> 

- **SticsOnR** and **SticsRFiles** : packages for managing STICS from 
  - Finding names and definitions of parameters and variables
  - Handling input and output files
  - Running simulations (parallel, forcing parameters, etc.)

- **CroptimizR** and **CroPlotR** : **generic packages** for coupling crop models with mathematical methods
  - Parameter estimation
  - Plots and statistical criteria

Used with various models (STICS, ApsimX, SiriusQuality, DSSAT, ...) and software backbone of the AgMIP Calibration project

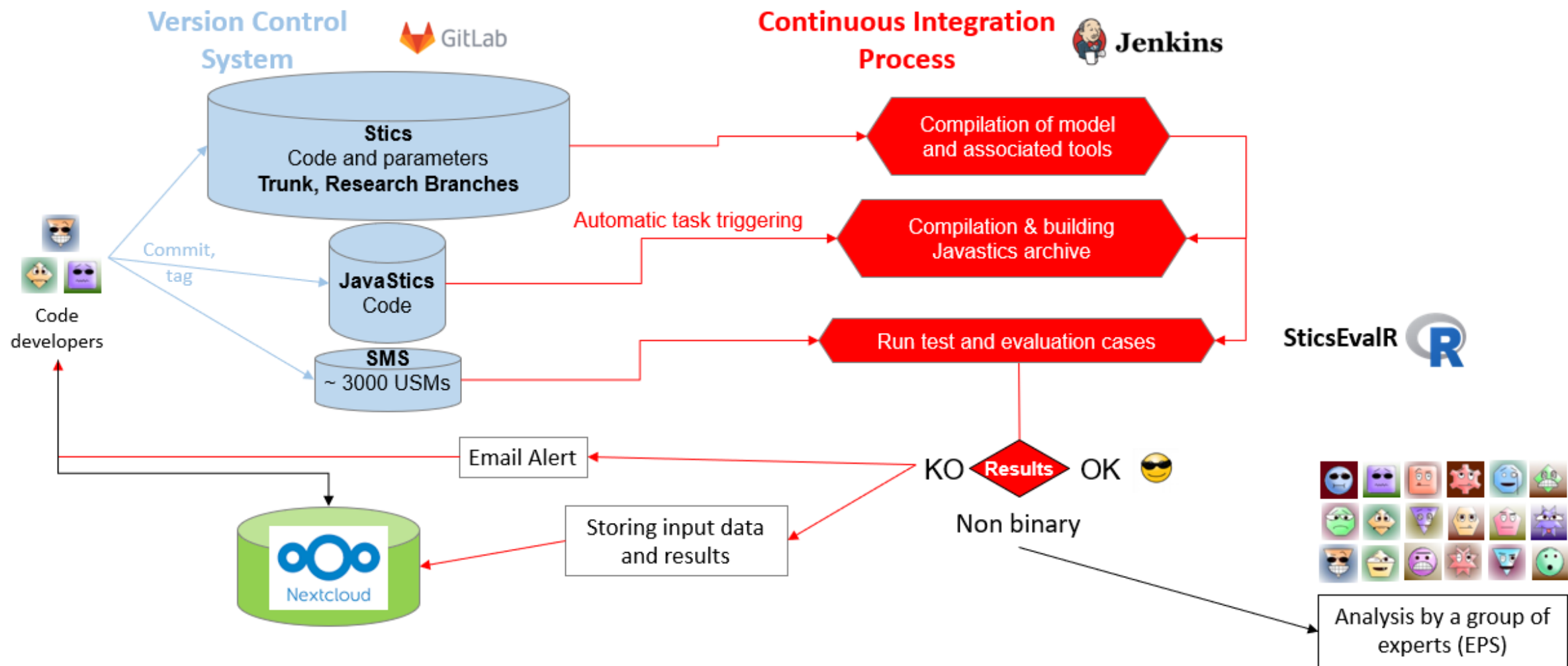
### NEWS

- **Optimization of XML files manipulation, text file generation, parameter information**
- **Parallel input file generation (dev.)**
- **Parallel execution of simulations in successive mode (dev.)**
- **AgMIP Calibration protocol**
- **User-defined sequential multi-step calibration workflows**
- **Flexible scatter plots: simulated values or residuals vs. any simulated, observed, or residual variable**

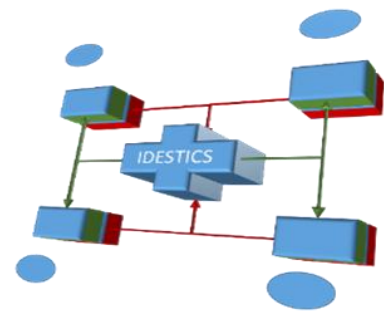
=> Buis et al., Session 4

Gawinowski et al.,  
Session 4

## ➤ Automated evaluation of model predictive performance



### ➤ IDE-STICS



#### What is it?

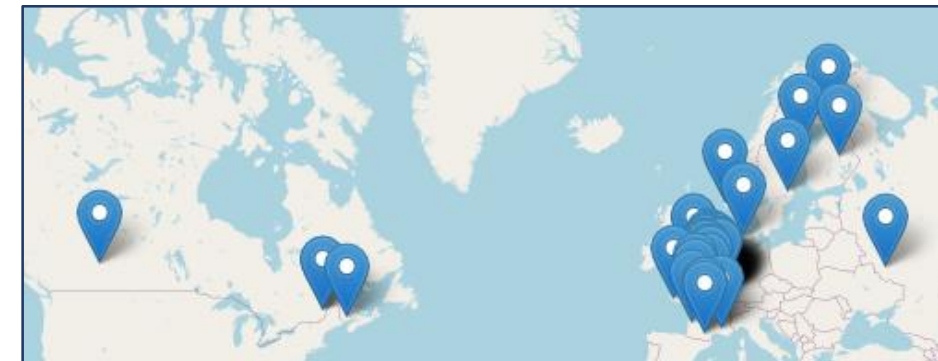
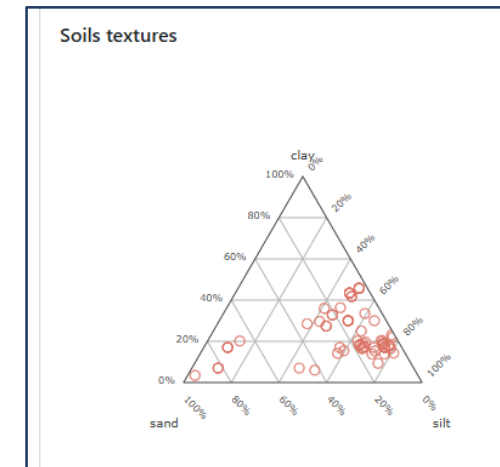
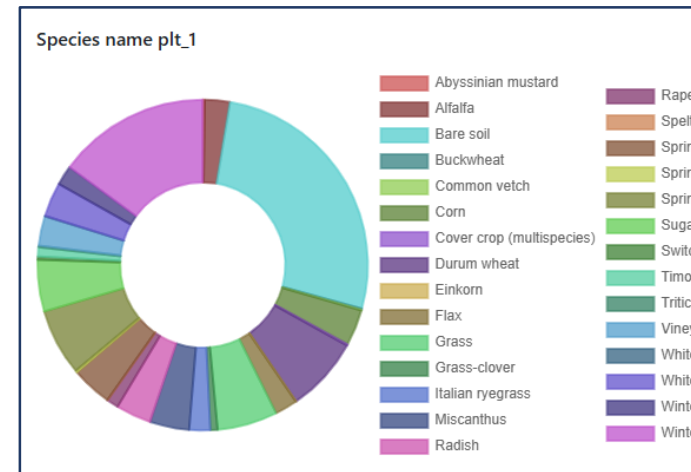
- Information system: SQL database + web interface (dev. Jérôme Duval, BioEcoAgro)
- Centralizes STICS evaluation datasets (inputs, observations, metadata)

#### Planned features

- Import of STICS files + Excel metadata sheets
- Visualization of available datasets
- Search and export of USMs

#### Current status

- Operational V0
- Several datasets already included
- Search and export interface under development
- Additional datasets have been identified for future integration
- Accessible to the STICS Project Team



## ➤ Test and evaluation: evaluation reports

### Evaluation reports distributed for grass, maize, winter wheat, miscanthus, bare soil

#### Stics Performance Evaluation Report : Wheat

Authors: N. Beaudoin, F. Ferchaud, L. Strullu, B. Dumont, G. Jégo, E. Justes, D. Ripoche, S. Buis

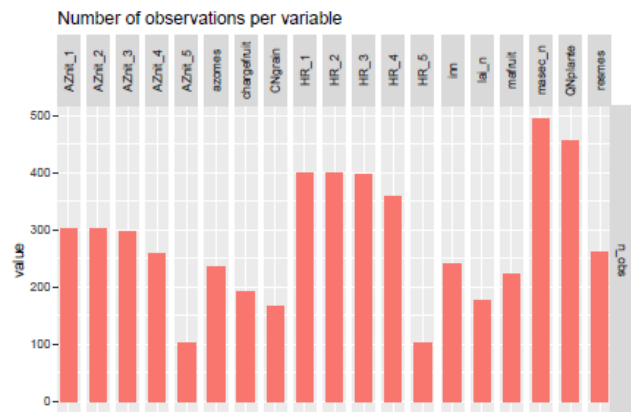
STICS version: V10.0.0

IdeSTICS version: r1956

Number of USMs: 222

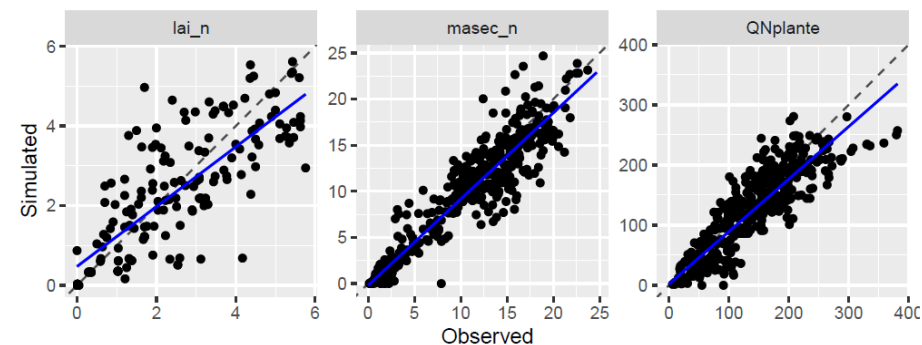
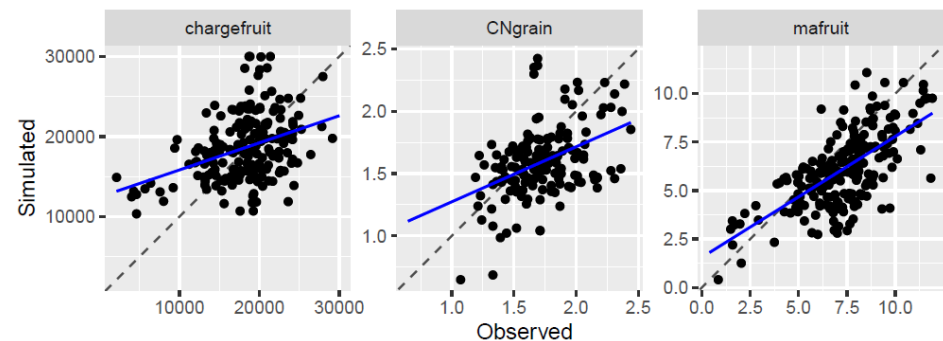
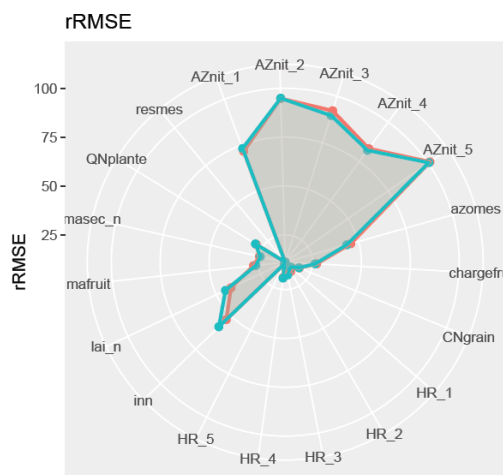
Number of cultivars: 9

Cultivars names: Arminda, Talent, Thesee, Soissons, Promentin, Sideral, Thésarmin, Thétalent, Shango



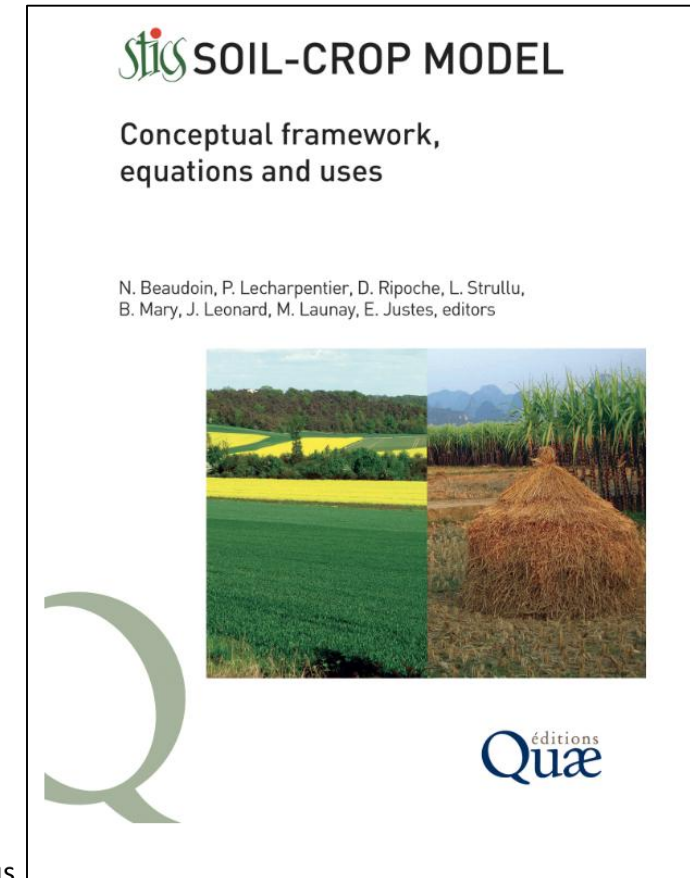
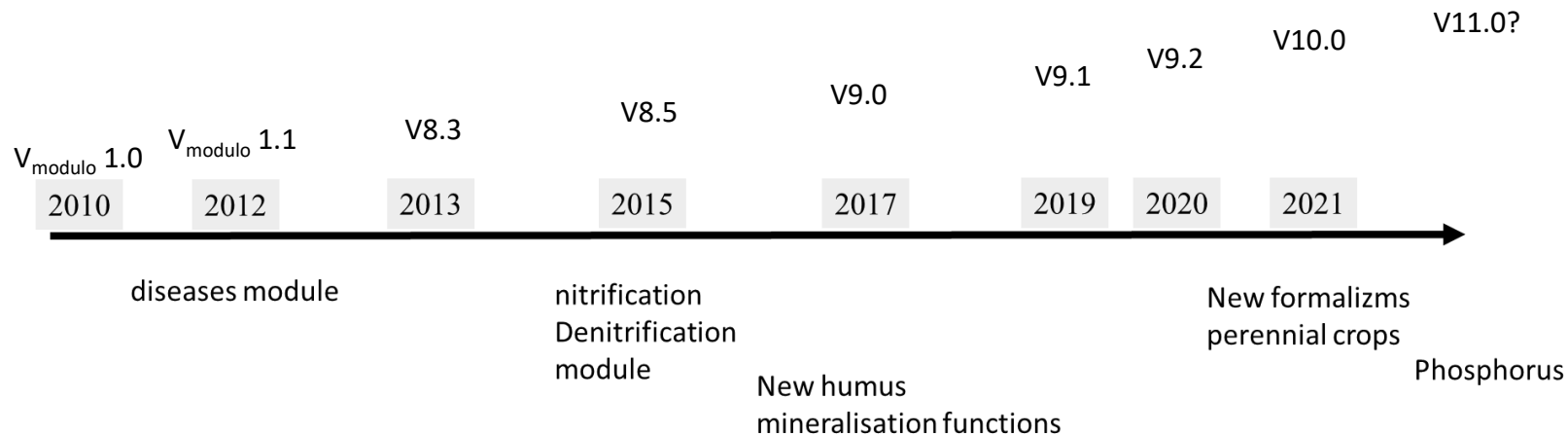
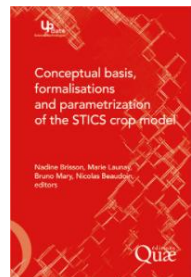
The evaluation dataset includes 222 USMs not used for model calibration, 9 cultivars and a large number of observations (>90) for all evaluated variables.

- Description of the evaluation dataset
- Evolution of performances wrt former Stics versions
- Global and specific analysis of performances



## > Documentation: the STICS book, new edition

- 29 authors, ~300 pages
- **Electronic version available for free** (CC BY-NC-ND license): [html](#), [epub](#), [pdf](#)
- Paper edition [on order](#)
- Objective: **continuous evolution** according to the versions of the model (RMD format under version management system)



## ➤ Current crop models: STICS chapter

### Chapter 9

#### **The STICS soil-crop model: a generic model to simulate the functioning of agroecosystems**

*Benjamin Dumont\* and Mathieu Delandmeter, University of Liège Belgium; Marie-Odile Bancal, Université Paris-Saclay, INRAE, AgroParisTech, UMR EcoSys, France; Nicolas Beaudoin and Joël Léonard, INRAE, UMR Transfrontalière BioEcoAgro, France; Samuel Buis, INRAE, Avignon Université, UMR EMMAH, France; Julie Caubel, EcoClimaSol, France/INRAE, US Agroclim, France; Hugues Clivot, Université de Reims Champagne-Ardenne, INRAE, FARE, UMR A 614, France; Julie Constantin, Université de Toulouse, INRAE, UMR AGIR, France; Antoine Couëdel and Mathilde de Freitas, CIRAD, University of Montpellier, UPR AIDA, France; Audrey Deheinzelin, INRAE, US Agroclim, France; Gatien N. Falconnier, CIRAD, University of Montpellier, UPR AIDA, France/CIRAD, UPR AIDA, Zimbabwe/International Maize and Wheat Improvement Centre (CIMMYT), Zimbabwe/University of Zimbabwe, Zimbabwe; Fabien Ferchaud, UMR Eco&Sols, Univ Montpellier, CIRAD, INRAE, IRD, Institut Agro Montpellier, France; Iñaki García de Cortázar-Atauri, Marie Launay, Patrice Lecharpentier and Dominique Ripoche, INRAE, US Agroclim, France; Anne-Isabelle Graux, Agrocampus Ouest, INRAE, UMR PEGASE, France; Guillaume Jego, Agriculture and Agri-Food Canada, Canada; Arthur Lenoir, University of Liège, Belgium; Gaetan Louam, INRAE UR P3F, France; Alain Mollier, INRAE, Bordeaux Sciences Agro, UMR1391 ISPA, France; Céline Schoving, Université de Toulouse, INRAE, UMR AGIR, France; Mounir Seghouani, INRAE, Bordeaux Sciences Agro, UMR1391 ISPA, France/CIRAD, Univ Montpellier, UPR Recyclage et Risque, France; Loïc Strullu, Strullu Company, France; Remi Vezy, CIRAD, University of Montpellier, CNRS, INRAE, IRD, UMR AMAP, France; Tiphaine Vidal, Université Paris-Saclay, INRAE, UR BIOGER, France; Eric Justes<sup>1</sup>, Cirad, France; and Jean-Louis Durand<sup>1</sup>, INRAE UR P3F, France*

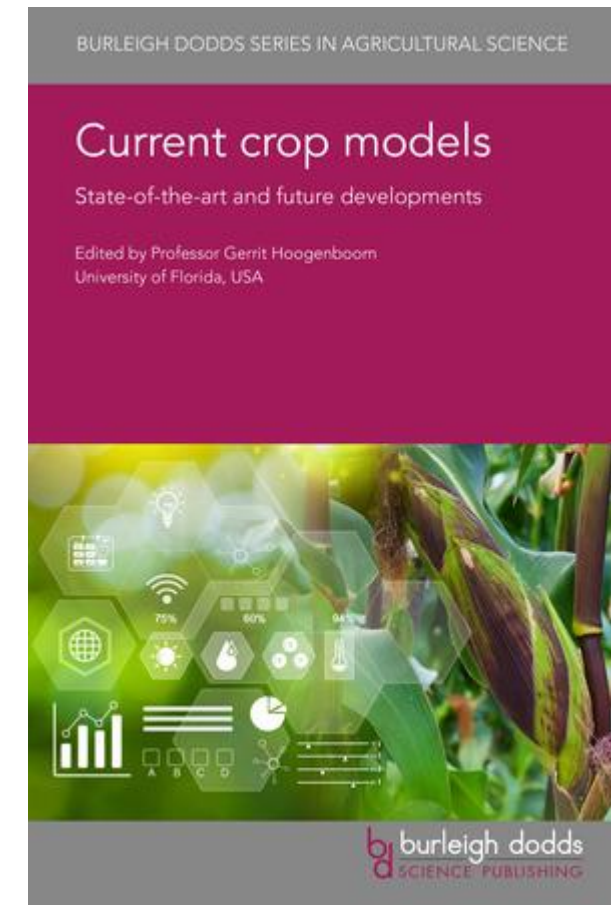
#### Current crop models: State-of-the-art and future developments

Publication Date: 30/12/2025

Extent: 778 pages

Edited by: *Professor Gerrit Hoogenboom, University of Florida, USA*

Preprint freely avail. here



## ➤ On Going Developments and Future Directions

## > Development of research versions

### • Main active research « branches »

- **Intercrop branch** : merge with the main and evaluation are almost complete  
-> soon to be released : v11
- **Vineyard branch** : C, N, and water cycles in vineyards & capillary rise  
-> awaiting merge with v11 Pardon et al., Session 2
- **Grassland-residual biomass branch**: C and N cycles in grasslands, grazing and manure returns  
-> awaiting merge with v11
- **Phosphorus branch** : P cycle (supply, plant requirements and absorption),  
P supply via fertilization (Seghouani et al., 2025)
- **Intercrop-pathogen branch**: epidemiological cycle (1 pathogen/1 host plant)  
-> stabilized module, coupled with the Intercrop branch Deheinzelin et al.,  
Session 3
- **N<sub>2</sub>O branch** : dynamic prediction of potential denitrification,  
influence of crop residues and decomposition  
-> currently being evaluated across a wide range of situations (UMR BioEcoAgro)
- **N fertilization branch**: automatic simulation of N fertilization for crop rotations (balance method)
- **Photovoltaics**: simulation of the effect of photovoltaic panels on IR radiation and temperature

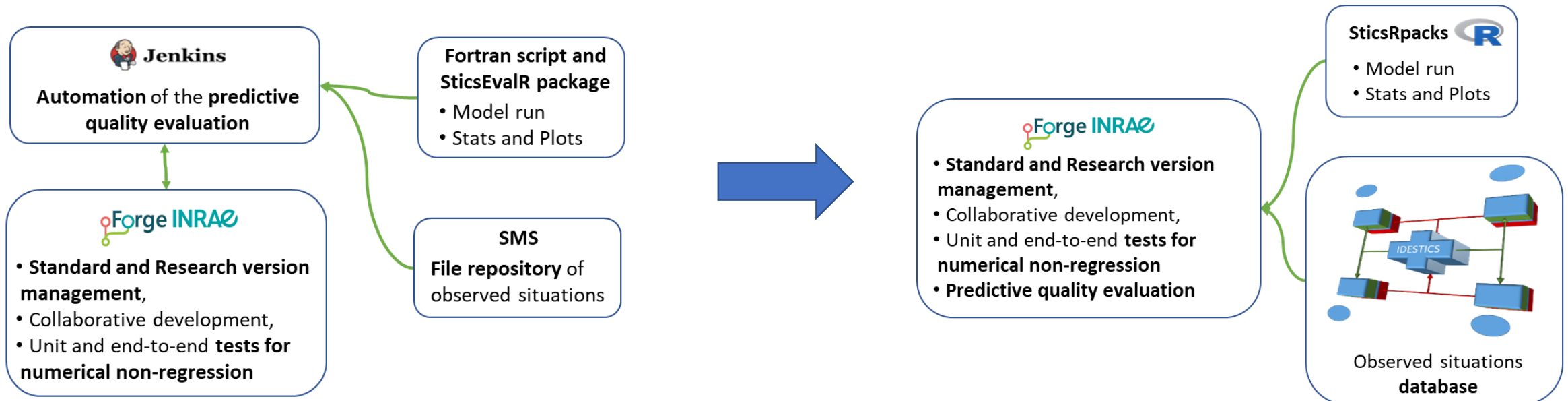
## > Updating the model evaluation system

Fixed-term position (V. Rahier), ongoing



- Migration from Jenkins to the INRAE forge CI/CD
- Updated scripts & workflows using SticsR Packs and IDE-STICS
- Expanded evaluations: non-observed variables, synthetic data, intercrop / long-term / rotation reports

→ faster feedback, smoother contributions, more comprehensive evaluations



# ➤ New evaluation reports

## Stics Performance Evaluation Report **Rotation**

Authors: J. Constantin, F. Ferchaud, B. Dumont, H. Clivot, S. Buis

STICS version: STICS\_1041

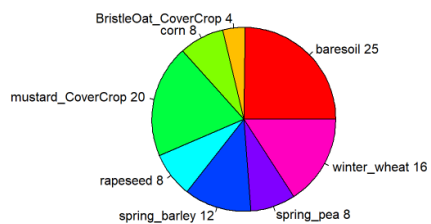
IdeSTICS version:

Number of USMs: 101

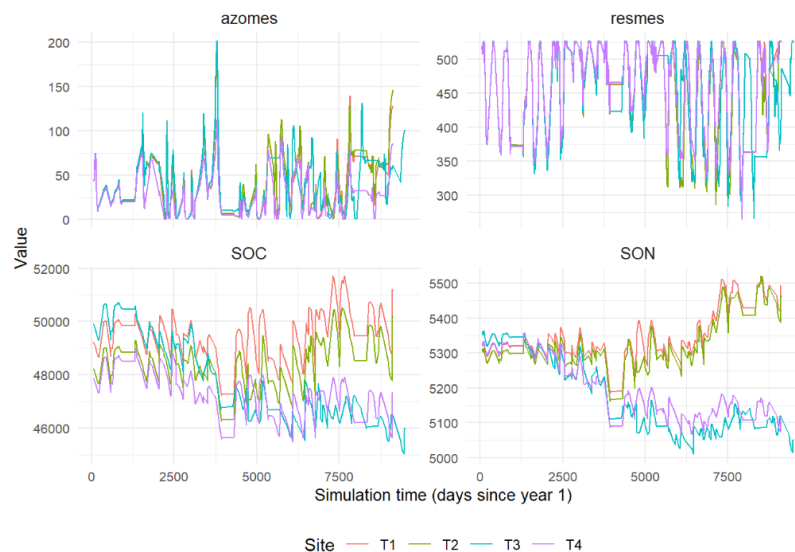
Number of rotations: 4

Number of sites: 1

Number of successive usms : 25 - 26



### Soil variables



## Stics Performance Evaluation Report **Intercrop**

Authors: Samuel Buis, Rémi Vezy, EPS

STICS version: v11.0.0

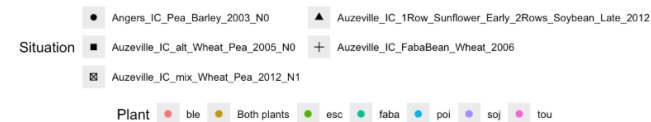
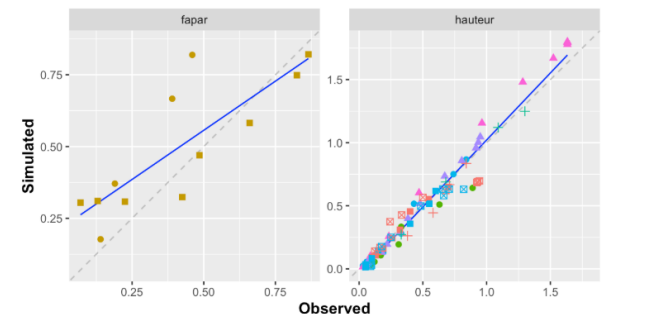
IdeSTICS version:

Number of USMs: 5

### Interaction for ressources

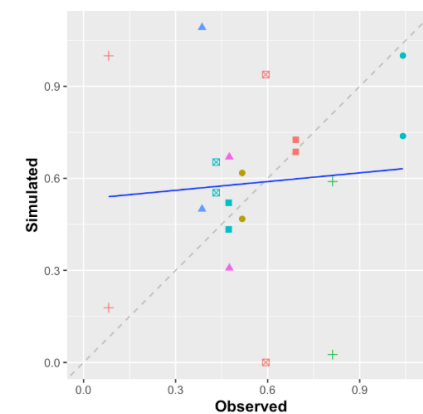
This section compares the current and previous model versions for key plant-plant interactions affecting light, water and nitrogen use in intercrops.

#### Light



### pLER

Partial LER (pLER) is computed from the intercrop yield divided by the yield of the linked sole crop for Partial overyielding corresponds to  $pLER > 0.5$ .



## ➤ 3 new training courses being set up

For experienced STICS users and/or those who have completed the basic training module

- **STICS adaptation to new species and cultivars**

Objective: concepts, methods, and tools needed to adapt STICS to new crops or varieties  
practice applying this knowledge to a personal or provided dataset

Format: 2 days in person + 1 day deferred (feedback with implementation)

- **Simulating fungal diseases with STICS-Mila**

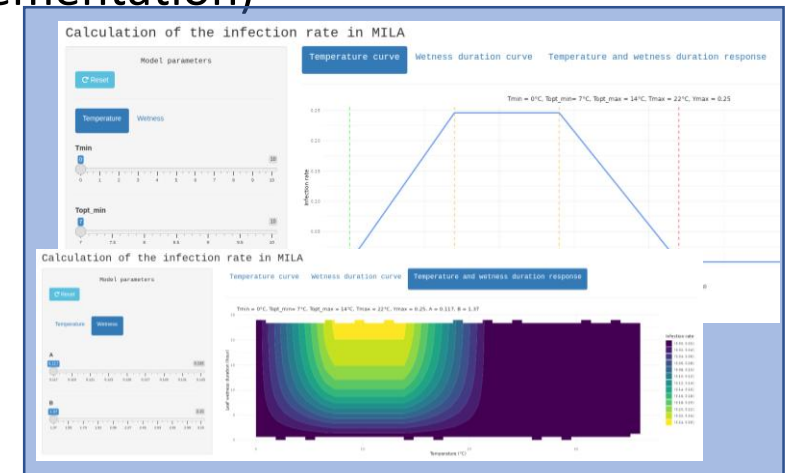
Objective: coupled model handling and configuration (interactive)

Format: 1/2 day webinaire

- **STICS for agri-photovoltaics**

Objective: understand processes behind agri-photovoltaics and run smart simulations with photovoltaics

Format: under consideration





➤ Recent model uses: ongoing projects involving EPS members

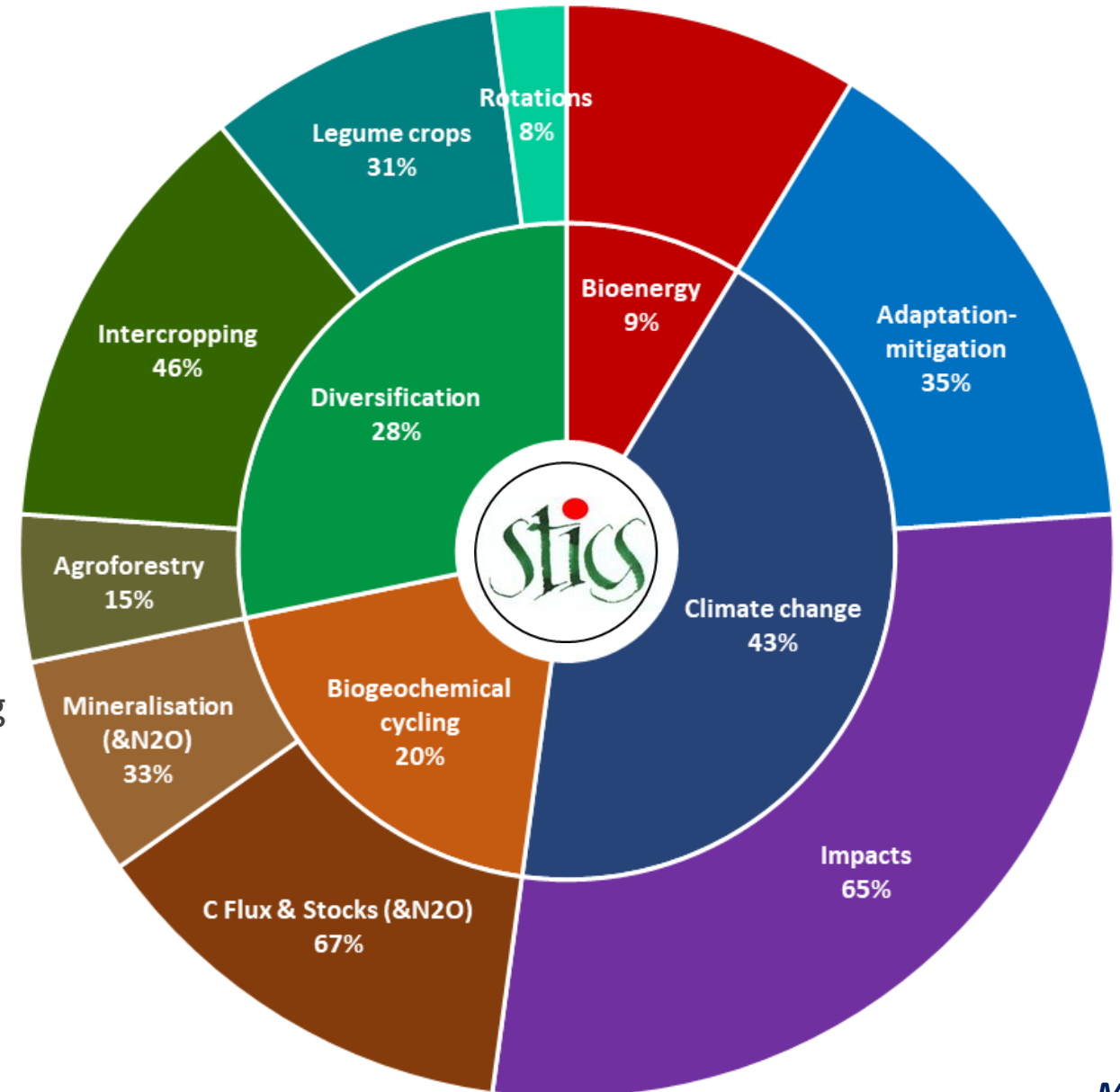
**46 projects and PhD thesis**

Main topics :

- Climate change (43%),
- Crop diversification (28%)
- Biogeochemical cycling (20%, including 33% with N<sub>2</sub>O emissions)
- Bioenergy (9%)

**Methodological issues**

- Calibration
- Model intercomparison, interoperability and coupling
- Spatialisation
- Transfer
- Evaluation and improvement



## ➤ Recent model uses: STICS workshop in Louvain

### Strengthening the model in relation to:

- Long-term **biogeochemical cycles**
  - ✓ improvement of formalisms related to residue decomposition (particularly N limitation) -> new research branch (PEPR Alamo, 2 years post-doc)
  - ✓ improvement of the model behaviour in low-input contexts
- **Grain legumes** (Projects INSERER LES, SOYSTAINABLE, BELIS, WAL'PROT...)
- **Agroecological transition** and **climate change**

Strullu et al., Session 1

Speeckaert et al., Session 2

Delandmeter et al.,  
Session 1

Nambinina et al.,  
Session 5

Gawinowski et al.,  
Session 5

Lacroix et al.,  
Session 5

### Expanding the model's capabilities to new systems/territories/simulation contexts

- **Spatialisation**  
(regional to global)
- **Tropicalisation**  
(new species, soil and climate types, new cropping systems)
- **Urbanisation**

Lenoir et al., Session 2

Desmarez et al.,  
Session 1

Kebalo et al., Session 4

de Freitas et al., Session 1

Clivot et al., Session 4

### Bring in new data sets for the model

Damien et al., Session 1

Giraud et al., Session 5

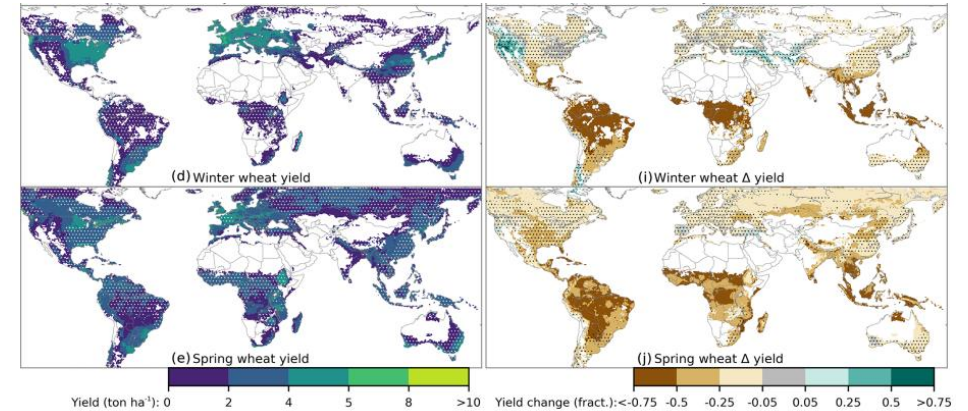
## ➤ Exploring new directions

**Coordinating efforts to simplify STICS spatialization and contribute to GGCM**

**=> New working group**  
(anim. J. Constantin & G. Falconnier)

## Assessing AI opportunities

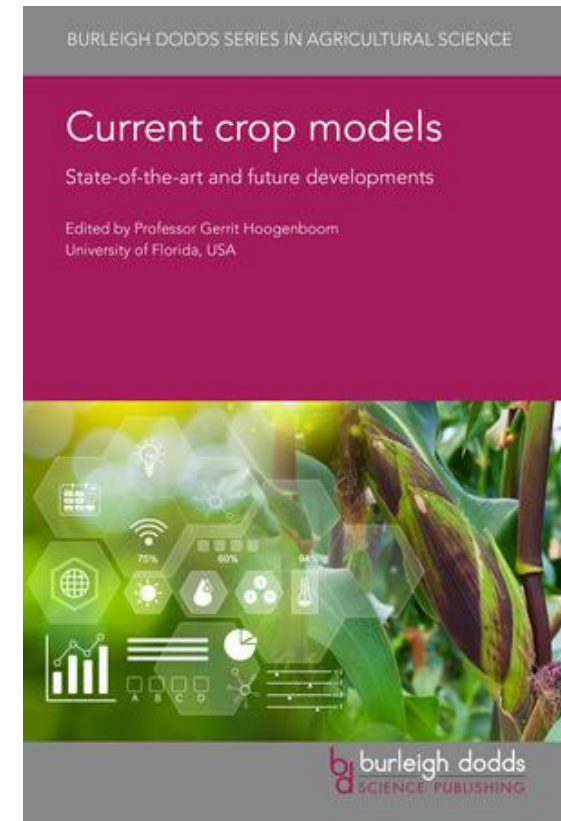
- => Interactive decision making and optimization (cf. TSIA Agrilore)
- => Automatic data extraction from the literature or from different database for model calibration or evaluation?
- => Intelligent Assistant for STICS Crop Model users?
- => ...



From Franke et al., 2020

## ➤ And now ...

- Enjoy the workshop!
- Think about **the next one** (where? when? who?)
- **Your input counts:** share your ideas before Wed. 16:00!
  - ✓ New formalisms / processes
  - ✓ New software tools / features
  - ✓ Community management
  - ✓ ...



Chapt. 9. The STICS Soil-Crop model  
Preprint freely avail. here

